Binge-eating disorder in the Arabic world and the Netherlands, assessment, etiology, efficacy, effectiveness and economic evaluation of psychological interventions

Melisse, B.

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Prof.dr. Anneke Goudriaan (Universiteit van Amsterdam)
Prof.dr. Glenn Waller (The University of Sheffield)
Prof.dr. Philip Spinhoven
Dr. Nadia Garnefski (secretaris)

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1. Chapter 1 General introduction

Background

Eating disorders have a significant impact on the psychological, social and physical well-being and quality of life of affected patients (Agh et al., 2015; Hay et al., 2015; Rojo-Moreno et al., 2015) including anxiety, depression, and even high rates of mortality (Smink et al., 2012; Watson et al., 2012). The conceptualization of eating disorders has expanded over the last 10 years (Hay, 2020). The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM 5) specifies four types of eating disorders: anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED) and otherwise specified feeding or eating disorder (OSFED). The OSFED category comprises patients who do not meet the behavioral frequency or all other criteria of AN, BN or BED (APA, 2013). However, until 2013 BED was a provisional diagnosis and therefore not included in the DSM. Therefore, BED is the most recently acknowledged eating disorder. Main reason for the revision of the DSM was the high frequency of eating disorder not otherwise specified (EDNOS) diagnoses. All other eating disorders of clinical significance that did not meet the criteria of AN or BN received the diagnosis EDNOS, even patients that barely missed the diagnostic threshold for AN or BN, or patients that met the criteria for BED (Smink et al., 2013; Walsh et al., 2015). Consequently, the diagnostic criteria for AN and BN were elaborated upon, and new disorders, such as BED were added in the DSM-5 (APA, 2013). The broader criteria of eating disorders are more likely to increase the clinical utility of the DSM-5 (Hay, 2020).

Eating disorders can either be approached from a diagnostic perspective, stipulating the differences among the various eating disorders, or from a transdiagnostic perspective. The transdiagnostic model for eating disorders assumes that all disorders share the same maintaining mechanisms (Fairburn et al., 2003), rather than each having a unique underlying

factor. The core overarching mechanism of all eating disorders is evaluating one's self-worth predominantly in terms of control over weight, shape and eating (Cooper & Fairburn, 2011; Fairburn et al., 2003). The diagnostic approach states that the differences among the various eating disorders are that AN is characterized by a severely restrictive food pattern, malnourishment, being underweight and sometimes the occurrence of binges followed by compensatory behavior such as laxative misuse and purging behavior. In contrast, BN is characterized by a normal weight, binges followed by compensatory behavior and a restrictive, irregular food pattern. Lastly, BED is characterized by an irregular food pattern, recurrent episodes of binge eating accompanied by a sense of lack of control, marked distress and absence of compensatory behavior. The binges are followed by feelings of shame, guilt and disgust (APA, 2013; Hay, 2020). Finally, OSFED refers to eating disorders which do not meet the criteria for AN, BN or BED, such as atypical AN, atypical BN, atypical BED, purging disorder or night eating syndrome. Life-time prevalence of AN is estimated at 0.16% and 0.63% for BN (Qian et al., 2021). BED and OSFED are the most common eating disorders with estimated life-time prevalence of 2% (Kessler et al., 2013) and 5% (Hay, 2020), respectively. However, these numbers might be outdated as recently, and related to the Covid-19 crisis, the estimated prevalence of BED has increased and patients seeking help display more severe symptoms (Termorshuizen et al., 2020).

Though BED is the most common eating disorder, BED remains underrecognized in comparison to AN and BN (Mitchison & Hay, 2014) leading to undertreatment of this disorder in clinical practice in the Netherlands. At the Novarum center for eating disorders we regularly admit patients who suffer from BED complaints for decades. Usually, they have been referred for weight loss treatments in the past. Consequently, the number of binges increase which leads to weight gain (Fairburn, 2008).

In conclusion, there is still a lack of sufficient data about clinical characteristics and the clinical course of BED. Moreover, due to its recent acknowledgement, data regarding BED examining the etiology, prevalence, correlates, and response to treatment are scarce. Therefore, this dissertation will focus on BED. It will focus on several knowledge gaps regarding assessment, prevalence, and correlates of BED. Another focus area will be treatment for BED: its efficacy, effectiveness, and cost-effectiveness. In short, three main subjects will be addressed in this dissertation: assessment, correlates and treatment.

Eating disorders occur globally

Though data regarding efficacy and cost-effectiveness of treatments for BED are scarce in the western world, etiology, prevalence, and correlates are unknown of several Arab countries such as Saudi Arabia. This may be because traditional Arab notions of beauty differ from the western ideal, with a curvy body being associated with fertility and wealth (Ford et al., 1990). However, since the rise of the thin ideal (Gordon, 2001) there are indications that also evaluation of self-worth predominantly in terms of control over weight and shape is increasingly prevalent in Saudi Arabia. After observation of the large diet (Imarcgroup, 2023) and cosmetic surgery (Bell, 2019) industries and from personal communications, it could cautiously be concluded that overevaluation of shape and weight is present in modernized Saudi Arabia. In addition, recent studies show that eating disorders occur globally (Keel & Klump, 2003; Thomas et al., 2016). However, research regarding eating disorders including BED is still in its infancy in Saudi Arabia. In addition, the lack of popular knowledge about eating disorders leads to stigmatization, and delayed help seeking (Griffiths et al., 2015). Since it is culturally unacceptable to discuss personal matters with non-family members, only 0.3% of Saudis with an eating disorder seek help, compared to 20% of eating disorder patients in western countries (Latzer et al., 2009). Saudis ae more prone to seek help when they

experience physical complaints, such as diabetes mellitus or kidney failure. Furthermore, eating disorders are not perceived as diseases of primary care and therefore barely recognized in Saudi Arabia (Alkhadari et al., 2016). Saudi Arabia faces an absence of assessment tools and specialized treatment centers (Darcy et al., 2012; Qadan, 2009). Moreover, Saudi Arabia is a widespread country, covering 2,150,000 km^2, including large desert plains. Therefore, even when specialist facilities would be available, Saudis would potentially deal with geographical barriers for treatment (Abrahamsson et al., 2018). Research regarding eating disorders in Saudi Arabia is further complicated by Saudi being a relatively culturally reclusive society, hard to access, and dealing with several taboos regarding mental health problems. Moreover, Saudi citizens are very sensitive to how they are viewed by others, and therefore, less likely to participate in surveys, questioning them on their personal beliefs and values (Al-Darmaki, 2003). It is challenging to build stepping stones for the investigation of eating disorder pathology in Saudi Arabia. It is deemed necessary to increase awareness on eating disorders in the Saudi community (Thomas et al., 2014).

Correlates of eating disorder pathology

The Saudi culture is currently undergoing rapid changes. Since the oil boom of the 1970's Saudi Arabia is dealing with an increased affluence resulting in rapid sociocultural and socioeconomic changes (Pike et al., 2014; Thomas et al., 2018). Furthermore, research shows that countries dealing with rapid sociocultural changes are impacted by an increase in eating disorder prevalence (Gordon, 2001; Pavlova et al., 2010). Various explanations have been put forth. Sociocultural changes come along with a sedentary lifestyle (WHO, 2006), and a dietary shift towards western types of foods, higher in salt, sugar and fat, all instrumental in the rise of excess weight (Hawks et al., 2004; Madanat et al., 2007). Currently, Saudi Arabia has one of the highest prevalence rates of excess weight (WHO, 2006), which is known to be

associated with eating disorder pathology, especially with recurrent binge eating and BED (Unikel Santoncini et al., 2018; Van der Horst et al., 2019; Van Son et al., 2013). Moreover, excess weight appears to be associated with body-shape dissatisfaction, and Saudis who are dissatisfied with their bodies have an increased risk for unhealthy dietary habits (Stice & Shaw, 2002), which may increase the risk of developing eating disorder pathology (Cooper et al., 1987). Other consequences of the rapid sociocultural changes in Saudi Arabia are associated with eating disorder pathology as well. The arrival of western companies, western expatriates (Thomas et al., 2018; Zeeni et al., 2013), increased exposure to western cultures (Pike & Dunne, 2015), and western social media (Madanat et al., 2007; Musaiger & Al-Mannai, 2013, 2014) led to a rise in the popularity of the "thin ideal" (Ford et al., 1990; Thomas et al., 2014). Consequently, levels of dieting, body-shape dissatisfaction and eating disorder pathology increased (Gow et al., 2020; Haines & Neumark-Sztainer, 2006; Pike & Dunne, 2015). Furthermore, rapid sociocultural changes might be accompanied by low self-esteem and increased stress. Both appear associated with eating disorder pathology (Gow et al., 2020; van der Valk et al., 2018; Yoneda et al., 2021). In addition, excess weight strengthens the association between eating disorder pathology and its correlates (Friedman et al., 2002; Madanat et al., 2007; Musaiger & Al- Mannai, 2013). However, since Saudi Arabia deals with a high prevalence of excess weight it is unclear whether media use, body-shape dissatisfaction, low self-esteem, increased socio-economic status, westernization and perceived stress are still correlates of eating disorder pathology after controlling for the effect of body mass index (BMI, kg/m^2) (Gow et al., 2020; Haines & Neumark-Sztainer, 2006; van der Valk et al., 2018; Yoneda et al., 2021). The prevalence of eating disorder pathology could potentially be predominantly associated with the rates of excess weight (Unikel Santoncini et al., 2018). Identification of correlates of eating disorder pathology, including BED and the covariating role of high BMI may facilitate the identification of individuals at risk for

developing an eating disorder and who may benefit from participation in prevention programs (Stice et al., 2010; Stice et al., 2007). Consequently, reliable and valid assessment tools adapted to the Saudi language and culture are needed, in order to detect Saudis at high risk of eating disorders and body-shape dissatisfaction (Latzer et al., 2009; Musaiger et al., 2013). Therefore, this dissertation will first focus on assessment of eating disorder pathology.

Assessment

Various interview and self-report measures are developed to screen for eating disorders and body-shape dissatisfaction . The Eating Disorder Examination (EDE), a semi-structured interview is the most widely used assessment tool to assess eating disorders and eating disorder symptoms such as binge eating and shape concern (Cooper & Fairburn, 1993). The EDE is generally considered reliable and valid, has good internal consistency (Cooper et al., 1989), test-retest reliability (Rizvi et al., 2000), and discriminative and concurrent validity are supported (Rosen et al., 1990). However, as administration of the EDE is time consuming and the instrument needs to be administered by trained professionals, self-report measures can be a less time consuming and more practical alternative. The Body Shape Questionnaire (BSQ) (Cooper et al., 1987) is most often used to measure body-shape dissatisfaction (Rosen et al., 1996). The original British BSQ (Cooper et al., 1987) is translated and adapted to various western cultures, such as Sweden, Norway, Portugal, Spain, Italy and various Latin-American countries such as Brazil, Colombia and Mexico (Ayensa et al., 2002; Castrillón Moreno et al., 2007; da Silva et al., 2014; Kapstad, 2015; Pook, 2008; Rosen et al., 1996; Stefanile et al., 2009; Welch et al., 2012). In addition, the Eating Disorder Examination-Questionnaire (EDE-Q) (Fairburn & Beglin, 1994) is a self-report measure based on the EDE (Cooper & Fairburn, 1993). The EDE-Q and EDE show acceptable levels of agreement, and therefore, when necessary, the EDE-Q can be used instead of the EDE (Reas et al., 2006).

Therefore, the EDE-Q is the most widely used self-report assessment tool to screen for eating disorder pathology and to assess its severity (Fairburn & Beglin, 1994). The EDE-Q is currently available in the Netherlands, Finland, Spain, Australia, Malaysia, Japan, Mexico and Israel, and various other countries (Aardoom et al., 2012; Calugi et al., 2017; Isomaa et al., 2016; Peláez-Fernández et al., 2012; Unikel Santoncini et al., 2018; Zohar et al., 2017). Although the BSQ and EDE-Q are valid and reliable assessment tools with good psychometric properties, such as high internal consistency and test-retest reliability, factorial and convergent validity (da Silva et al., 2014; Isomaa et al., 2016; Kapstad, 2015; Luce et al., 2008; Pook, 2008; Rosen et al., 1990; Welch et al., 2012), the BSQ and EDE-Q are currently not available in an Arabic version adapted for use in Saudi Arabia. Absence of assessment tools to measure body-shape dissatisfaction and eating disorder pathology may lead to overlooking or underdiagnosing BED and other eating disorders, which hampers timely proper treatment (Alkhadari et al., 2016). In addition, the ability to screen for body-shape dissatisfaction is an important first step to help prevent eating disorders through intervention programs, since targeted programs are more effective than universal preventative programs (Stice et al., 2019). Due to cultural differences, norms for Western and Arabic populations may differ (Welch et al., 2011). Therefore, the present thesis aims to adapt the BSQ and EDE-Q to the Saudi language and culture and evaluate its psychometric properties. In addition, valid assessment tools could also be used to measure reduction of eating disorder symptoms after eating disorder treatment, and therefore to assess efficacy and effectiveness of the various eating disorder treatments across the globe. This dissertation will also focus on efficacy and effectiveness of eating disorder treatment.

Treatment

Data regarding efficacy, effectiveness and cost-effectiveness of treatments for BED are scarce in the western world. Currently there is a range of treatments available for BED and other eating disorders, such as Dialectical Behavioral Therapy, Interpersonal Therapy and Cognitive Behavioral Therapy (ANZAED, 2014; Fairburn, 2008; NICE, 2017). Treatments for eating disorders based on cognitive behavioral principles display superior treatment outcomes (Agras et al., 2000). However, in 2003 Fairburn suggested that eating disorder pathology is maintained by a set of common mechanisms and that treatments addressing these mechanisms should be effective for various eating disorder presentations (Fairburn et al., 2003). Therefore, Fairburn modified the most leading evidence-based treatment for BN (CBT-BN) (Cooper & Fairburn, 1993) to make it suitable for treatment of all eating disorders. This resulted in Enhanced Cognitive Behavioral Therapy (CBT-E) (Fairburn, 2008), of which efficacy is proven in several randomized controlled trials. CBT-E appeared effective among transdiagnostic samples and for adult patients suffering from BN and atypical AN (Fairburn et al., 2003). In addition, CBT-E appeared also affective among adolescents with BED. Therefore, the Dutch national guideline recommends "Cognitive Behavioral Therapy-Enhanced" (CBT-E) (Zorgstandaard, 2021). However, data are scarce on how adult patients diagnosed with BED respond to CBT-E when offered individually (Berg et al., 2020; Fairburn et al., 2015; Fairburn et al., 2009; Wade et al., 2017). In addition, efficacy of CBT-E is mostly examined in randomized controlled trials, conducted under ideal circumstances, while effectiveness studies involve a naturalistic design and measure the degree of beneficial effect in real world, clinical settings (Andrews, 1999; Nordon et al., 2016). Therefore, as efficacy of CBT-E is well documented, its effectiveness among patients suffering from BED should be investigated. Furthermore, comparing the effectiveness of CBT-E between various eating disorders could potentially confirm its transdiagnostic nature. Moreover, determination of factors predicting CBT-E treatment outcome would provide prognostic information about for

whom CBT-E is likely to be beneficial and for whom less so. Treatment outcomes can potentially be maximized by understanding its predictors as more targeted treatments can be offered and potentially add-ons can be developed, thus improving clinical decision making (Kraemer, 2013).

Towards more efficiency: Guided self-help treatment

CBT-E is effective, but it is a time consuming treatment, requesting intense therapist involvement. In order to offer more efficient treatments, several new technologies are implemented, such as online guided self-help interventions or eMental Health (Donker & Kleiboer, 2018; Eysenbach, 2001). Therefore, the availability of eMental Health interventions has grown extensively over the past years. During eMental Health interventions patients will complete home assignments and upload them in an interactive treatment platform. eMental Health interventions can be unguided or therapist guided. During guided interventions patients and therapist interact through telephone calls, videoconferencing or chat. In addition, guided eMental Health interventions are more effective than unguided eMental Health interventions (Andersson & Cuijpers, 2009; Palmqvist et al., 2007; Spek et al., 2007). Furthermore, eMental Health interventions are effective for alcohol abuse (Cunningham et al., 2009; Eysenbach et al., 2010), depression (Andersson & Cuijpers, 2009; Andrews et al., 2010; Spek et al., 2007) and anxiety disorders (Andrews et al., 2010; Palmqvist et al., 2007; Spek et al., 2007). However, it is yet unknown whether CBT-E is effective and indeed efficient when offered by an online treatment modality. In addition, many authors mention the present gap between treatment needs and treatment provision (Abrahamsson et al., 2018; Becker et al., 2010; Fairburn & Patel, 2017; Shafran et al., 2009). There is a lack of specialized therapists and consequently, eating disorder patients have to deal with long waiting time to commence treatment (Fairburn & Peveler, 1990; Shafran et al., 2009). For instance, over all treatment

facilities in Amsterdam, the average wait time for an intial intake session is 11 weeks, and a further 20 weeks for treatment (NZA Nederlandse zorg autoriteit). Thus, there is a need to increase access for patients to specialized eating disorder treatment (Abrahamsson et al., 2018). The shortage in treatment availability can be covered by offering treatment as eMental Health. eMental Health offered as a guided self-help intervention may reduce the amount of intensive therapy, the amount of specialists time invested in a single treatment and, therefore, potentially reduce waiting time duration (Abrahamsson et al., 2018; Fairburn & Peveler, 1990; Shafran et al., 2009). Furthermore, guided self-help increases access to specialized treatment (Abrahamsson et al., 2018), which may improve quality of life (Fairburn & Peveler, 1990; Shafran et al., 2009). Guided self-help has also several additional advantages for the patient, such as the removal of geographical barriers, the possibility to hold sessions within the patient's own environment, reduced travel costs and travel time, and to communicate with their therapist wherever they are (Abrahamsson et al., 2018; Becker et al., 2010; Evans et al., 2011). Furthermore, according to a stepped care principle (Bower & Gilbody, 2005), guided self-help should be the first treatment of choice for patients diagnosed with BED, as preferably, the least resource-intensive treatment is delivered first (Mitchell et al., 2011). As international guidelines recommend guided self-help based on cognitive behavioral principles for BED (ANZAED, 2014; NICE, 2017), offering a guided self-help version of CBT-E including 12 weekly brief telephone sessions first might be an efficient treatment modality for BED.

Responding to the absence of a CBT-E based guided self-help treatment in Dutch, Novarum, Center for Eating Disorders in the Netherlands, developed a guided self-help version of CBT-E, based on the self-help section (Part two) of *Overcoming Binge Eating, The Proven Program to Learn Why You Binge and How You Can Stop* (Fairburn, 2013; Fairburn, 2016). As a first step of evaluating this treatment modality for BED, its efficacy should be

examined in a randomized controlled trial by comparing outcomes of an experimental treatment group to a waiting list control group. Thus, efficacy will be examined in comparison to a delayed treatment control condition. It is hypothesized that guided self-help CBT-E is superior to the control condition with regard to a decrease in binges, full recovery and diminished clinical impairment. Guided self-help CBT-E is also expected to be superior to the waiting list with regard to an increase in self-reported quality of life.

When the efficacy of guided self-help CBT-E is demonstrated, it could potentially mitigate the scarcity of specialized therapists, since guided self-help CBT-E requires less therapist involvement. In addition, if proven efficacious guided self-help CBT-E could be a cost-effective alternative compared to treatment as usual (ANZAED, 2014; NICE, 2017). Guided self-help CBT-E is briefer than in-person CBT-E and therefore potentially associated with lower costs of offering treatment. For example, costs of offering guided self-help based on regular CBT vary between €630- €900, whereas the costs for in person CBT-E are around €3,500 (Berg et al., 2020; Jenkins, 2021; König et al., 2018). In addition, guided self-help CBT-E potentially decreases societal burdens (Weissman, 2017), since BED is associated with non communicable diseases such as hypertension and diabetes mellitus (Eapen et al., 2006) and decreased work place productivity (Jenkins, 2021).

Conclusion

While studies regarding eating disorders are in their infancy in Saudi Arabia, knowledge in the Netherlands is more advanced. The Netherlands has several validated assessment tools available, such as the EDE (Cooper & Fairburn, 1993) and the EDE-Q (Fairburn & Beglin, 1994) as well as several kind of evidence based psychological treatments for eating disorders. Example of such an effective treatment is CBT-E (Berg et al., 2020; Fairburn et al., 2015).

However, effectiveness of CBT-E for BED is currently unknown, as well as efficacy and cost-effectiveness of the recently developed guided self-help version of CBT-E.

Saudi Arabia currently deals with an absence of culturally validated assessment tools and specialized treatment centers. It is of importance to increase awareness regarding eating disorders since Saudi Arabia currently deals with rapid sociocultural changes, which is associated with eating disorder pathology (Pike et al., 2014; Thomas et al., 2018). Cautiously, it can be concluded that the current state of knowledge concerning eating disorders in Saudi Arabia appears comparable to those of eating disorders in the Netherlands around the 1980's (Alkhadari et al., 2016; Qadan, 2009).

Aims

In this dissertation several knowledge gaps of aspects of eating disorders, mainly BED in the Netherlands and Saudi Arabia will be investigated. However, due to the major differences regarding the current state of knowledge, studies in the Netherlands will focus on different aspects of BED than in Saudi Arabia. Each chapter in this thesis focuses on different aspects of eating disorders which include screening, identification of correlates and therefore individuals at potential risk, treatment effectiveness, treatment efficacy, and cost-effectiveness.

Aim of the studies in Saudi Arabia is two-fold: (1) to adapt and examine psychometric properties of the two most used assessment tools to examine body dissatisfaction and eating disorder pathology: the BSQ and EDE-Q; (2) to investigate potential correlates of eating disorder pathology.

Main purpose of the studies in the Netherlands is to examine the effectiveness and efficacy of two treatment modalities of CBT-E for BED. The first treatment modality will be

in-person CBT-E for BED. As several trials showed that the efficacy of CBT-E is well documented among BN and transdiagnostic samples, its effectiveness in clinical practice using ROM data will be evaluated for patients with BED. Through a naturalistic design, outcome predictors of CBT-E will also be examined. The second treatment modality for BED will be eMental Health, offered as an online guided self-help version of CBT-E. Therefore, next efficacy of guided self-help CBT-E for BED will be examined through a randomized controlled trial (RCT) and an economic evaluation alongside the RCT will be undertaken.

Outline of this thesis

Chapter 2 reports on the evaluation of an adapted version of the EDE-Q in order to make it suitable for use among Saudis.

Chapter 3 describes the development of a Saudi version of the BSQ.

Chapter 4 presents a comprehensive synthesis regarding rapid sociocultural changes in Saudi Arabia and its consequences, including correlates and risk factors for BED. It will offer guidance for further studies investigating correlates of eating disorders.

Chapter 5 investigates the associations between expressions of sociocultural changes and eating disorder pathology in Saudi Arabia.

Chapter 6 will examine the effectiveness of CBT-E in everyday clinical practice. It investigates and compares effectiveness of CBT-E among patients with BED to patients diagnosed with BN and OSFED. Furthermore, predictors of treatment outcome are evaluated.

Chapter 7 will present the study protocol of the study described in Chapter 8.

Chapter 8 reports on the efficacy of online guided self-help CBT-E in a randomized controlled trial.

Chapter 9 will focus on cost-effectiveness and cost-utility of guided self-help CBT-E utilizing the outcome data of the randomized controlled trial.

Finally, **chapter 10** contains a summary and general discussion of the main findings. Furthermore, the strengths and limitations will be discussed, and directions for future studies will be considered. Last, implications of the findings of the studies for clinical practice will be presented.

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Chapter 2 Eating Disorder Examination Questionnaire (EDE-Q): Validity and Norms for Saudi nationals

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Abstract

Purpose: The aim of this study was to develop an Arabic version of the EDE-Q and to assess its psychometric properties and utility as a screener in the Saudi population. An additional aim was to establish EDE-Q norms for Saudis.

Method: EDE-Q data were collected in a convenience sample of the Saudi community (*N*=2690), of which a subset was also subjected to the EDE interview (*N*=98). Various models for the factor structure were evaluated on their fit by CFA. With ROC analysis, the AUC was calculated to test how well the EDE-Q discriminated between Saudis at high and low risk for eating disorders.

Results: The original four factor model of the EDE-Q was not supported. Best fit was found for a three factor model, including the weight/shape concern scale, dietary restraint scale and eating concern scale. The ROC analysis showed that the EDE-Q could accurately discriminate between individuals at high and low risk for an eating disorder according to the EDE interview. Optimal cut off of 2.93 on the global score yielded a sensitivity of 82% and specificity of 80%. EDE-Q scores were fairly associated with BMI.

Discussion: Psychometric characteristics of the Saudi version of the EDE-Q were satisfactory and results support the discriminant and convergent validity. Severity level of eating disorder pathology can be determined by the EDE-Q global score. Global scores were high compared to what is found in Western community samples, leading to high prevalence estimates for Saudis at high risk for eating disorders.

Level of Evidence: Not applicable, empirical psychometric study

Keywords: Eating Disorder Examination Questionnaire, Eating Disorders, Norms, Validity, Saudi Arabia

Introduction

Prevalence of eating disorders (EDs), which occur allover the world (Keel & Klump, 2003; Thomas et al., 2016) is increasing in the Middle East (Abou- Saleh et al., 1996; Nasser, 1994; Pike et al., 2014). The Eating Disorder Examination (EDE) interview is the most widely used assessment tool to assess EDs and ED symptoms and is generally considered reliable and valid (Cooper & Fairburn, 1993). As administration of the EDE is time consuming a self-report questionnaire, the Eating Disorder Examination Questionnaire (EDE-Q) was created to screen for EDs and assess its severity (Aardoom et al., 2012; Fairburn & Beglin, 1994; Isomaa et al., 2016a; Isomaa et al., 2016b). EDE-Q is a reliable assessment tool with a high test-retest reliability (Berg et al., 2011; Luce et al., 2008), internal consistency (Isomaa et al., 2016a; Luce et al., 2008), discriminative validity (Aardoom et al., 2012; Streiner et al., 2015) and sufficient sensitivity to changes in eating pathology (Luce et al., 2008). If it proves to be a sufficiently sensitive and specific screener, it can be used prior to the EDE interview as part of a two-staged assessment procedure.

There is a lack of valid ED assessment tools in the Middle East (Schulte, 2016; Thomas et al., 2016). Normative data of the EDE-Q are only available for Western populations (Aardoom et al., 2012; Isomaa et al., 2016a; Luce et al., 2008), and due to cultural differences, norms for Western and Arabic populations may differ (Welch et al., 2011). An Arabic version of the EDE-Q is needed to facilitate detection of Saudis at high risk of an ED and subsequently treatment of EDs in Saudi Arabia (Latzer et al., 2009; Musaiger et al., 2013).

The aim of this study was to translate the EDE-Q in Arabic, to assess its psychometric properties among Saudi nationals, and to assess its utility as a screener to identify Saudis at high risk for EDs. An additional aim was to establish EDE-Q norms for Saudis.

2 Methods

2.1 Procedure

This study recruited a convenience sample, from students of Princess Noura bint Abdulrahman University (PNU), King Saud University, and the Sixth High School for Quran Memorization, all located in Riyadh. Additional participants were recruited through the principal investigator her social network, and through a project explanation shared through social media, targeting Saudi nationals allover the country. One influencer (@Eyaad) and several sports facilities also distributed a link to the questionnaire: NuYu gym (Riyadh, Dammam & Jedda), Sukoun Yoga studio in Riyadh, and the Belgian embassy in Riyad sent a link to Saudi nationals residing in or who previously had resided in Belgium. The Saudi embassies in Germany, France and Switzerland did the same in those countries. Recruitment was conducted between April 2017 and May 2018. Participants were asked to complete an online survey, available in Arabic (n=2599 participants, 96,6 %) and English (n=91 participants, 3,4%). Prior to assessment, all participants were asked to provide informed consent. Minors were asked to get their guardian (father, brother or uncle) to sign the informed consent form. Questions were sent by email to the principal investigator. Participants were recruited in two phases. In the first, based on self-report, the EDE-Q and a demographics questionnaire were administered. During the second phase, the EDE interview was administered to a subset of participants (N=98). Participants who provided their contact details in the online questionnaire were contacted for EDE interview, which took place between November 2017 and February 2018, in English (52,5%) and Arabic (46,5%). The majority of the participants were Saudi nationals (97,4% for the EDE-Q and 99,0% of the EDE sample. For demographic details (Table 1).

2.2 Measures

2.2.1 Self-Report Questionnaire: EDE-Q 6.0

The EDE-Q is based on the DSM (Abdollahi & Mann, 2001; Hilbert et al., 2012). EDE-Q is a self-report questionnaire of 28 items with a 7-point Likert scale ranging from 0 (feature was absent) to 6 (feature was markedly present or present every day), measuring purging and bingeing behaviors during the previous 28 days (Fairburn & Beglin, 1994), consists of four subscales: dietary restraint, weight concern, shape concern, and eating concern (Hilbert et al., 2012) and a global score for general severity (Aardoom et al., 2012; Hilbert et al., 2012; Isomaa et al., 2016a; Luce et al., 2008). Dietary restraint, weight concern and eating concern are each measured by five items, shape concern by eight items and six additional items measure frequency of binge episodes, overeating, purging and laxative abuse. Subscale scores are the mean of the items that compose them, with a range of 0 to 6. The global score is the mean of the subscale scores, with higher scores indicating higher severity/frequency of EDs. Questions about weight, height and menstrual functioning are also included in the EDE-Q (Isomaa et al., 2016a).

The Arabic version of the EDE-Q was translated by a native speaker, a clinical psychology student of Princess Noura bint Abdulrahman University with a parallel translation by a professional translator. Minor differences in word choice and phrasing between both versions were discussed then resolved and translated back, and the following cultural adaptations were made by the principal investigator. In item 2 on restraint eating behavior, it was stipulated that not eating for a long period while being awake should be motivated by shape and weight concerns and not by religious motivates arising from the holy month of Ramadan. Item 28, involving shape concern (avoidance of exposure) was also adapted, because communal changing rooms and public swimming pools are rare in Saudi Arabia and the few that exist are strictly genders separated. Thus, communal changing rooms and

swimming pools were replaced by weddings and the gym, which are locations where women do not cover themselves, because they are strictly gender separated. When this study was conducted, female gyms were about to be legalized and were a popular place to work-out and meet friends. Still, since women consider weddings a good place to find future wives for their male family members, some women in the principal investigators personal network admitted feeling exposed while attending them.

The Arabic version of the EDE-Q 6.0 is available from the principal investigator upon request. A pilot study among 50 Princess Noura bint Abdulrahman Health faculty students conducted in January 2017, offered the choice of completing the English or Arabic version of the EDE-Q. Although bilingual, most students preferred the Arabic to the English. Participant feedback on the pilot indicated that the quality of the translation was good. Substantial non-response (14 persons, 28%) was noticed on the questions regarding menstrual functioning, probably due to Saudi Arabia being a closed society, leading to a taboo on discussing fertility and menstrual issues. Besides, Islam considers women as impure during their menstruation and they are not allowed to fast during menstruation in the holy month of Ramadan, or to pray and do their ablutions.

2.2.2 Interview: EDE 16.0

The EDE (Fairburn & Beglin, 1994) 16th edition is a semi- structured interview that is widely used to assess ED pathology (Guest, 2000) in the previous 28 days to 6 months (Cooper & Fairburn, 1987). The EDE, has good internal consistency (Cooper et al., 1989), test-retest reliability (Rizvi et al., 2000), and discriminative & concurrent validity is supported (Rosen et al., 1990). ED pathology severity is measured on a 7 point Likert scale (0: feature was absent, to 6: feature was markedly present or present every day) (Fairburn & Beglin,

1994), and the global score calculated as the mean of all individual items. Subscale scores are calculated as average score of the relevant items. For the Arabic version, some items were first culturally adapted by the principal investigator and two of her students, then translated to Arabic by the students. As with the EDE-Q, for questions regarding dietary restriction, it was made clear that this must not involve religious motivation during Ramadan. The question regarding discomfort about exposure, swimming and communal changing rooms were replaced by gym and weddings, and wearing a wider or dark colored abaya (mandatory coat for women) was added. Because of the high non-response to the question about menstruation, interview questions regarding menstruation were introduced after asking for permission to discuss a potentially taboo topic. All female participants agreed to discuss taboo topics.

2.2.3 Administration of Measures

The EDE-Q was administered online through Survey Monkey. For cultural reasons, as Saudi law does not allow being in public places with a non-relative of the opposite sex, leading to some participants feeling uncomfortable being interviewed in a public place or at home, participants who agreed to participate in the EDE interview were asked to propose locations for their interviews. Most interviews with female participants were held at the principal investigator her office, which was only accessible to women. Most interviews with male participants were held at the principal investigators home office. Other locations were restaurants and participants' homes.

2.4 Participants

The EDE-Q was completed by 2769 participants, a substantial proportion of female respondents declined to respond to the question about their menstrual cycle (143 participants,

5,3%) in the EDE-Q. Those respondents were included, as were participants with missing data on the behavioral frequency items, 79 (2,9%) participants had missing data in their EDE-Q so were excluded. In total, 2690 respondents completed the EDE-Q without any missing items.

The EDE interview was conducted in a subset (*N*=102). Six participants did not attend their scheduled EDE assessment, four participants (3,9%) who completed the EDE and EDE-Q had ≥5% missing data in their EDE-Q and were also excluded. In total, there was complete data for both the EDE and the EDE-Q for 98 participants. All participants were Saudi passport holders, ≥14 years and literate.

2.4.1 EDE-Q sample

Participants were 2690 Saudi nationals (Table 1), and the EDE-Q was completed between April 2017 and May 2018. There were differences between the EDE-Q sample and the Saudi population: females were over- represented, with the EDE-Q sample including 78% females, vs. 42,3% in the Saudi population (MLA, 2019). There was a greater percentage of single participants (70,4% vs 33,0%) and a smaller percentage married (27,5% vs 58,8%) (General Authority for Statistics, 2016b). The EDE-Q sample was also more highly educated: most participants attended high school (27,7%) compared to 5,4% of the wider population (Puri- Mirza, 2019), and around a quarter of the sample attended university in KSA, compared to 4,4% generally (Habibi, 2015). Besides, 20,4% of the sample was employed, compared to 30,2% generally (Trading Economics, 2019). Participants resided all over Saudi Arabia (details available with the principal investigator), though most resided in the larger cities, and some regions were overrepresented in the EDE-Q sample (MLA, 2019). Some participants lived abroad, 56 off them lived in another Gulf country and one female participant resided in Spain. Nationality statistics of Saudi Arabia were unavailable.

Table 1 Demographics of the EDE and EDE-Q sample

	EDE-Q (*N*=2690)	EDE (*N*=98)	Saudi Statistics	Source
Age (SD)	24.7 (9,3)	25.2 (9,8)	30.3	Plecher (2019)
Male	592 (22,0%)	29 (29,6%)	57,3%	MLA (2019)
Female	2098 (78,0%)	69 (70,4%)	42,7%	MLA (2019)
Weight status				
BMI (SD)	31.0 (5,9)	25.7 (5,9)	28.5	WHO (2004)
Underweight	269 (9,8%)	6 (6,2%)	8,5%	Higa et al. (2017)
Normal Weight	1149 (43,0%)	45 (46,4%)	39,0%	Higa et al. (2017)
Overweight	623 (23,0%)	26 (26,8%)	23,8%	Al-Khaldi (2016)
Obese	634 (24,8%)	20 (20,6%)	29,0%	El-Gilany and Hammad (2010)
Marital Status				General Authority for Statistics (2016a)
Single	1894 (70,4%)	80 (81,6%)	33,0%	
Married	740 (27,5%)	15 (15,3%)	58,8%	
Divorced	56 (2,1%)	3 (3,1%)	2,6%	
Occupation (highest completed)				
High School	745 (27,7%)	0	5,4%	Puri- Mirza (2019)
University in Saudi Arabia	686 (25,5%)	55 (56,1%)	4,4%	Habibi (2015)
Employed	549 (20,4%)	24 (24,5%)	30,2%	Trading Economics (2019)
Unemployed	401 (14,9%)	11 (11,2%)	12,5%	Arab News (2019)
University in another Arab country	56 (2,1%)	1 (1,0%)	1,8%	Top Universities (2015)
University in a Western country	27 (1,0%)	2 (2,0%)	0,4%	Habibi (2015)
Other[1]	218 (8,1%)	5 (5,1%)		
City of residence[2,3]				MLA (2019)
Riyad	1065 (39,9%)	43 (44,0%)	12,2%	
Jedda	191 (7,1%)	19 (19,4%)	8,3%	
Mecca	80 (3,0%)	1 (1,0%)	3,8%	
Medina	48 (1,8%)	2 (2,0%)	3,8%	
Dammam	88 (3,3%)	5 (5,0%)	2,2%	
Taif	38 (1,4%)	1 (1,0%)	1,5%	
Tabuk	24 (0,9%)	1 (1,0%)	1,3%	
Bariatric surgery				
Underwent surgery	207 (7,7%)	4 (4,1%)	8,0%	Ahmed et al. (2018)

[1] unable to find statistical data, [2] data were missing of *n*=685 (32.1%) participants in the EDE-Q sample, [3] only largest cities mentioned

2.4.2 EDE sample

Participants with high EDE-Q global scores who provided email addresses were sent a request in Arabic and English, to schedule an appointment for an EDE interview. If they didn't respond but had left their phone number, they were called within one week. Text message reminders about the appointment were sent on the day the interview was scheduled. The EDE was generally conducted within two weeks of completion of the EDE-Q. The EDE (*N*=98) was conducted in Arabic or English depending on the participants' preference; 53 (54%) in English by the principal investigator; 45 (46%) in Arabic by one of her female students, trained by the principal investigator. Differences between the average Saudi population and the participants interviewed with the EDE were as follows: females were over-represented, 70,4% in the sample vs. 42,7% in the general population (MLA, 2019), there were minor differences in BMI, with a smaller proportion of the sample (20,6%) suffering from obesity compared to the average population (29,0%) (El-Gilany & Hammad, 2010). In addition, the majority of the sample was attending university in Saudi Arabia (56,1%), compared to 4,4% of the general population (Habibi, 2015); and most participants resided in the largest cities, Riyadh (44,0%) and Jeddah (19,4%), as compared to national percentages 12,2% and 8,3% respectively (MLA, 2019).

2.5 Statistical analysis

SPSS version 25 and AMOS version 26 were used for statistical analysis. Scores were inspected regarding the frequency distribution by skewness and kurtosis. A two way mixed

intra class correlation (ICC) with consistency agreement was calculated to test for agreement between the EDE and EDE-Q scores. A Bland-Altman plot was used to investigate the relationship between severity level and differences between EDE and EDE-Q total scores, and to identify bias and outliers. Kappa (κ) between the EDE and EDE-Q was calculated to test concordance between both. Binge eating frequencies and compensatory behavior were also assessed and compared between instruments.

Cronbach's alpha was calculated to measure internal consistency of the EDE-Q subscales and total score. A score of ≥0.70 was considered to be acceptable, ≥0.80 good and ≥ 0.90 as excellent. Convergent validity with the EDE of ≥0.70 was considered to be acceptable, ≥0.80 good and ≥ 0.90 as excellent. Effect of age, gender and, level of education/profession on the EDE-Q global score were investigated with ANOVA. To investigate the factor structure of the translated EDE-Q in both samples, the original four factor model (Fairburn & Beglin, 2008) was evaluated on fit using a confirmatory factor analysis (CFA). In addition, the factor structure of a three factor model (1: weight/ shape concern, 2: eating concern, 3: dietary restraint) (Peterson et al., 2007) and two factor model (1: eating/ weight/ shape concern, 2: dietary restraint) (Byrne et al., 2010) were evaluated on fit using CFA.

Based on a subsample scoring at least 2SD above average (n=44, 45%) on the EDE (EDE+ sample), a receiver operating characteristic (ROC) analysis was performed to test the discriminative validity of the EDE-Q for ED pathology severity according to the outcome of the EDE interview. The area under the curve (AUC) was calculated to test how well the EDE-Q discriminated between the groups at high and low risk for an ED. An AUC≥ .90 meant high accuracy,.70- .90 moderate accuracy, and .50-.70 low accuracy. To determine optimal cut-off values on the EDE-Q as a screener for EDs, sensitivity and specificity were calculated for various scores. In order to account for selective non-response percentile scores were weighted

using inverse response probability weighting to obtain estimates for the prevalence of Saudis at high risk for EDs. Finally, the association between BMI and ED pathology was estimated (Fairburn & Beglin, 2008). *T*-tests were used to assess differences in severity level between groups .

2.6 Ethical considerations

The study design was approved on May 7th, 2017 (17-0097) by the ethical review boards of PNU and the King Abulaziz City for Science and Technology, both in Riyadh, Saudi Arabia.

Results

Internal consistencies of the EDE-Q were calculated based on the complete sample (*N*= 2690). Cronbach's α was high for the global scale score (α=0.93), the dietary restraint (α=0.81), shape concern (α=0.84) and weight concern (α=0.83) scales. Internal consistency of the eating concern scale was lower (α=0.69), but still acceptable. Convergent validity was excellent on the global, weight concern and shape concern scales, high on the eating concern scale and unacceptable on the dietary restraint scale. An ANOVA revealed no significant differences in score on the EDE-Q between age groups (age≥18 versus age<18) (F(1, 2689)=0.90, p=0.343), gender (F(1, 2665)=2.38, p=0.123), or level of education/profession (F(6, 2659)=2.04, p=0.058). Furthermore, all scales were normally distributed. BMI was strongly and positively correlated with the EDE-Q global score r=0.96, p<0.001 (Table 2).

Table 2 Average scores, skewness, kurtosis, reliability, convergent validity and association with BMI of the EDE-Q and it's subscales (*N*=2690) and AUC of the EDE-Q global score based on the EDE and concordance rates (*N*=98)

	Mean	SD	Skewness[1]	Kurtosis[1]	α	convergent validity	*R* (BMI)[2]	AUC based on EDE	*R* (EDE)
EDE-Q global	2.25	1.32	0.23	-0.74	0.93	0.99	0.96	0.84	0.72
Dietary restraint	1.71	1.54	0.74	-0.39	0.81	0.63	0.36	0.40	0.60
Eating concern	1.40	1.40	1.02	0.26	0.69	0.83	0.95	0.44	0.65
Weight concern	2.43	1.65	0.34	-0.80	0.83	0.92	0.90	0.37	0.62
Shape concern	2.90	1.62	0.12	-0.94	0.84	0.93	0.91	0.36	0.68

Notes: *AUC* area under curve; *BMI* body mass index; [1]0.05≤ SE≤0.10; [2] p<.001

Confirmatory factor analysis

There was a strong relationship between the weight concern and shape concern subscales (r=0.86, p<0.001). A moderate to strong relationship was found between the eating concern and weight concern scales (r=0.68, p<0.001) and the eating concern and shape concern (r=0.67, p<0.001) scales. These correlations indicate that these four subscales primarily assess the same underlying construct. None of the models tested showed acceptable fit (Table 3). All items loaded substantially on their respective factors in all models.

In the three factor model (Peterson et al., 2007) correlations were high between the weight/ shape concern and eating concern scale. Best fit was a found for a three factor model (with shape and weight concerns combined in a single factor) with RSMEA<0.10 and TLI and CFI of 0.77 and 0.74. As the lack of fit may be due to low intercorrelations among items typically found in a community based sample, the CFA were repeated for a subsample with elevated scores on the EDE-Q. We selected the 20% respondents with the highest scores (n=538). All items loaded positive and significantly on their respective factors in all models. As, even when non-normal items were removed and items with estimated correlations greater than 1 were merged, the four factor and bifactor did not yield a solution, the non-positive method was used, which only provides estimates. Best fit for the sample with elevated scores was the three factor model with the smallest $\chi 2$ to degrees of freedom ratio, GFI=0.86, AGFI=0.83 and RSMEA<0.10. CFA were repeated for a female subsample with elevated scores on the EDE-Q, the results were comparable (results not shown in Table 3). The subsample involving males with elevated scores was too small to conduct a CFA.

Table 3 Fit statistics for alternate models of EDE-Q data in sample with elevated scores on the EDE-Q (*n*=538) and community sample (*N*=2690)

Fit indices	χ2 (df)	RMSEA	GFI	AGFI	NFI	CFI	TLI	IFI
Four factor model Fairburn et al. (1993)								
Community sample	23924.5 (224)[2]	0.199[2]	0.719	0.654	0.486	0.487	0.368	0.488
Elevated scores sample[3]	51760.5 (224)	NA	0.792	NA	NA	NA	NA	NA
Bifactor model Fairburn et al. (1993)								
Community sample	5452.9 (201)[2]	0.099	0.827	0.763	0.883	0.886	0.857	0.887
Elevated scores sample [3]	26283 (208)	NA	NA	NA	NA	NA	NA	NA
Three factor model Peterson et al. (2007)								
Community sample	6697.9 (206)[2]	0.108[2]	0.782	0.732	0.765	0.770	0.742	0.770
Elevated scores sample	922.3 (206) [2]	0.080[2]	0.861	0.830	0.606	0.660	0.619	0.614
Two factor model Byrne et al. (2010)								
Community sample	8527.6 (208)[2]	0.122[2]	0.723	0.663	0.700	0.706	0.706	0.706
Elevated scores sample	1050.5 (208)[2]	0.087[2]	0.843	0.809	0.551	0.600	0.556	0.605
One factor model Aardoom et al. (2012)								
Community sample	9769.5 (209)[2]	0.131[2]	0.677	0.607	0.657	0.661	0.626	0.662
Elevated scores sample	1389.8 (209)[2]	0.103[2]	0.790	0.745	0.406	0.440	0.381	0.446
Re-specified three factor model								
Community sample	3383.9 (87) [2]	0.119	0.829	0.765	0.846	0.850	0.819	0.850
Elevated scores sample	355.6 (87) [2]	0.076[2]	0.916	0.884	0.760	0.805	0.765	0.807

χ2 (df) minimum discrepancy, *RMSEA* root mean square error of approximation, *GFI* goodness of fit index, *AGFI* adjusted goodness of fit index, *NFI*= normed fit index, *CFI* comparative fit index, *TLI* Comparative Fit Index, *IFI*= incremental fit index;
[1] estimates; [2] p<.001

Exploratory factor analysis

As CFA revealed limited fit, an Exploratory Factor Analysis (EFA) with promax rotation was conducted on the entire sample and on sample with elevated scores. The scree-plot suggested four factors explaining 69,9% of the variance. However, item allocation to these four factors did not correspond at all with the purported factor structure. A three factor model was better interpretable and resulted in 15 items loading between 0.21-0.76 in the sample with elevated scores (supplementary Table 1). The first factor (dissatisfaction and discomfort) was comprised of three items of the shape concern scale and two items of the weight concern scale (two items describing dissatisfaction with shape or weight and two items about seeing or exposing body), the second factor (dietary restraint) was comprised of all the items of the dietary restraint subscale, the third factor, four items, included two items of the weight concern scale. Preoccupation with food, guilt about eating, preoccupation with shape and weight and flat stomach did not load substantially on any factor. An EFA conducted for males and females separately provided comparable results, although the item loadings on the first factor were a bit higher in the female than in the male sample. Fit of this three factor model sample with elevated scores was compared to the fit indices of the CFA. The re-specified three factor model had the best fit for the current sample in comparison to other models according to CFA with $\chi 2$ being relatively small in comparison to the degrees of freedom, GFI=0.916, AGFI=0.884 and RSMEA<0.10 for the subclinical sample, although these indices reveal still not acceptable fit. Cross loadings on other factors are low (0.00-0.29) (Table 3).

Other aspects of validity

Since the CFA and EFA did not support the purported factor structure, in further analyses the EDE-Q global score was based on equally weighed item scores rather than the average score on the four subscales. Several analyses were conducted to investigate whether the EDE-Q actually measured a high risk for EDs and ED symptoms. An ICC indicated an acceptable relationship between the EDE and EDE-Q global (*r*=0.78, 95% C.I. [2.03, 4.51]), eating concern (*r* =0.75, 95% C.I. [1.01, 3.78]), shape concern (*r* =0.79, 95% C.I. [2.35, 5.03]), weight concern (*r* =0.73, 95% C.I. [2.21, 4.78]) and dietary restraint (*r* =0.73, 95% C.I. [1.03, 3.51]) scale scores. The EDE and EDE-Q global scores were compared: the mean difference in score was -2.42 (SD= 2.01) with higher scores for the EDE-Q. There are differences between the EDE and EDE-Q and the difference increases for higher scores (Figure 1).

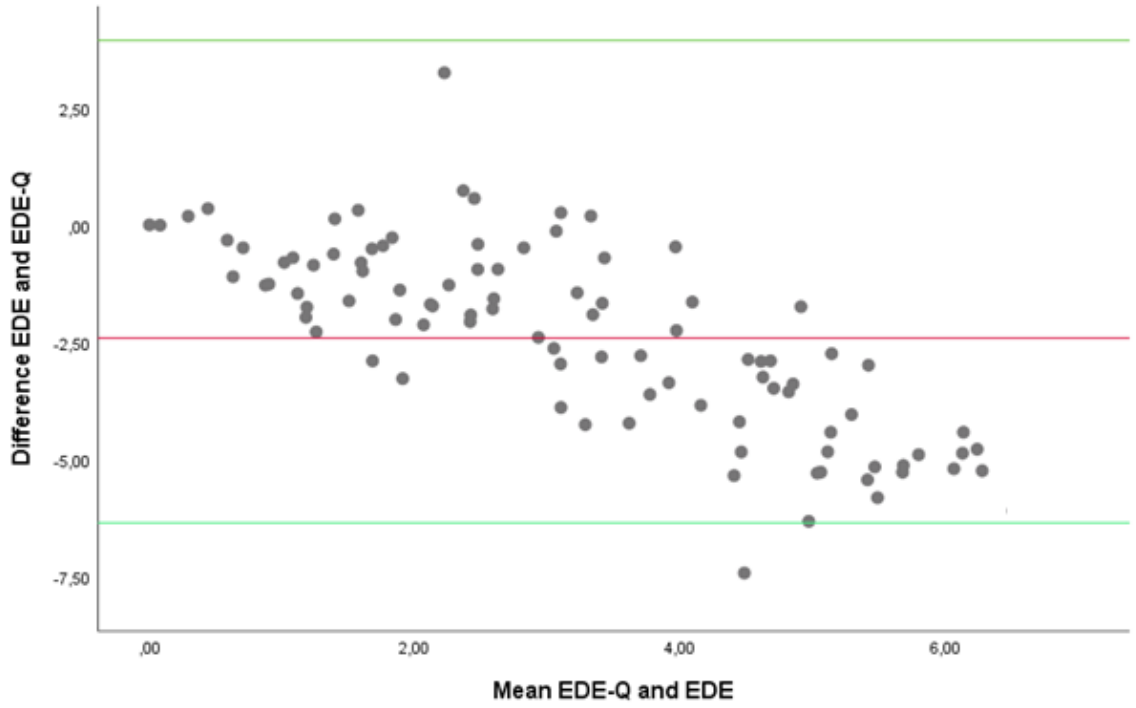

Figure 1

Bland Altman plot revealing a weak association between severity and the difference in score between the EDE interview and the EDE-Q.

Concordance rates between de EDE and the EDE-Q on the global (κ=0.009, p=0.054) and shape concern (κ=0.022, p=0.137) scales were low and not significant. Concordance rates on the eating concern (κ=0.10, p<.001), weight concern (κ=0.07, p<.001) and dietary restraint (κ=0.07, p<.001) scales between the EDE and EDE-Q were low and significant.

The ability of the EDE-Q to discriminate between Saudis at high and low risk for an ED (according to the EDE) was assessed with a ROC analyses in the subsample of interviewed participants. EDE+ was defined as a global score of ≥ 2.5 (Fairburn et al., 1993); 44 respondents (45%) met this criterion. The ROC analysis of the EDE-Q data showed an AUC of 0.84 (95% C.I. [0.69-0.90]), indicating that the EDE-Q is an excellent classifier (Mandrekar, 2010). Apparently, the EDE-Q global score discriminates well between Saudi nationals at high and low risk for an eating disorder. With a cut-off of 4.87 (based on 2 SD above average), sensitivity of the EDE-Q was 89%, specificity was 69%. There were 31% false positives and 11% false negatives. EDE-Q cut-off score of 2,68 had good sensitivity 84% with a specificity of 75%, a cut-of value of 3,40 had a sensitivity of 64% and a specificity of 85% and a cut off score of 2,93 yielded a good compromise, a specificity of 80% and a sensitivity of 82%.

Using this last cut-off value of an EDE-Q score (≥ 2,93) it is estimated that 28,8% (n=775) of the sample was at high risk for an ED. This was 28.5% of the females and, 29.7% of the males included in the sample, there were no differences between both genders (p=0.205). In addition, of the total sample scored 2,1% (n=57) 2 SD's above average and 20,0% (n=538) of the participants scored 1 SD above average. Off the participants with obesity (n=648) scored 5,4% (n=35) 2SD above average and 52,2% (n=338) of off them scored ≥2,93. In addition, 25.9% of the females, 28.4% of males had an EDE-Q score of 2.05 or lower and, 58.1% of the females, 45.9% of male participants had an EDE-Q score below international cut-off of 2.77 or lower. These results are presented in Table 4, along with the

prevalence of specific ED behaviors according to the two measures in both samples, which clearly differ according to both measures. There were no differences in EDE-Q scores (p=0.124) between the subgroup that participated in EDE interview (N=98; M=2.21, SD=1.27), and the subgroup (N=2690; M=2.25, SD=1.32) that did not participate.

Percentile scores were weighted for education/occupation, and presented separately for males and females. (Table 5). The average EDE-Q scores were 2.24 (SD=1.53) and 2.30 (SD=1.28) for females and males respectively. There were no differences in EDE-Q scores (p=0.205) between females and males.

Table 4 Prevalence of eating disorder behaviors measured by the EDE-Q and EDE

Eating disorder behavior	EDE-Q N=2690	EDE N=98
Overeating		
once a week	7,2%	1,0%
twice a week	2,1%	2,0%
trice a week	0,1%	1,0%
every day	0,8%	1,0%
at least once a day	3,1%	0,0%
Subjective binge episodes [1]		
once a week	6,2%	4,1%
twice a week	1,8%	4,1%
trice a week	0,8%	1,0%
every day	1,0%	1,0%
at least once a day	4,0%	1,0%
Objective binge episodes		
once a week	5,9%	4,1%
twice a week	1,9%	1,0%
trice a week	0,4%	1,0%
every day	2,6%	0,0%
at least once a day	0,0%	0,0%
Compensatory behavior		
Vomiting		

	once a week	1,0%	0,0%
	twice a week	0,6%	1,0%
	trice a week	0,0%	0,0%
	at least once a day	0,1%	0,0%
Laxatives			
	once a week	1,1%	0,0%
	twice a week	0,6%	2,0%
	trice a week	0,1%	0,0%
	at least once a day	0,1%	0,0%
Exercising			
	once a week	3,3%	4,1%
	twice a week	1,8%	1,0%
	trice a week	0,7%	5,1%
	at least once a day	1,8%	6,1%
Other [2,3]			
	once a week	NA	12,5%
	twice a week	NA	12,5%
	trice a week	NA	6,3%
	at least once a day	NA	12,5%
Above compromised cut off			
	total sample	28,8%	NA
	male	29.7%	NA
	female	28.5%	NA

During the EDE, one participant admitted using diuretics every day in the previous 28 days; [1] during the EDE, one participant admitted to have subjective binge episodes after bariatric surgery; [2] other compensatory behavior: diet pills, medication misuse, drinking lots of water; [3] not measured by the EDE-Q

Table 5 Mean, standard deviation and percentiles for females and males of the EDE-Q, weighted by occupation/education, and the EDE, non-weighted

Measure	EDE-Q	EDE					EDE-Q	EDE				
	Females						Males					
	(*N*= 2098)	(*N*= 69)					(*N*= 592)	(*N*= 29)				
Variables	EDE-Q global	EDE global	Dietary restraint	Eating concern	Weight concern	Shape concern	EDE-Q global	EDE global	Dietary restraint	Eating concern	Weight concern	Shape concern
Mean	3.04	1.97	1.81	1.01	2.12	2.13	2.90	2.19	1.65	1.33	2.00	2.70
SD	1.27	1.19	1.54	1.43	1.95	1.48	1.20	1.10	1.49	1.50	1.14	1.26
Percentile												
5	0.77	0.15	0.00	0.00	0.00	0.09	0.73	0.12	0.00	0.00	0.00	0.27
20	2.00	0.73	0.00	0.00	0.57	0.64	1.85	1.08	0.00	0.00	0.71	1.45
40	2.77	1.46	1.20	0.00	1.57	1.45	2.60	2.23	1.00	0.50	2.00	2.64
60	3.50	2.38	2.00	1.00	2.29	2.36	3.31	2.69	2.00	1.00	2.57	3.18
80	4.18	3.15	3.20	2.00	3.29	3.64	4.00	3.08	3.20	3.00	2.86	3.91
95	5.07	3.88	4.60	4.25	4.21	4.77	4.73	3.94	4.60	5.00	3.64	4.45

Discussion

Aim of this study was to assess psychometric properties of a Saudi version of the EDE-Q, to assess its utility as a screener for Saudis at high risk for EDs, and to establish EDE-Q norms for the Saudi population. This is the first study to assess the psychometric properties, including norms and discriminative validity of a culturally adapted EDE-Q in a large Saudi community sample. As in other studies, the results did not support the four factor structure of the English original (Aardoom et al., 2012; Becker et al., 2010; Byrne et al., 2010; Fairburn & Beglin, 1994; Peterson et al., 2007), or the alternative three factor model (Allen et al., 2011; Heiss et al., 2018), questioning the validity of EDE-Q subscale scores. Moreover, attempts to establish an alternative factor structure with sufficient fit to the data were not successful.

Females and highly educated Saudis were oversampled, therefore percentile scores were presented separately for males and females and weighted for education/occupation. Although the living conditions for males and females diverge considerably in Saudi Arabia, no gender differences were found in scores on the EDE-Q, nor on the factor structure of the measure. Compared to Western community samples (Aardoom et al., 2012; Fairburn & Beglin, 1994; Isomaa et al., 2016b; Machado et al., 2014; Mond et al., 2004; Rø et al., 2015; Villarroel et al., 2011), the global and subscale scores were higher in the Saudi sample. However, Luce et al. (2008) reported comparable dietary restraint scores for USA students as found among Saudi students in this sample. Whether these high scores are specific to Saudi's or rather reflect an aspect more general in the Arabic culture is unclear, as no data are available of other countries in the Gulf area. Interestingly, in somewhat comparable societies, such as Turkey (Yucel et al., 2011) and Iran (Mahmoodi et al., 2016) the EDE-Q global score is also higher compared to western societies. Severity of ED pathology was associated with BMI, a finding consistent with other international (Burke et al., 2017; Grilo et al., 2015) and

Saudi studies where associations were found between BMI and body dissatisfaction (Abdel-Fattah et al., 2008), binge eating behavior and irregular eating patterns (Rasheed, 1998). Furthermore, EDE-Q scores of Saudis suffering from obesity were comparable with Mexicans suffering from obesity (Unikel Santoncini et al., 2018), slightly higher than Dutch with obesity (Aardoom et al., 2012) and, higher than Iranians with obesity (Mahmoodi et al., 2016), Norwegians (Rø et al., 2012) and Australians (Byrne et al., 2010). High EDE-Q scores in the population might reflect the high rates of obesity and maladaptive strategies to lose weight among the Saudi population. This is especially important because Saudi Arabia has the highest rates of obesity worldwide (Mirkim, 2012), increasing the risk of developing an ED two to three times (Musaiger et al., 2013), although it is remarkable that the items restraint, food avoidance and dietary rules were negatively associated with importance of weight and shape, guilt about eating, social eating and reaction to prescribed weighing.

Reliability (internal consistency and convergent validity) was high and the EDE-Q discriminates accurately between individuals at high and low risk for an ED according to the EDE interview. EDE-Q global scores can be used to determine severity level of ED pathology and screen for Saudis at high risk for EDs in community samples. Participants were consistent in presentation of the severity of their ED pathology, but not in symptom presentation between the EDE and EDE-Q. These findings are also similar to what has been found in other studies. Even in a clinical sample, classification concordance between the EDE and EDE-Q was moderate at best (Berg et al., 2012) and concordance between the subscales varied from poor to excellent (Berg et al., 2013). It was remarkable that the concordance rate was higher in items regarding eating and eating behavior than in the other items. Apparently, EDE and EDE-Q results tend to diverge. The low concordance rate might result from participants' lack of knowledge and understanding about EDs and their symptoms, invalidating their self-reports on the EDE-Q. In general, there is a lack of knowledge and awareness of EDs and its

risk factors and EDs are rarely recognized and properly treated in Arab clinics (Alkhadari et al., 2016; Melisse et al., 2020). Participants who are better informed about EDs indeed appear to have more valid scores on the EDE-Q (Berg et al., 2013).

The EDE-Q should not be used for classification assessment, and might therefore better suited as a treatment outcome measure (Dingemans, 2017) or as part of two-staged sampling by using the EDE-Q as a screener to identify Saudis at high risk for an ED, and to conduct the EDE or another clinical interview to formally establish an ED diagnosis in case of elevated EDE-Q scores. The explanation and expression in Arab countries of EDs as somatic rather than in psychiatric symptoms may also contribute to the low concordance rate (Kayano et al., 2008; Viernes et al., 2007). Besides, Saudis with an ED generally seek psychiatric help only after suffering from somatic complaints such as diabetes, kidney failure and infertility.

The study has several strengths. First of all, while Saudis are an understudied population, this is the first study to explore the psychometric properties of the EDE-Q in Saudi Arabia, testing also alternative factorial models. Psychometric analysis was based on a large sample, which allowed the CFA to be fully powered. Second, it is the first study to evaluate psychometric properties of the EDE-Q in the Gulf. Moreover, EDE-Q scores were verified by the semi-structured diagnostic EDE interview in a subsample in order to understand the involved culture. Furthermore, this is the first study based on interview data, as they were not available in Saudi Arabia. Since we were unable to identify a clinical population by classification, all psychometric tests were done in subsamples at high risk for EDs. Although classification concordance was low, as there is statistically significant association between both global scores, severity of ED pathology appeared to be measured accurately. Therefore the discriminant validity of the Arabic EDE-Q got confirmed and a cut-off point for the identification of Saudis at risk for EDs was obtained. Due to the short time span between the EDE-Q and EDE differences in measurement outcome are likely to be due

to differences in response patterns and not due to change in ED pathology. This study provides data on a widely used assessment tool on EDs, which will allow future comparisons of Saudis with samples from other socio-cultural contexts. As data were collected in a closed society with a taboo on mental health care (Latzer et al., 2009) this is a first step towards expanding knowledge about EDs in Saudi Arabia.

Notwithstanding the strengths several limitations must be considered. First, although this study contains a large sample, reflecting the whole Saudi population well regarding age, geographical location and weight status, the sample was biased regarding gender and education level. A too large proportion of the sample was female, single and highly educated. To counteract potential effects of selection bias, the prevalence estimates and percentile scores were presented separately for males and females and corrected for educational level by propensity weighting (Bethlehem, 2010). Still, unmeasured factors may have caused selection bias: respondents to the EDE-Q, but EDE interviewees in particular, can be expected to be more interested in health care, mental health care, EDs or to have more concerns regarding their body image or eating behavior compared to the general population. Since sexes are strictly separated in Saudi Arabia and all EDE interviews were conducted by females, it is also likely that more progressive section of the population, especially among the males, participated in the EDE interview. Thus, although the presented norms were based on a large Saudi community sample, it should be noted that it was a web-based convenience sample and results should be interpreted with care.

The EDE was used as a reference in order to determine discriminative validity of the EDE-Q. The EDE was somewhat adapted to the Saudi culture. However, formal assessment of reliability and validity of a Saudi version of the EDE has not yet taken place in a clinical Saudi sample. The EDE could unfortunately not be validated in a clinical sample due to the unavailability of such a sample in Saudi Arabia. Still, as it is an assessor based detailed

interview assessing ED pathology over the same time period, by the same rating scale and similar phrases and wording are used in the EDE and EDE-Q (Fairburn & Beglin, 1994) it deemed suitable as criterion but it should not yet be considered as the gold standard. An alternative that has been evaluated on its validity is the shortened Eating Attitude Test (EAT26). Its use was considered but dismissed for the following reasons: high rates of false positives were found, and psychometric properties of the EAT26 were only assessed among teenage schoolgirls (al-Subaie et al., 1996), while our study aimed to target a representative community sample. In addition, the EAT26 was validated more than 20 years ago while the country has undergone rapid socio- cultural changes (Eapen et al., 2006; Melisse et al., 2020) and EDs were perceived as diseases of globalization (Gordon, 2001). Therefore, the established norms might not be accurate anymore.

Last, use of a clinical sample would be of great value but this appeared to be impossible since there were no specialized clinics and therapists (Qadan, 2009) and EDs were rarely recognized in Saudi Arabia (Alkhadari et al., 2016). A few off the respondents got ED treatment in Germany and the United Kingdom. Furthermore, within our sample we tried to identify participants with AN, BN and BED. Participants were consistent in severity presentation, but their symptom presentation between the EDE and EDE-Q was inconsistent. Therefore, classification identification appeared to be impossible.

The results implicate several areas of future research regarding the EDE and EDE-Q. Future validation of the EDE among Saudis is important, as differences may exist in the presentation and manifestation of ED pathology between populations (Kayano et al., 2008; Marques et al., 2011; Viernes et al., 2007). Availability of a validated diagnostic interview will improve classification of these conditions, which may be quite prevalent given the high EDE-Q scores in our population sample. In addition, since none of the evaluated models of the EDE-Q provided fit, it's imperative to further evaluate the factor structure of the EDE-Q

in different Saudi populations, including patients suffering from obesity classified with an ED.

In summary, the results indicate poor fit for the four factor model of the EDE-Q, which is in line with previous research. However, the total score on the Saudi version of the EDE-Q adequately measures ED pathology and identifies Saudis at high risk for EDs.

What is already known on this subject?

The EDE-Q is a widely used screener to assess for EDs and its severity. It has been translated and used in many, but not in Arab countries. In most studies the results do not support the purported four factor structure of the English original. In Saudi Arabia, only psychometric properties of the EAT26 were assessed. However, the established norms might not be accurate anymore.

What does this study add?

A Saudi version of the EDE-Q discriminates well between Saudis at high and low risk for EDs according to the EDE interview. There were no differences in gender. Global scores were high compared to Western community samples and fairly associated with BMI. This is the first study regarding EDs based on interview data in Saudi Arabia. Data were collected in a closed society with a taboo on mental health care. This study involves a first step towards expanding knowledge about EDs in Saudi Arabia.

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Supplementary Table 1 Principal Axis analysis with promax rotation of EDE-Q items in the subsample with elevated scores

	Factor 1	Factor 2	Factor 3
Dissatisfaction with shape	,759	-,279	,204
Discomfort seeing body	,715	-,226	,198
Dissatisfaction with weight	,698	-,292	,199
Discomfort exposing body	,564	-,270	,305
Feelings of fat	,408	-,123	,173
Desire to lose weight	,289	,023	,030
Fear of weight gain	,250	-,035	-,010
Eating in secret	-,240	-,091	,087
Fear of loosing control over eating	,205	-,134	,072
Preoccupation with food	-,165	-,050	,022
Dietary rules	-,116	,729	-,135
Food avoidance	-,141	,710	-,212
Restraint over eating	-,158	,679	-,206
Avoidance of eating	-,237	,303	-,019
Empty stomach	-,132	,257	-,033
Guilt about eating	,106	-,188	,142
Preoccupation with shape/weight	-,098	-,175	,044
Flat stomach	,073	,082	-,064
Importance of shape	,077	-,106	,764
Importance of weight	,243	-,173	,702
Reaction to prescribed weighing	,179	-,198	,253
Social eating	-,076	-,115	,211
Eigenvalue	3,53	2,28	1,72
% Variance	16,0	10,4	7,8

Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization. Factor 1; (9 items with loadings >.20; Dissatisfaction and discomfort), included 5 of the 8 items from the shape concern subscale and 2 items of the weight concern scale. Factor 2; (dietary restraint), five items, included all of the dietary restraint scale items. Factor 3; four items, included two items from the weight concern scale. Preoccupation with food, guilt about eating, preoccupation with shape and weight and flat stomach did not load substantially on any factor.

Chapter 3 The Saudi-Arabic adaptation of the Body Shape Questionnaire (BSQ34): Psychometrics and Norms of the full version and the short version (BSQ8C)

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Abstract

Introduction: Saudi Arabia experiences elevated levels of body-shape dissatisfaction which might be related to the increased thin ideal. Studies on body-shape dissatisfaction are scarce, mainly because adapted assessment tools are unavailable. This study describes the Saudi-Arabic adaptation of the Body Shape Questionnaire (BSQ34), preliminary examines the psychometric properties and provides normative data.

Methods: The BSQ34 was administered in a convenience community sample (*N*=867) between April 2017- May 2018. Receiver-operating-characteristic curve analysis was used to establish discriminant validity, in a subsample (*N*=602) in which the Eating Disorder Examination–Shape concern, was administered, the factor structure investigated with confirmatory-factor-analyses and *T*-scores and percentile-scores were determined.

Results: The BSQ34 discriminated well between low and high levels of body-shape dissatisfaction (area-under-the-curve value=0.93), had high internal consistency and a unidimensional factor structure, 23.9% appeared at risk for body-shape dissatisfaction. Analyses were repeated for the shortened BSQ8C, which yielded similar results.

Discussion: The results indicated that the BSQ34 and BSQ8C appeared suitable measurement tools to screen for body-shape dissatisfaction in a Saudi convenience community sample, mainly comprised of young, unmarried, and highly educated women. The BSQ34 supplies more information on the type of concerns respondents have, which is worthwhile when the measure is used in a clinical setting; the BSQ8C is recommended as a short screener. As body-shape dissatisfaction is viewed as a risk factor for the development of eating disorder symptoms, screening for body-shape dissatisfaction with reliable tools is important to detect individuals at risk for eating disorder symptoms and may suggest subsequent preventive steps.

Keywords: Body Shape Questionnaire, Body-shape dissatisfaction, Psychometric properties, Normative data, Saudi Arabia

Contribution to the field:

The BSQ34, and its short version, the BSQ8C, are most often used to measure body-shape dissatisfaction, and have good psychometric properties in various cultures. Until now, no adapted BSQ was available for use in Saudi Arabia. As body-shape dissatisfaction is a risk factor for the development of eating disorder-symptoms, screening for body-shape dissatisfaction with reliable tools is important to detect individuals at risk for eating disorder-symptoms and may suggest subsequent preventive steps.

Aim was a preliminary evaluation of the psychometric properties of a Saudi-Arabic BSQ, and to investigate the screening potential for body-shape dissatisfaction in a convenience community sample. Additional aim was to determine the factor structure, to establish norms, *T*-scores and percentile-scores. The BSQ34 and BSQ8C appeared suitable measurement tools to screen for body-shape dissatisfaction. However, these results should be interpreted with care as mainly unmarried, highly educated Saudi women participated in this study.

The BSQ34 supplies more information on the type of concerns respondents have, which is worthwhile when used in a clinical setting; the BSQ8C is recommended as a short screener. The proposed cut-off values can be used to select Saudis for preventative programs aimed to avert the development of eating disorder-symptoms and other psychopathology.

Introduction

Body-shape dissatisfaction, defined as "a subjective negative evaluation of one's physical body", is a maintaining factor of eating disorders (Stice, 2002). Recent studies report high prevalences of body-shape dissatisfaction in parts of the Arabic world, but the current prevalence of body-shape dissatisfaction in Saudi Arabia remains unknown, as only one study reported that 83% of Saudi women preferred a different weight (Rasheed, 1998). However, approximately 30-78% of women and 30-58% of men in the Gulf are reported to be dissatisfied with their bodies (Al-Sendi et al., 2004; Bener et al., 2006; Eapen et al., 2006; Thomas et al., 2010). Saudi Arabia currently experiences major sociocultural changes, adopting Western values (Thomas et al., 2018) and the thin ideal increased in Saudi Arabia (Thomas et al., 2010), potentially explaining the elevated levels of body-shape dissatisfaction.

The increasing prevalence of body-shape dissatisfaction might not only be due to the shift in beauty ideals from a curvy body into a thin body (Melisse, Beurs, et al., 2020), but also the presence of single-sex schools in Saudi Arabia could influence body perception (Dittmar, 2005). The social comparison theory states that individuals gather information about themselves and where they fit in society by comparing themselves to more attractive peers, which is associated with body-shape dissatisfaction (Carter, 2022; Dittmar, 2005). In addition, self-concept in women is mainly determined by appearance and its evaluation by others (Dittmar, 2005). Furthermore, high levels of exposure to idealized body images, enhanced by single-sex schools, often accumulate into body-shape dissatisfaction (ALAhmari et al., 2019; Frederick et al., 2017). Moreover, the number of people with excess weight is on the rise in Saudi Arabia, which might also result in an increase of body-shape dissatisfaction (Melisse, de Beurs, et al., 2020). Even though body-shape dissatisfaction is prevalent, its consequences are often underestimated. For instance, Saudis who are dissatisfied with their bodies have an increased risk for unhealthy dietary habits (Stice & Shaw, 2002), which may result in

developing eating disorder symptoms, as a strong association was found between body-shape dissatisfaction and eating disorder symptoms in Saudi Arabia (Melisse et al., 2022). Furthermore, eating disorder symptoms are associated with psychological symptoms in Saudi Arabia (AlHadi et al., 2022) and body-shape dissatisfaction is associated with psychological symptoms in other cultures (Gailledrat et al., 2016; Murray et al., 2013; Pritchard et al., 2021; Rich & LeClere, 2011; Rodríguez-Cano et al., 2006; Turk et al., 2021).

Research on body-shape dissatisfaction in Saudi Arabia is hampered, by the unavailability of assessment tools. Thus, adapted assessment tools for the measurement of body-shape dissatisfaction are urgently needed for the Saudi population. The Body Shape Questionnaire (BSQ) (34 items; BSQ34) (Cooper et al., 1987) is most often used to measure body-shape dissatisfaction (Rosen et al., 1996). In addition, various short versions of the BSQ34 (16A, 16B, 14, 8A, 8B, 8C, 8D) are evaluated (Kapstad, 2015), of which the 8C version appears superior over other short versions, as it shows high sensitivity to change during therapy (Pook, 2008). Both, the BSQ34 and BSQ8C are adapted for use in various western, Latin (da Silva et al., 2014; Kapstad, 2015; Pook, 2008; Rosen et al., 1996; Welch et al., 2012), and Iraqi-Arab cultures (Medya & Ishak, 2016) and have strong psychometric properties, such as high internal validity, test-retest reliability, convergent validity and unidimensional factor structure. Furthermore, the BSQ34 and BSQ8C are currently not available in an Arabic version adapted for use in Saudi Arabia.

The ability to screen for body-shape dissatisfaction is an important first step to help prevent development of eating disorder symptoms and other psychological symptoms through intervention programs, since targeted programs are more effective than universal preventative programs (Stice et al., 2019). In order to select participants for such preventative programs the BSQ8C can be used as a first screener before administration of the BSQ34 among those who scored above cut-off on the BSQ8C. In addition, a valid Saudi- Arabic BSQ could be used to

measure reduction of eating disorder symptoms after eating disorder treatment. Furthermore, based on an Item Response Theory (IRT) analysis factor scores can be used to obtain normalized standard scores (*T*-scores) and to establish percentile scores, both will offer a conversion of raw scores into these common metrics, which will ease interpretation and increase applicability of the measure (de Beurs, Böhnke, et al., 2022).

Aim of this brief report is to evaluate the psychometric properties (internal consistency, concurrent and discriminative validity, factor structure) of a Saudi- Arabic version of the BSQ34, and the BSQ8C and investigate the screening potential for body-shape dissatisfaction in a convenience community sample in Saudi Arabia. Additional aim is to establish norms, *T*-scores and percentile scores as they enable to measure whether body-shape dissatisfaction changes over time. The community sample first completes an online BSQ34, and when they leave their contact details they will be contacted to participate in a brief in-person interview.

Methods

Procedure

In order to validate the Arabic BSQs adapted for use in Saudi Arabia, a convenience sample was recruited as Saudis are very sensitive to how they are viewed by others, and therefore, less likely to participate in surveys, questioning them on their personal beliefs and values (Al-Darmaki, 2003). Therefore, aim was to reach as many Saudi passport holders as possible. Recruitment took place between April 2017 and May 2018 from students (Princess Noura University (PNU), King Saud University in Riyadh), and through social media (Twitter, Facebook), and the social network of the first author (BM) (friends, colleagues, and their relatives and friends). Furthermore, some of BM's students recruited participants through their personal network. Participants had to be Saudi, literate and aged≥18.

Participants provided informed consent and completed anonymously an online self-report questionnaire including the BSQ34 and demographics through Survey Monkey (Waclawski, 2012). At a second phase of data collection, between November 2017 and May 2018, the EDE-SC interview was administered to a subsample (*N*=602). Participants who provided their contact details in the online BSQ34 were contacted for an EDE-SC interview.

Participants

The study was approved May 7th, 2017 (17-0097) by the ethical board of PNU. A total of 871 Saudis were recruited of which four participants (0.4%) had ≥5% missing data regarding BSQ34 items and were therefore excluded, resulting in a sample size of *N*=867. Mean age was 23.6 (SD=5.5) years, the majority (*n*=475, 54.8%) was aged between 18-21 years old. There were several differences in the study sample compared to the general Saudi population: the majority were women (85.5% vs 42.3%), university student (41.2% vs 4.4%) and unmarried (76.5% vs 33.0%). Body Mass Index was calculated based on self-reported body weight and height (*M*=25.08, *SD*=6.8). Table 1 displays demographics of the sample.

Table 1

Demographics of a Saudi convenience sample (*N* = 867)

		N	*MD (S)*
Age		867	23.6 (5.5)
	18-21 years	475 (54.8%)	
	22-25 years	162 (18.7%)	
	26-40 years	175 (20.2%)	
	41-81 years	54 (6.2%)	
Gender			
	Female	745 (85.5%)	
	Male	122 (14.5%)	
BMI		867	25.2 (6.8)
Marital status		867	
	Married	149 (17.2%)	
	Unmarried	663 (76.5%)	
	Divorced	53 (6.1%)	
Occupation/ education		867	
	High school	232 (26.9%)	
	University in country of heritage	336 (38.7%)	
	University in Arab country	17 (2.0%)	
	University in Western country	43 (0.5%)	
	Employed	130 (14.9%)	
	Unemployed	90 (10.4%)	
	Other	57 (6.6%)	
Measures			
	EDE-SC	602	2.78 (1.6)
	BSQ34	867	86.5 (36.3)
	BSQ8C	867	21.3 (9.7)

BMI Body Mass Index, *BSQ* Body Shape Questionnaire, *EDE-SC* Eating Disorder Examination- Shape Concern subscale

Measures

The BSQ34 was administered and then compared to the Eating Disorder Examination-Shape Concern (EDE-SC) subscale to examine if the BSQ accurately measures body-shape dissatisfaction, as some studies state the BSQ measures shape concern (Cooper et al., 1987; da Silva et al., 2014) and some state it measures body-shape dissatisfaction (Kapstad, 2015; Welch et al., 2012) it is assumed that the EDE-SC and BSQ measure the same construct.

Body Shape Questionnaire

The BSQ34 is a self-report questionnaire to measure body-shape dissatisfaction, such as fear of gaining weight, desire to lose weight, and self-devaluation related to physical-appearance, as experienced during the last 28 days. A total of 34 items are answered on a 6-point Likert scale (1:never, to 6:always) (Cooper et al., 1987). The total score is the sum-score of all items and ranges between 34-204. The proposed cut-off score for the British original is <110, indicating body-shape dissatisfaction. A shortened 'alternate' form, comprising items 4, 6, 13, 16, 19, 23, 29, 33 was proposed as the BSQ8C (Evans & Dolan, 1993) for which the cut-off score is <26 (Cooper et al., 1987). The BSQ34, and BSQ8C have good psychometric properties, such as high internal consistency (Cronbach's α=.96, and .91 respectively), and good test-retest stability (r=.88, and .95 respectively) (Pook, 2008; Rosen et al., 1996; Welch et al., 2012). A Jordan BSQ34 was provided by Mousa et al., (2010) which was slightly adapted by BM and a psychology student of PNU and a translator as Jordan and Saudi Arabic differ slightly. Differences were discussed and resolved. Then, a back translation was made by the translator. One cultural adaptation was made in question 27: as women in Saudi Arabia share cars rather than travel by bus, "bus seat" was changed to "car seat".

A pilot study among 50 PNU Health faculty students conducted in January 2017, offered the choice of completing the English or Arabic version of the BSQ34, both versions were adapted for use in Saudi Arabia. Although bilingual, all students preferred the Arabic to the English BSQ34. Therefore, it was decided only to offer the Arabic version. Participant feedback on the pilot indicated that the quality of the translation was satisfactory.

Eating Disorder Examination 16.0 shape concern scale

The shape concern scale of the Eating Disorder Examination (EDE-SC) consists of eight items measuring shape concern as a feature of eating disorders, is a subscale of a widely used semi-structured interview (EDE), which has good psychometric properties (Cooper et al., 1989). The EDE-SC assesses shape concern during the previous 28 days on a 7-point Likert scale (0:feature was absent, to 6:feature was markedly present/present every day) (Cooper & Fairburn, 1987). Saudis with an EDE-SC score of <4.34 (community mean+1SD) were considered high in shape concern, 117 participants (19.4%) scored within the clinical range. For the Arabic version adapted for use in Saudi Arabia, some items were first culturally adapted by BM and two of her students, then translated to Arabic, and back-translated by the students. In the item regarding discomfort about exposure, swimming and communal changing rooms were replaced by gym and weddings, and wearing a wider or dark colored abaya (mandatory coat for women) was added since they were more appropriate for Saudi culture (Melisse et al., 2021). Internal consistency of the EDE-SC was high (Cronbach's α=.87, McDonalds ω=.85), and an Exploratory Factor Analyses indicated a unidimensional factor structure for the shape concern subscale with item loadings between .50-.87.

Statistical analyses

The BSQ34 was compared to the EDE-SC subscale to examine if the BSQ34 accurately measures body-shape dissatisfaction. This procedure was repeated when analyzing only the eight items of the BSQ8C. A one-way ANOVA was conducted to test for the effect of gender, age, and occupation on BSQ score. Item scores were inspected regarding their mean (and SD) and the frequency distribution by assessing skewness and kurtosis. The unidimensionality of the BSQs was investigated with a Confirmatory Factor Analysis (CFA). In addition, invariance of the BSQ34 and the BSQ8C across two age groups and genders (18-

25 and 26-81) was investigated with a multi-group CFA measurement (Wu & Estabrook, 2016). Internal consistency of the BSQs was measured by Cronbach's α (α≥.70 was considered good and α≥.90 excellent) (Cronbach, 1951; Gliem & Gliem, 2003) as well as McDonald's ω (MacDonald, 1999). In addition, an IRT based transformation of scores was performed, as described elsewhere (de Beurs, Böhnke, et al., 2022; de Beurs, Oudejans, et al., 2022). First, an IRT model was fitted to the data and factor scores (theta's) with *M*=0, SD=1 was calculated. Next, these standard scores were converted into *T*-scores with *T*=10*Z+50. With curve fitting (Non-linear Least Squared) (Baty et al., 2015) a function was derived to compute *T*-scores from raw scores. For *T*-scores a cut-off value of 55 was proposed. The appropriateness of this cut-off value for the BSQ34 and BSQ8C was investigated. The discriminative validity of the Saudi-BSQs was examined by a receiver-operating-characteristic (ROC) analysis. Thus, sensitivity and specificity of the BSQs was established regarding the presence of body-shape dissatisfaction/ shape concern as assessed by the EDE-SC. An EDE-SC score of 4.34 was used to distinguish between Saudis high and low in shape concern (Cooper & Fairburn, 1987). The area-under-the-curve (AUC) was calculated for both BSQs. An AUC≥ .90 meant high accuracy, .70-.90 moderate, and .50-.70 low accuracy in predicting EDE-SC status. Data were analyzed with SPSS version 28, *R* and *R* package Lavaan, version 0.6-5 (Rosseel, 2012).

Results

There was no effect of gender ($F(1, 784)=.19$, $p=.659$), occupation ($F(6,732)=1,46$, $p=.189$) and no difference among four age groups up to 21, 22-25, 26-40, and 40-81 years old ($F(3,785)=1.60$, $p=.192$). Supplementary Table A shows that BSQ scores (BSQ34: *M*=87.7, *SD*=36.8; BSQ8C: *M*=21.3, *SD*=9.7) were slightly skewed due to an excess

of low scores. Items 7, 8, 11, 13, 18, 19, 26, 27, 31, and 32 were skewed and peaked with many responses in the lowest response category ("never"). Internal consistency was high (BSQ34: Cronbach's α=.96, McDonalds ω=.97; BSQ8C: Cronbach's α=.85, McDonalds ω=.87). BSQ and EDE-SC scores were strongly correlated (BSQ34: r=.85, p <.001; BSQ8C: r=.82, p<.001). Table 2 shows that the ROC analysis revealed a high AUC (BSQ34: *AUC*=.93, 95%CI [0.90-0.95], p<.001; BSQ8C: *AUC*=.92, 95%CI [.89-.94], p<.001), which indicated that both Arabic BSQs adapted for use in Saudi Arabia discriminate well between individuals high and low in body-shape dissatisfaction according to the EDE-SC.

IRT analysis showed that a unidimensional model fitted well ($\chi^2(527)=2513.38$; RMSEA=.069; 95%CI=.066-.072; SRMSR=.063, TLI=.974, CFI=.976) for the BSQ34. Similar fit indexes were found for the BSQ8C. We also investigated with multigroup CFA whether the data yield sufficiently similar factor solutions among men and women and two age groups of respondents younger than 26 and 26 and older (Wu & Estabrook, 2016). We evaluated configural invariance, restriction of threshold and restriction of threshold and loading invariance. For both the BSQ34 and the BSQ8C, this provided models with almost equal fit and no significant differences in fit were demonstrated. We concluded that the factorial structure is very similar for both age groups. Finally, we also investigated measurement invariance for gender and obtained similar results of equal fit for both genders. All in all, these results indicate that support for the unidimensional factor structures of the BSQ34 and BSQ8C is found in both age groups and for both genders.

Table 2

Summary of reliability and validity measures of the Saudi BSQ34

Measure	Mean	SD	α	ω	*R* (EDE-SC)	*AUC*	*n*, % above original cut-off †	*n*,% above estimated cut-off ‡
BSQ34	87.7	36.8	.96	.97	.85*	.93	209, 23.9%	231, 26.7%
BSQ8C	21.3	9.7	.85	.87	.82*	.92	267, 30.8%	190, 21.9%

*p<.001

†Original cut-off: BSQ34 < 110; BSQ8C < 26 (Cooper et al., 1987)

‡ Estimated cut-off: BSQ34 < 114; BSQ8C < 28

α = Cronbach's alpha (Cronbach, 1951); ω = Omega (hierarchical) (MacDonald, 1999)

AUC area under the curve, *BSQ* Body Shape Questionnaire, *EDE-SC* Eating Disorder Examination- Shape Concern subscale

Figure 1 shows the relation for the BSQ34 between raw scores and theta-based *T*-scores. The figure shows some variance in *T*-scores per raw score (vertical dispersion). Figure 2 shows histograms with a density line (black) and a normal curve (red) and normal probability plots for raw scores and *T*-scores of the BSQ34, showing that normalization was successful. We also established Percentile Rank (PR) scores based on the frequency of responses in the sample, using: $PR = (\frac{m+0.5k}{N}) * 100$, where m is the number of respondents with a score<Raw Score (RS), k is the number of respondents with exactly RS and *N* is the size of the normative sample (Crawford & Garthwaite, 2009). Figure 3 shows for a selection of raw scores on the BSQ34 their association with *T*-scores and PR scores. In the supplementary materials cross-walk tables from RS to *T*-scores and percentile rank scores are provided (Supplementary Tables B and C). Finally, when the original cut-off score of <110 (Cooper et al., 1987) was applied to the BSQ34 sensitivity was 87.4%, specificity 82.2%. However, present data suggested different cut-off values. If optimal sensitivity is called for,

e.g., when screening for subsequent assessment with a diagnostic interview, a raw score>100 (*T*> 53.8) on the BSQ34 seems appropriate. When optimal specificity is called for, e.g., when screening for need of treatment, a cut-off of *RS*>123 (*T*> 59.1) would seem more appropriate. Sensitivity and specificity are in balance at .85 when a cut-off of *RS*>114 (*T*> 57.0) is applied. For the BSQ8C cut-off values for RS can be found in Table 3; corresponding cut-offs in *T*-scores are *T*>53.6, *T*>57.7 and *T*>56.4. **Fig. 2 s**hows a cross walk figure to look up percentile rank scores and *T*-scores for a selection of raw scores.

Figure 1

Relationship between raw scores and theta-based *T*-scores on the BSQ34

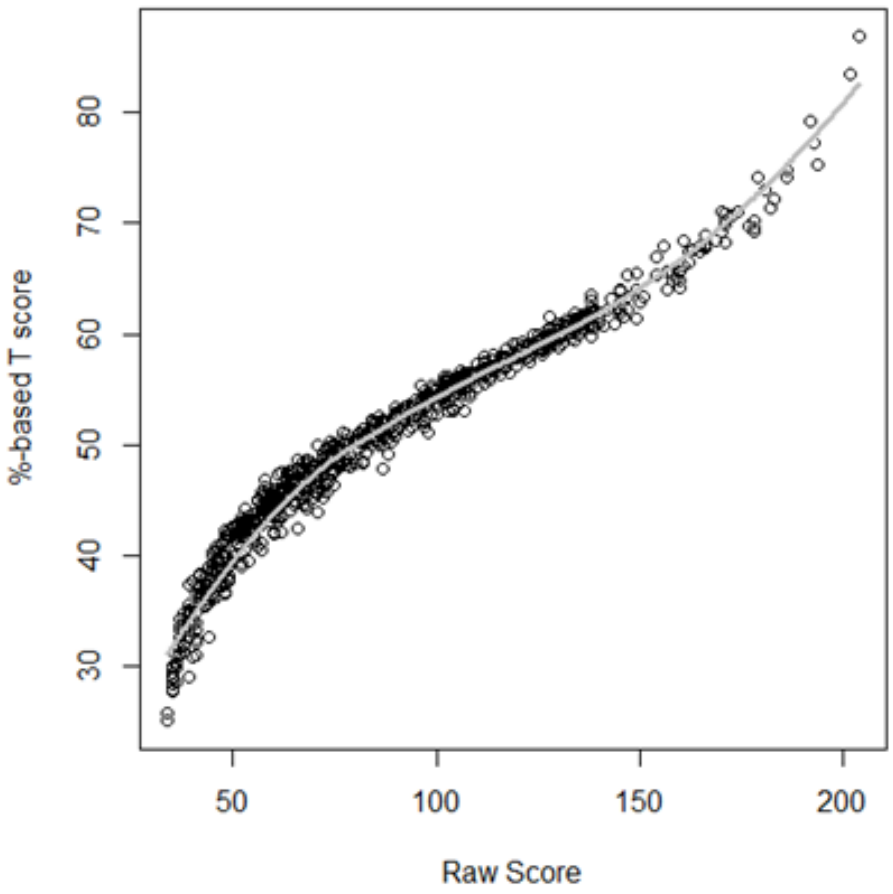

Figure 2

Histogram and normal probability plot for the BSQ34

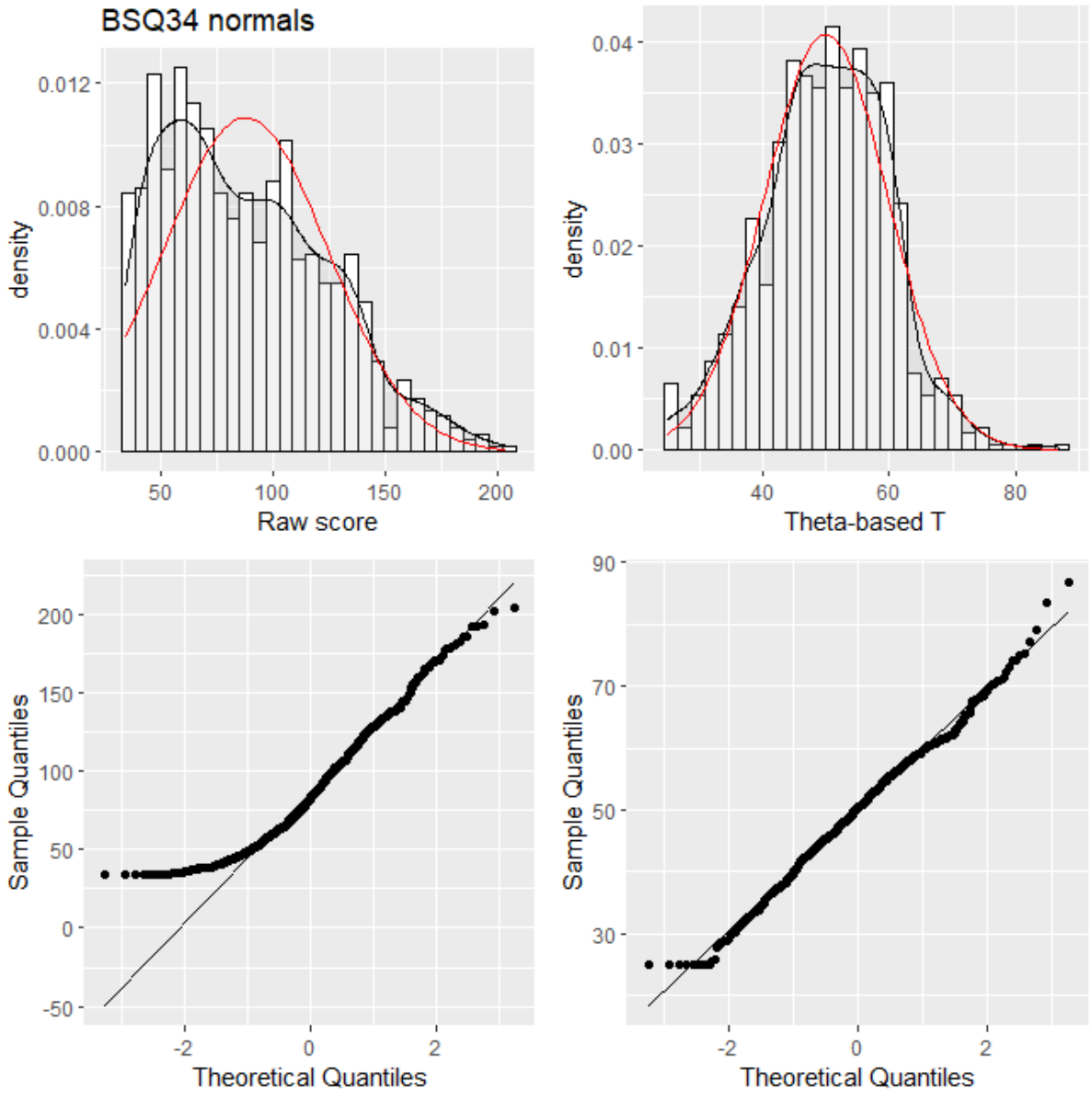

Figure 3

Raw scores, *T*-scores, and Percentile Rank scores of the Saudi- Arabic BSQ34

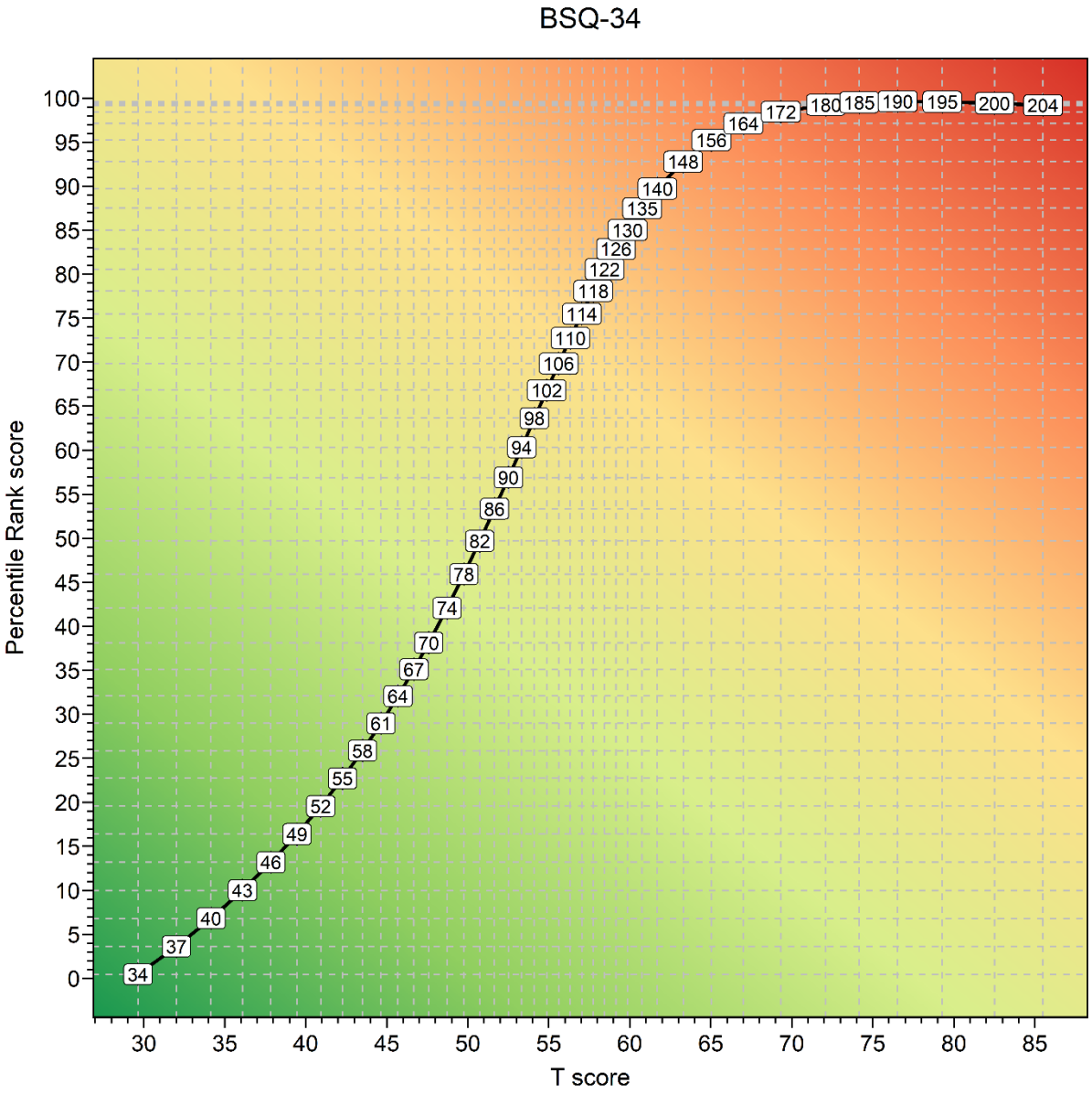

Table 3

Sensitivity and specificity for the Saudi- Arabic Body Shape Questionnaire

		Optimal sensitivity			Optimal specificity			Best of both		
Scale	AUC	Cut-off	Sens.	Spec.	Cut-off	Sens.	Spec.	Cut-off	Sens.	Spec.
BSQ34	.929	100	.90	.74	123	.74	.89	114	.85	.85
BSQ8C	.916	24	.89	.72	30	.74	.88	28	.83	.83

AUC area under the curve, *Sens.* Sensitivity, *Spec.* Specificity

Discussion

This is the first study to provide preliminary data on a measure to assess body-shape dissatisfaction in Saudi Arabia. The main findings of this study are that both versions of the Saudi- Arabic BSQ accurately discriminated between Saudis with low and high body-shape dissatisfaction, had a unidimensional factor structure, high internal consistency and high convergent validity. Even though living conditions between men and women differed significantly (ALAhmari et al., 2019; Melisse et al., 2021), no effect of gender and level of education was found on BSQ34 or BSQ8C score in the present data. Also, no difference between age-groups was found, and the factor structure was equal between both genders and age groups. However, since young, unmarried Saudi women were overrepresented these results should be interpret with caution. Though, it should be noted that Saudi Arabia has a large young population since median age is 31.8 years and about 72% of the population is aged between 15 and 64 years (O'Neil, 2022; Worldometers, 2021).

Results regarding the psychometric properties of the BSQs adapted for use in Saudi Arabia are in line with other studies. Current study found a unidimensional factor structure and a high internal consistency, similar to previous western, Latin and Iraqi-Arab studies (da Silva et al., 2014; Medya & Ishak, 2016; Pook, 2008; Welch et al., 2012), underlining the potential multi-cultural applicability of the BSQs. The BSQ8C can be used as a first screener before administration of the BSQ34 among those who scored above cut-off on the BSQ8C.

This study shows a variety of strengths. This study is the first to investigate body-shape dissatisfaction and the properties of the BSQs in a large Saudi community sample. Furthermore, the sample consisted of men and women, which is quite unique in Saudi society. As Saudi Arabia is socially a rather reclusive society (Melisse et al., 2022), being able to investigate such a large and diverse sample was a rare opportunity. Furthermore, as there was no effect of age, gender and level of education it may be concluded that both versions of the BSQ are widely applicable across Saudi Arabia to screen for or assess the severity of body-shape dissatisfaction. In addition, this study contributes to the assessment and knowledge regarding body-shape dissatisfaction in Saudi Arabia. The proposed cut-off values can be used to select Saudis for preventative programs aiming to avoid the development of eating disorder symptoms (Stice & Shaw, 2002).

There are certain limitations to this study. First, since the BSQ was only completed once, test-retest reliability could not be established. Secondly, this study did not include a clinical sample. Inclusion of a clinical sample suffering from body-shape dissatisfaction related to eating disorders would have helped to determine the discriminant validity. However, unfortunately, eating disorders are barely recognized in Saudi Arabia (Melisse et al., 2021), creating difficulties to study a clinical population. Thirdly, the EDE-SC was used to determine how well the Saudi-Arabic BSQs discriminated between Saudis with low and high levels of body-shape dissatisfaction. Use of this EDE subscale is not ideal since its factor structure is inconclusive (Burke et al., 2017; Byrne, 2010; Grilo et al., 2010; O'Brien et al., 2016). Examining the factor structure of the full Saudi-Arabic EDE would be superior. However, only 98 participants completed the EDE, therefore running a CFA in this sample would not yield valid results. Though, use of the EDE-SC appeared most suitable since bias appeared to be reduced due to its investigator based nature (Cooper & Fairburn, 1987), the shape concern subscale has the highest internal consistency (Burke et al., 2017) and there are

no other standardized measures available to measure body-shape dissatisfaction in Saudi Arabia. Fourthly, since data collection ended, there have been several cultural changes in Saudi Arabia, such as transformations to empower women and modernize the relatively conservative Saudi society (Melisse et al., 2022). Nowadays, women no longer have to wear a traditional abaya which might influence body-image and therefore rates of body-shape dissatisfaction (Dittmar, 2005). In addition, when conducting the interviews, Saudi Arabia applied a strict gender separation, and interviews were conducted by female assessors only. Therefore, potentially only progressive Saudi men participated in this study. It is further noteworthy, that, though no effect of gender or educational level was found, there was a gender and educational bias in current sample. There was an overrepresentation of highly-educated women compared to the general Saudi population which should be considered when interpreting the results and potentially impacts generalizability. Furthermore, as women tend to show higher body-shape dissatisfaction than men in general (Stice & Shaw, 2002), though not in the present sample, cut-off scores suggested in this study should be used with some caution.

Future studies should take the limitations of this study into account. Based on the current results, a logical next step for future research would be to examine test-retest reliability of the Saudi-Arabic BSQs (Polit & Yang, 2016). Furthermore, examination of body-shape dissatisfaction is more reliable among clinical samples, for example among Saudis with eating disorder symptoms. In present study, the external criterion to evaluate the screening ability of the BSQs was a score above or below the community mean +1SD on the EDE-SC. Examination of the factor structure of the full Saudi-Arabic EDE among a sufficient sample is recommended. An alternative approach would be to compare BSQs scores in a mixed community and clinical sample, e.g., Saudis seeking treatment for eating disorders and evaluate discriminative validity of the BSQs. However, body-shape dissatisfaction and eating disorders

are rarely recognized and treated in Saudi clinics (Alkhadari et al., 2016; Melisse, Beurs, et al., 2020). In addition, it would also be of interest to examine the psychometric properties of additional measures assessing body-shape dissatisfaction or body shape concern, such as the Body Attitude Test (Probst et al., 1995), Body Uneasiness Test (Cuzzolaro et al., 2006), and the Body Appreciation Scale-2 (Tylka & Wood-Barcalow, 2015). In contrast to the other self-reports, the Body Appreciation Scale-2 measures positive body image (Tylka & Wood-Barcalow, 2015). Both, the Body Attitude Test (Probst et al., 1995), and Body Uneasiness Test (Cuzzolaro et al., 2006) have a stable multi-factor structure and look into different aspects of body-shape dissatisfaction, however the Body Uneasiness Test involves significantly more items compared to the BSQ34 and the Body Attitude Test is only moderately correlated with the BSQ34 (Probst et al., 1997). Furthermore, it is recommended to validate the Saudi-Arabic BSQ34 among Saudis with excess weight, like the Body Uneasiness Test has been validated among patients with excess weight in other cultures (Marano et al., 2007). This is of relevance since almost half of the Saudi population suffers from excess weight and a high BMI is associated with more severe body-shape dissatisfaction in Saudi Arabia (Melisse et al., 2022). Moreover, it would also be of interest to investigate general psychopathology, as body-shape dissatisfaction was associated with increased levels of psychological symptoms (Gailledrat et al., 2016; Murray et al., 2013; Pritchard et al., 2021; Turk et al., 2021). Furthermore, body-shape dissatisfaction also predicted psychological symptoms in other cultures (Rich & LeClere, 2011; Rodríguez-Cano et al., 2006). Moreover, it would be of interest to investigate whether the recent transformations to modernize Saudi society, for example by releasing the obligation for women to wear an abaya, impacts body-shape dissatisfaction. For instance, body-shape dissatisfaction could be compared between women who still wear an abaya and women who have decided not to wear the traditional abaya anymore. Last, a more balanced community sample regarding gender, age, and

educational level would increase confidence in the generalizability of the findings and normative values.

In conclusion, this study made a first attempt to evaluate the psychometric properties and provide preliminary normative data of Saudi-Arabic BSQs. Both, the BSQ34 and the BSQ8C displayed a unidimensional factor structure, high internal validity and are, therefore, potentially valid assessment tools to measure body-shape dissatisfaction in Saudi Arabia. The estimated cut-off score for the BSQ34 was <114 and <28 for the BSQ8C. Though no effect of gender, level of education and age was found on BSQs total score and the BSQs performed equally across gender and age, unmarried women were overrepresented in this study which potentially impacts generalizability of the Arabic BSQ. Therefore, the results should be interpreted with care when the BSQs are applied across Saudi Arabia.

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Supplementary Table A

Basic psychometrics of the Saudi- Arabic BSQ items and total scores

Items	*n*	*M*	SD	median	skewness	kurtosis	% of responses						
							1	2	3	4	5	6	Missing
Item1	871	2.66	1.44	3	0.71	-0.26	25	24	28	8	8	6	0
Item2	871	3.28	1.80	3	0.21	-1.29	23	15	19	15	9	19	0
Item3	870	3.11	1.85	3	0.35	-1.27	30	13	20	11	8	19	0
Item4	871	3.86	1.85	4	-0.16	-1.41	15	13	18	13	8	33	0
Item5	867	3.80	1.80	4	-0.12	-1.35	14	13	19	14	10	29	1
Item6	870	3.31	1.79	3	0.22	-1.26	22	15	22	12	10	20	0
Item7	869	1.76	1.37	1	**1.88**	**2.53**	68	12	8	4	3	4	0
Item8	867	1.54	1.18	1	**2.42**	**5.29**	77	7	8	3	2	3	1
Item9	869	2.83	1.73	3	0.56	-0.94	32	16	21	10	8	13	0
Item10	868	2.63	1.78	2	0.73	-0.84	42	14	16	9	7	12	1
Item11	868	1.84	1.35	1	**1.69**	**2.00**	63	14	11	4	3	4	1
Item12	869	2.75	1.67	3	0.61	-0.84	33	17	21	10	9	10	0
Item13	872	1.86	1.35	1	**1.66**	**1.89**	60	18	11	4	4	4	0
Item14	869	2.79	1.73	2	0.64	-0.88	32	19	19	9	8	13	0
Item15	871	3.05	1.79	3	0.38	-1.21	28	16	19	10	11	15	0
Item16	867	2.39	1.78	1	0.97	-0.47	52	10	15	6	5	12	1
Item17	868	2.97	1.76	3	0.47	-1.06	29	17	20	12	7	15	1
Item18	869	1.74	1.33	1	**1.87**	**2.52**	68	12	9	4	4	4	0
Item19	869	2.04	1.57	1	**1.40**	**0.72**	60	12	11	5	4	7	0
Item20	870	2.50	1.65	2	0.90	-0.40	39	20	17	7	7	10	0
Item21	868	2.75	1.73	2	0.63	-0.88	35	15	20	10	7	12	1
Item22	870	2.91	1.83	3	0.49	-1.16	34	14	19	9	9	16	0
Item23	868	2.55	1.77	2	0.77	-0.81	46	12	15	9	8	11	1
Item24	866	2.87	1.81	3	0.53	-1.11	34	15	18	9	9	15	1
Item25	869	2.02	1.55	1	1.41	0.76	61	11	12	6	4	7	0
Item26	867	1.37	1.04	1	**3.06**	**8.68**	85	5	3	3	2	2	1
Item27	868	1.97	1.51	1	**1.52**	**1.14**	61	14	10	5	4	6	1
Item28	861	3.05	1.82	3	0.40	-1.22	29	16	19	11	9	17	1
Item29	864	2.49	1.70	2	0.90	-0.47	43	17	17	6	7	10	1
Item30	864	2.92	1.74	3	0.49	-1.03	30	15	23	8	10	13	1
Item31	867	1.80	1.39	1	**1.78**	**2.16**	67	11	11	3	4	4	1
Item32	868	1.37	0.98	1	**2.88**	**7.74**	85	4	5	3	2	1	1
Item33	863	2.99	1.75	3	0.39	-1.13	30	14	20	13	10	13	1
Item34	862	3.85	1.83	4	-0.21	-1.36	16	11	18	12	13	30	1
BSQ34	867	87.70	36.75	82	0.57	-0.39							
BSQ8C	846	21.34	9.69	19	0.59	-0.42							

† The indicators marked in bold type signify skewed and peaked items with many responses in the lowest response category.

Supplementary Table B

Cross walk from raw scores to *T*-scores and percentiles for the Saudi- Arabic BSQ34

RS†	T‡	PR§	RS	T	PR	RS	T	PR	RS	T	PR
34	26.5	-0.7	77	48.5	44.8	120	58.4	79.2	163	68.3	96.6
35	28.2	0.6	78	48.7	45.7	121	58.6	79.8	164	68.5	96.7
36	29.8	1.8	79	48.9	46.6	122	58.9	80.5	165	68.7	96.9
37	31.2	3.0	80	49.2	47.5	123	59.1	81.1	166	69.0	97.0
38	32.4	4.2	81	49.4	48.4	124	59.3	81.7	167	69.2	97.2
39	33.5	5.4	82	49.6	49.3	125	59.5	82.3	168	69.4	97.3
40	34.5	6.6	83	49.9	50.2	126	59.8	82.8	169	69.7	97.4
41	35.4	7.8	84	50.1	51.1	127	60.0	83.4	170	69.9	97.5
42	36.2	9.0	85	50.3	52.0	128	60.2	84.0	171	70.1	97.6
43	37.0	10.1	86	50.6	52.9	129	60.5	84.5	172	70.4	97.7
44	37.7	11.2	87	50.8	53.8	130	60.7	85.1	173	70.6	97.8
45	38.3	12.4	88	51.0	54.7	131	60.9	85.6	174	70.8	97.9
46	38.9	13.5	89	51.3	55.5	132	61.2	86.1	175	71.0	98.0
47	39.4	14.6	90	51.5	56.4	133	61.4	86.6	176	71.3	98.0
48	39.9	15.7	91	51.7	57.3	134	61.6	87.1	177	71.5	98.1
49	40.4	16.8	92	52.0	58.1	135	61.8	87.6	178	71.7	98.1
50	40.8	17.9	93	52.2	59.0	136	62.1	88.1	179	72.0	98.2
51	41.2	19.0	94	52.4	59.8	137	62.3	88.5	180	72.2	98.2
52	41.6	20.0	95	52.6	60.6	138	62.5	89.0	181	72.4	98.3
53	42.0	21.1	96	52.9	61.5	139	62.8	89.4	182	72.7	98.3
54	42.4	22.1	97	53.1	62.3	140	63.0	89.9	183	72.9	98.4
55	42.7	23.2	98	53.3	63.1	141	63.2	90.3	184	73.1	98.4
56	43.0	24.2	99	53.6	63.9	142	63.5	90.7	185	73.3	98.4
57	43.3	25.3	100	53.8	64.7	143	63.7	91.1	186	73.6	98.4
58	43.6	26.3	101	54.0	65.5	144	63.9	91.4	187	73.8	98.5
59	43.9	27.3	102	54.3	66.3	145	64.1	91.8	188	74.0	98.5
60	44.2	28.3	103	54.5	67.1	146	64.4	92.2	189	74.3	98.5
61	44.5	29.3	104	54.7	67.9	147	64.6	92.5	190	74.5	98.6
62	44.8	30.3	105	54.9	68.6	148	64.8	92.9	191	74.7	98.6
63	45.0	31.3	106	55.2	69.4	149	65.1	93.2	192	75.0	98.6
64	45.3	32.3	107	55.4	70.2	150	65.3	93.5	193	75.2	98.7
65	45.5	33.3	108	55.6	70.9	151	65.5	93.8	194	75.4	98.7
66	45.8	34.3	109	55.9	71.6	152	65.8	94.1	195	75.6	98.7
67	46.1	35.3	110	56.1	72.4	153	66.0	94.4	196	75.9	98.8
68	46.3	36.2	111	56.3	73.1	154	66.2	94.6	197	76.1	98.9
69	46.6	37.2	112	56.6	73.8	155	66.4	94.9	198	76.3	98.9
70	46.8	38.2	113	56.8	74.5	156	66.7	95.1	199	76.6	99.0
71	47.0	39.1	114	57.0	75.2	157	66.9	95.4	200	76.8	99.1
72	47.3	40.1	115	57.2	75.9	158	67.1	95.6	201	77.0	99.1
73	47.5	41.0	116	57.5	76.6	159	67.4	95.8	202	77.3	99.2
74	47.8	42.0	117	57.7	77.2	160	67.6	96.0	203	77.5	99.4
75	48.0	42.9	118	57.9	77.9	161	67.8	96.2	204	77.7	99.5
76	48.2	43.8	119	58.2	78.6	162	68.1	96.4			

† Raw scores;

‡ Calculated *T*-scores based on IRT (*T* =30.8-EXP(-0.132*RS-52.9))+0.23*RS, an exponential function);

§ Calculated Percentile Rank Scores (*T*=-56,7+2,218*RS-2,314e-02*RS^2+2,238e-04*RS^3-1,135e-06*RS^4+2,073e-09*RS^5, a polynomial function).

Supplementary Table C

Cross walk from raw scores to *T*-scores and Percentile ranks scores

for the Saudi- Arabic BSQ8C.

RS†	*T*‡	PR§	RS†	*T*‡	PR§	RS†	*T*‡	PR§
8	34.2	3.1	22	52.1	57.4	36	61.9	90.9
9	36.1	7.3	23	52.9	60.6	37	62.7	92.3
10	37.8	11.5	24	53.6	63.7	38	63.5	93.5
11	39.5	15.7	25	54.4	66.7	39	64.4	94.6
12	41.0	19.8	26	55.1	69.6	40	65.3	95.6
13	42.5	23.9	27	55.7	72.3	41	66.3	96.5
14	43.8	27.9	28	56.4	75.0	42	67.4	97.2
15	45.1	31.9	29	57.1	77.4	43	68.5	97.8
16	46.3	35.8	30	57.7	79.8	44	69.7	98.3
17	47.4	39.6	31	58.4	82.0	45	70.9	98.6
18	48.5	43.4	32	59.1	84.0	46	72.3	98.9
19	49.5	47.0	33	59.7	86.0	47	73.7	99.0
20	50.4	50.6	34	60.4	87.8	48	75.3	99.1
21	51.3	54.0	35	61.2	89.4			

† Raw scores;

‡ Calculated T-scores based on IRT (*T*=14.6+3.040*RS+8.067e-02*RS^2+9.096e-04*RS^3, a hyperbolic function);

§ Calculated Percentile Rank Scores (*T*=-29,8+3,879*RS+4,679e-02*RS^2-2,342e-03*RS^3+1,769e-05*RS^4, a polynomial function).

Chapter 4 Eating Disorders in the Arab world: a literature review

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Abstract

Background: The prevalence of eating disorders has been assumed to be low in the Arab world, due to the alleged absence of the thin ideal. However, the Arab world is undergoing rapid sociocultural changes, and there are reports of an increase of the desire to be thin. This literature review therefore provides point-prevalence of Arabs at high risk for eating disorders, and a comprehensive synthesis of correlates of eating disorder symptoms, eating disorder-related variables and of a high risk for eating disorders.

Method: Several electronic databases were searched for published, peer-reviewed studies between 1986 and 2019 involving several key terms. From 317 screened studies, 81, mainly cross-sectional, were included. Preferred Reporting Items for Systematic reviews and meta-analyses was used as guidance and the quality of studies were assessed using the Newcastle-Ottawa scale.

Results: Estimates of individuals at high risk for eating disorders ranged from 2-54.8%. The eating disorder-related variables identified were desire to be thin, body dissatisfaction, disturbed-, and dieting- eating behavior. Identified correlates were increased affluence, media use, western influences, and obesity. An additional finding was that in some cases eating disorders were expressed somatically rather than psychiatrically.

Discussion: In the Arab world, females were most at risk for eating disorders and eating disorder symptoms. Sociocultural changes gave rise to the thin ideal and the prevalence of obesity, increasing the risk for the development of eating disorder-related variables and eating disorders. The literature on eating disorders in the Arab world suffers from

potential limitations due to the use of non-validated assessment tools. Further research is necessary, particularly on the development and validation of a culturally sensitive assessment tool. Improved knowledge is likely to increase the number of people seeking treatment and decrease the stigma of psychotherapy.

Keywords: Arab; Eating Disorders; Prevalence; Eating disorder-related variables; Desire to be thin; Correlates

Plain English Summary

In the Arab world a curvy body was perceived as fertile, so eating disorders were assumed to be rare. In recent years, however, due to rapid sociocultural changes, Western influences, media use, and increased affluence, Arabs have started to admire a thinner body. Consequently, research has now begun to address the existence of eating disorders in the Arab world. The increased popularity of the desire to be thin has been associated with soft symptoms such as disturbed eating behavior, body dissatisfaction and dieting behavior. In addition to Arabs at risk for eating disorders, eating disorder symptoms identified include binge eating, self- induced vomiting, and laxative use. Sometimes, eating disorders manifest themselves in different way in the Arab world: some Arabs have expressed eating disorders somatically, as nausea, stomach ache, and so on, rather than psychiatrically. There is a need for assessment tools to be adjusted to the Arab culture. Improved knowledge will facilitate recognition of eating disorders, encourage people to seek treatment and decrease the stigma of psychotherapy.

Background

Eating disorders (EDs) have a significant impact on the well-being of affected individuals (Hay et al., 2015). This includes comorbid obesity (Brody et al., 2005), depressive symptoms, anxiety (Watson et al., 2012) substance abuse, suicide attempts (Wilson et al., 2003), and high rates of mortality and relapse (Smink et al., 2012). Since EDs have historically been associated with Caucasian females in developed Western countries with high socio-economic status (Gordon, 2001), they have been perceived as culturally bound syndromes (Pike et al., 2014). Taking this in consideration most studies regarding EDs have been heavily concentrated in Western countries (Pike & Dunne, 2015).

Cultural factors are essential to understanding the development of EDs (Lewis-Fernández & Kleinman, 1994) and the main feature identified associated with EDs in the West is a thin body ideal (Gordon, 2001), which is presented to the society as achievable by dieting and exercising (Pike & Dunne, 2015). Traditional Arab notions of beauty are different, with the curvy body ideal associated with fertility and wealth (Ford et al., 1990) EDs were assumed not to afflict Arabs[1] (Dolan & Ford, 1991; Ford et al., 1990) hence EDs were not reported in the Arab world until 1986 (Nasser, 1986). However, from then on (Dolan & Ford, 1991; Ford et al., 1990) reports on the thin ideal in the Arab world steadily increased (Al Subaie, 1999; Musaiger et al., 2004; Thomas et al., 2010).

Recent studies have shown that EDs occur globally (Keel & Klump, 2003; Thomas, Lee, et al., 2016), EDs occur particularly in cultures in transition as they adopt Western values (Pike et al., 2014; Thomas, O'Hara, et al., 2018), illuminating the

interplay between culture and psychopathology (van Son et al., 2006). This is relevant to the Arab world, since the oil boom of the 1970s and the consequent increased affluence (Eapen et al., 2006; WHO, 2006), it has been undergoing rapid sociocultural and socioeconomic changes (Fox & Mourtada- Sabbah, 2006; Thomas et al., 2010). The oil boom led to the arrival of Western companies, Western expatriates (Thomas, O'Hara, et al., 2018; Zeeni et al., 2013), and to increased exposure to Western culture (Pike & Dunne, 2015).

The sociocultural changes associated with acculturation include adopting the language, lifestyle, values, and beliefs of other cultures (Salant & Lauderdale, 2003). In the Arab world, increased exposure to Western media (Ahmed, 2012; Eapen et al., 2006; Musaiger & Al- Mannai, 2014; Musaiger et al., 2013), and increased contact with expatriates (Al Adawi et al., 2002; Eladawi et al., 2018) has also led to a rise in the popularity of the thin ideal (Ford et al., 1990; Thomas et al., 2014), and to increased levels of dieting, body dissatisfaction and EDs (Pike & Dunne, 2015). However, the theory of Westernization assumes that the Western culture is transferrable to Arab cultures (Lester, 2004), the oil boom has also been associated with elevated levels of industrialization (Thomas, O'Hara, et al., 2018) including increased technology, affluence, and higher education (Mourtada-Sabbah et al., 2008; Pavlova et al., 2008). Industrialization in particular has coincided with changes in the types of food available (Pike et al., 2014; Swain, 2006), and these are instrumental in a rise in obesity (Bener et al., 2006; Eladawi et al., 2018; Saleh et al., 2018). Together, these changes have contributed to elevated levels of non-communicable diseases such as diabetes mellitus, hypertension (Eapen et al., 2006), and psychological problems (Ghubash et al., 2001)

including ED-related variables and EDs (Nasser, 1994; Pavlova et al., 2010; Thomas, O'Hara, et al., 2018; Thomas, Quadflieg, et al., 2016).

Kraemer and colleagues (Jacobi, Hayward, et al., 2004; Kraemer et al., 1997; Stice et al., 2010) have provided us with a terminology to address how culture and EDs may be associated. An important distinction is that between a correlate and a risk factor. A correlate is a potential risk factor that is measured at the same time as an ED. The correlate and ED are associated with each other, but precedence of the correlate to the onset of an ED is not proven (Jacobi, Hayward, et al., 2004; Kraemer et al., 1997). Therefore correlates cannot be defined as risk factors. Correlates are identified in cross sectional studies (Jacobi, Hayward, et al., 2004; Kraemer et al., 1997; Stice et al., 2010). Currently identified correlates are increased affluence (Gordon, 2001; Stice et al., 2010), obesity (Jacobi, Abascal, et al., 2004; Stice et al., 2008), and societal changes such as industrialization (Nakai et al., 2018), globalization (Gordon, 2001), and acculturation (Nakai et al., 2018; Pavlova et al., 2010). If it is established that an associated variable precedes the onset of an ED, this variable may be indicated as a risk factor (Jacobi, Hayward, et al., 2004): gender is an example (Kraemer et al., 1997). A risk factor identifies individuals who are at elevated risk for future emergence of an ED (Stice et al., 2010), and risk factors can best be identified by longitudinal studies (Jacobi, Hayward, et al., 2004; Kraemer et al., 1997). Initiation of the onset of an ED can be indicated by ED-related variables (Stice et al., 2010). ED-related variables are an early sign of an ED which indicate vulnerability to develop an ED. However, on their own ED-related variables do not meet the criteria for an ED as described in the DSM-5 (APA, 2013).

Examples of ED-related variables are disturbed eating behavior, self-reported dieting, an elevated desire to be thin, and body dissatisfaction (Kraemer et al., 1997).

To distinguish between various levels of ED-pathology, commonly the following types are described: ED symptoms, at high risk for ED and full syndrome ED (Jacobi, Hayward, et al., 2004; Kraemer et al., 1997; Stice et al., 2010). ED symptoms are symptoms that are defining features of an ED (Stice et al., 2010) such as binge eating, and compensatory behaviors, which can be measured by self-report and clinical interviews. If the frequency of ED symptoms meets the criteria of an ED, including clinically significant functional impairment (Gordon, 2001), an individual can be classified as suffering from a full syndrome ED (APA, 2013; Stice et al., 2010). Full syndrome EDs are best diagnosed with a clinical interview (Stice et al., 2010). Individuals who score above a clinical cut-off on an ED-screening instrument are considered to be at high risk for an ED (Kraemer et al., 2001; Stice et al., 2010).

This review will differentiate between ED-related variables, ED symptoms, and high risk for EDs. Arabs with elevated levels of ED-related variables and ED symptoms are at risk for EDs, as are Arabs who score above a clinical cut-off on an ED-screening instrument, who will be referred to as Arabs at high risk for EDs. Correlates of ED-related variables, ED symptoms, and scores above a clinical cut-off on an ED-screening instrument will also be identified. Identification of correlates and ED-related variables is likely to facilitate identification of risk groups for prevention programs (Stice et al., 2010; Stice et al., 2007). At the same time, preventative and treatment programs cannot be copied from Western societies (Hoek, 2016). They need to be adapted to the relevant sociocultural context (Smink et al., 2013; Viernes et al., 2007).

Although EDs have been reported in the Arab world (Al Adawi et al., 2002; Aoun et al., 2015; Eladawi et al., 2018; Kronfol et al., 2018; Saleh et al., 2018; Thomas, O'Hara, et al., 2018), there is limited valid data (van Hoeken et al., 2016), and the substantial differences in the expression of EDs among different cultures (Hoek & van Hoeken, 2003; Kayano et al., 2008; Pike et al., 2014; Viernes et al., 2007) are yet to be taken into account. For example, somatic expression of EDs is more likely in the Arab world than in the West (Kayano et al., 2008; Viernes et al., 2007). Some Arabs attribute a restrictive food pattern to somatic complaints (Lee et al., 2001), while there are also reports of body dissatisfaction and fear of fatness (Kayano et al., 2008; Viernes et al., 2007). Examples of somatic complaints are stomach ache, feeling bloated or an absence of appetite (Lee et al., 2001). In addition, perceptions of body image also differ between cultures (Viernes et al., 2007).

There are a number of comprehensive reviews of the nature of EDs in Western countries (Ricciardelli et al., 2007; Smink et al., 2016; Smink et al., 2012, 2013; Stice et al., 2010). However, as the Arab world has undergone rapid sociocultural changes (Fox & Mourtada- Sabbah, 2006; Thomas et al., 2010), EDs could be more culturally reactive than culturally bound (Pike & Dunne, 2015). An overview of EDs in the Arab world is needed. Unfortunately, due to a lack of appropriate and valid data, it is not feasible to examine how the prevalence of EDs in the Arab world has changed over the years. Still, data from ED-screening instruments can help identify individuals at high risk for EDs, and enable examination of associations between ED-related variables, correlates and ED symptoms. In this review, we therefore aim to provide estimates regarding the point-prevalence of Arabs at high risk for EDs, with ED symptoms above threshold values for

caseness, and to provide a comprehensive synthesis of relevant studies of correlates and ED-related variables. The countries included here are those together referred to as "the Arab world", which is a part of the Eastern Mediterranean Region (WHO, 2020), also referred to as the Middle East (infoplease.com, 2020). Non-Arab countries such as Cyprus and Turkey are excluded (Abdollahi & Mann, 2001). To the best of our knowledge, this is the first review summarizing EDs in the Arab world.

Method

Search strategy

The primary search was conducted in Web of Science, PubMed (Medline) and Google Scholar databases from 1986 up to July 2019 by BM, and involved key terms related to ED prevalence in the Arab world. All combinations of ("Eating disorders" OR "Anorexia Nervosa" OR "Bulimia Nervosa" OR "Binge Eating Disorder" OR "Disturbed Eating Behavior" OR "Eating Attitudes" OR "Dieting" OR "Body Image" OR "Body Satisfaction" OR "Obesity") AND ("Arab" OR "Middle East" OR "Gulf" OR "United Arab Emirates (UAE)" OR "Saudi" OR "Oman" OR "Qatar" OR "Bahrain" OR "Kuwait" OR "Lebanon" OR "Palestine" OR "Jordan") were searched. To be included, articles had to be peer reviewed. This resulted in 14656 hits. Subsequently, more records were added from other sources (n=13). After duplicates were removed, 14629 studies remained. The titles were then screened for eligibility. Eligible studies were conducted in Arab countries in the Middle East, providing estimates regarding the point prevalence of individuals at high risk for EDs, ED symptoms and ED-related variables, and reporting

correlates of scores above a clinical cut-off in ED-screening instruments, ED symptoms, and ED-related variables. Records (*n*=14312) studying, for example, diabetes mellitus, metabolic syndrome or nutrition related to other diseases, were excluded. When there was doubt, the abstract and discussion section were further screened. This resulted in 72 relevant studies, plus 9 additional studies identified from their lists of reference. The additional sources of studies were four websites involving statistical data such as GCC stat (Figure 1). Most studies were conducted in the UAE (*n*=11), followed by Jordan and Saudi Arabia (*n*=7). A further six studies were conducted in Kuwait, five in Egypt, four each in Oman, and Qatar. Three among Palestinian populations, two each in Bahrain, Lebanon, Iran, and one each in Algeria, and Libya.

Inclusion criteria

Inclusion criteria were that the studies involved Arab Middle Eastern countries (infoplease.com, 2020) of the Eastern Mediterranean Region (WHO, 2020). These are West Asian countries (Lebanon, Jordan, Iran), the Gulf (Bahrain, Kuwait, Qatar, UAE, Saudi Arabia, Oman), Egypt, and Palestinian populations. Though, a non-Arab country, Iran is included because of the several cultural similarities (e.g. hijab and full body coverage for females in public) (Abdollahi & Mann, 2001). All studies investigated at least one ED symptom or ED-related variable. In cases where obesity was studied, study of at least one additional ED behavior was required. There were no restrictions on age or gender. All studies reported point prevalence, the prevalence at a certain point in time (Smink et al., 2013). Additional studies examined correlates of EDs, ED symptoms or ED-related variables.

Exclusion criteria

Studies involving non-Middle Eastern countries, and non-Arab Middle Eastern countries were excluded (infoplease.com, 2020), as were studies focusing only on obesity, and qualitative studies without empirical data.

Assessments

While correlates and ED-related variables can be accurately measured by self-report (Stice et al., 2010), diagnostic interviews are preferable for ED symptoms. Since diagnostic concordance between diagnostic interviews and self-report is moderate at best (Berg et al., 2012), and EDs can best be assessed by diagnostic interviews (Stice et al., 2010), questionnaires including the SCOFF, EAT, and EDE-Q may at best provide prevalence estimates of Arabs at high risk for EDs, indicated by elevated scores at ED-screening instruments. However, since for several Arab populations norms of ED-screening instruments were not available, norms of either Western populations or other Arab populations were used. Therefore, these instruments indicated elevated scores on ED-screening instruments in the target country using the norms of another country. In this study, Arabs who scored above a clinical cut-off are referred to as Arabs at high risk for EDs, regardless of the norms used.

Data abstraction and quality assessment

This review is based on studies published in English between 1986 and 2019; a large timeframe was chosen due to the limited number of studies on EDs conducted in the Arab world. Since only studies on point prevalence were found and none on incidence rate and

lifetime prevalence, prevalence refers to point prevalence. Most of the studies were published in peer reviewed journals. Two theses were also included (Bano et al., 2013; Fallatah et al., 2015). In total, 81 studies met the inclusion criteria. Almost all the studies were quantitative; most were cross sectional, although three were case control studies (Alkhadari et al., 2016; Bener et al., 2006; Rasheed, 1998). One validation study was included (Aoun et al., 2015), and longitudinal data were not available. Eight cross sectional studies involved cross cultural aspects (Abdollahi & Mann, 2001; Dolan & Ford, 1991; Kayano et al., 2008; Latzer et al., 2009; Musaiger et al., 2013; Nasser, 1994; Viernes et al., 2007; Zeeni et al., 2013). Author BM assessed the risk of bias on study validity. Discrepancies or uncertainties were resolved by discussion with either the second or the third author. Data extraction was done independently by BM, taking into consideration study characteristics, demographics, study results, and key study outcomes. Quality of included studies was assessed using the Newcastle-Ottawa scale (Modesti et al., 2016), a seven item scale that investigates power, research design, sample, recruitment, and statistical analysis (see supplementary material). The maximum score was 10 stars, based on selection (maximum five stars), comparability (maximum two stars) and outcome (maximum three stars). Only studies with at least four stars were included in the review. Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) was used as guidance (Figure 1) (Moher et al., 2010).

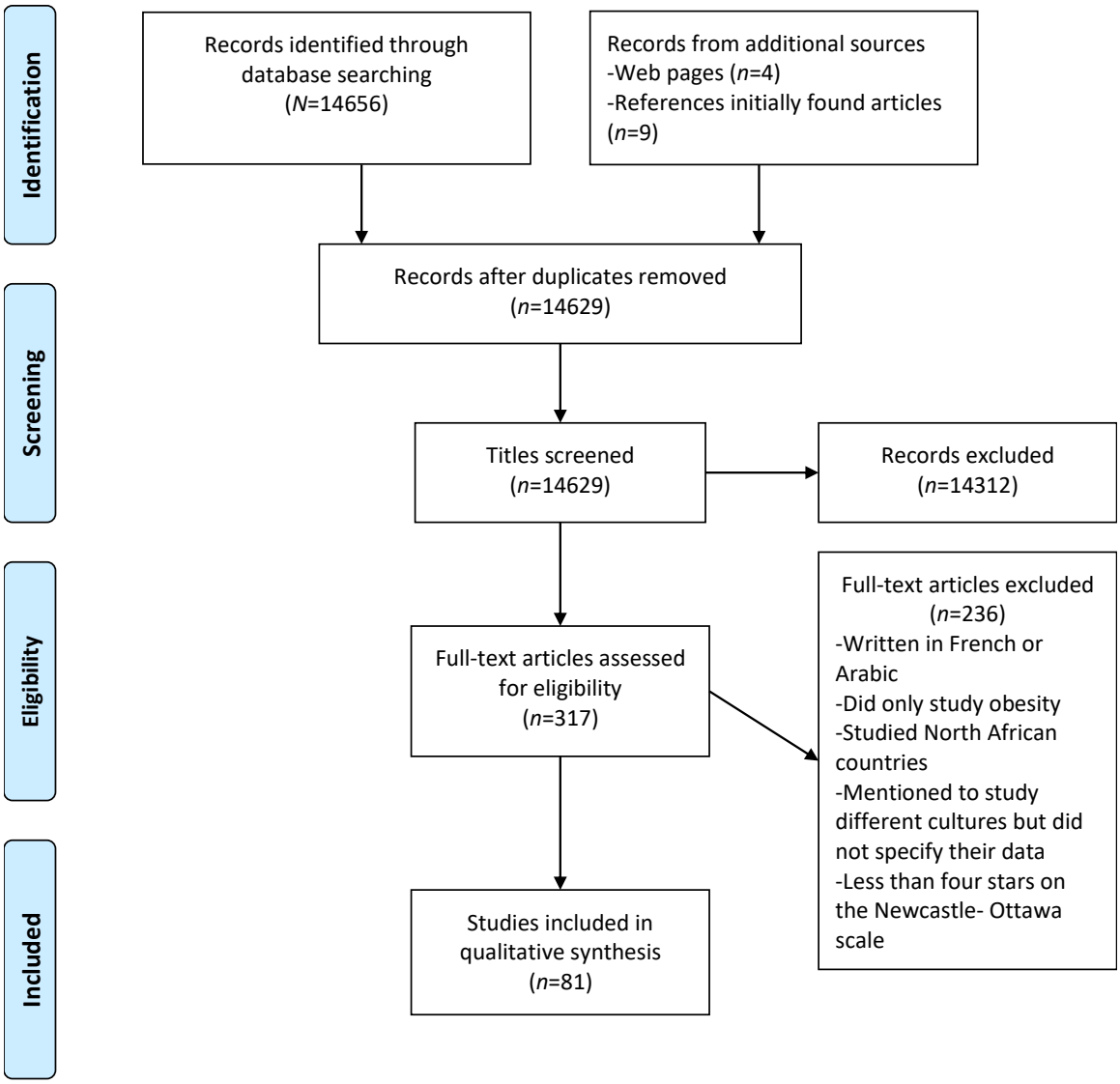

Figure 1 Flow chart of study selection process based on PRISMA

Results

Quality assessment

Of 317 studies assessed for eligibility, 81 studies met the minimum criteria of four stars on the Newcastle Ottawa scale (Figure 1) (Modesti et al., 2016). However, the 81 studies

included had several limitations, these studies either involved a selected group of users or had a selective sample. For example, the association between media and EDs in Kuwait was assessed only on female adolescents at one university (Musaiger, 2011), disturbed eating behavior only amongst adolescent girls in the UAE, and only among the inhabitants of al Ain province (Eapen et al., 2006), and in Saudi Arabia, only in the city of Hail (Bano et al., 2013), all involving academically inclined schoolgirls (Nasser, 1994). Most of the studies involved a population of university students (O'Hara et al., 2016). In addition, reporting in some studies was incomplete (lack of demographic data, such as mean age, and marital status) (Bano et al., 2013; Musaiger & Al- Mannai, 2013). In other studies mean and SD (Abdollahi & Mann, 2001; al-Subaie, al-Shammari, et al., 1996; Al Adawi et al., 2002; Aoun et al., 2015; Kronfol et al., 2018; Mousa, Al-Domi, et al., 2010; Musaiger et al., 2014; Musaiger et al., 2013; Nasser, 1994; Raouf et al., 2015) or percentage that scored above the clinical cut-off (Abdollahi & Mann, 2001; Kayano et al., 2008; Viernes et al., 2007) on the ED-screening instrument were not reported.

Another limitation was that power calculations were not reported in some studies, so their sample size was not justified and was low. This was the case (N=100) in an Omani (Al Adawi et al., 2002), a Saudi (Bano et al., 2013), and (N=104) an Iranian (Abdollahi & Mann, 2001) sample. Studies examining the association between Westernization and ED had only small samples (N<100) in the UAE (Thomas, Quadflieg, et al., 2016), and in Iran (Abdollahi & Mann, 2001).

Another limitation was that several studies used non-validated ED-screening instruments. Several studies, for instance, translated the EAT-40 without adaptations, and used Western norms (Eapen et al., 2006; Eladawi et al., 2018; Nasser, 1994). In another

study on ED in Saudi Arabia, the EAT-26 was translated without adaptations, and applied using Western norms (Bano et al., 2013). The Saudi version of the EAT-26, which included the Western norms was also used in non-Saudi countries (Kayano et al., 2008; Madanat et al., 2007; Musaiger et al., 2014; Musaiger et al., 2013; O'Hara et al., 2016; Thomas et al., 2010; Thomas, O'Hara, et al., 2018; Thomas, O'Hara, et al., 2018; Thomas, Quadflieg, et al., 2016; Viernes et al., 2007). Other studies investigated adults using a version of the Saudi EAT-26 validated in a high school population (Musaiger et al., 2013). Musaiger and Al-Mannai (2011) also examined a Kuwaiti sample using questions validated in a Bahraini sample. In addition, two studies assessed disturbed eating behavior among adolescent Omani and European expatriates residing in Oman using the EAT26 and the EDI-2. These studies found that Omanis had significant higher EAT26 scores, while European expatriates had significantly higher EDI-2 scores. Omanis and European expatriates scored significantly different on both ED-screening instruments (Kayano et al., 2008; Viernes et al., 2007), possibly due to the fact that a Saudi version including Saudi norms were used for the EAT26 and EDI-2 (al-Subaie, al-Shammari, et al., 1996; al-Subaie, Bamgboye, et al., 1996). Several studies also failed to provide essential information on the norms used, and some studies provided no information at all. One study, in Kuwait (Musaiger & Al- Mannai, 2013), did not provide information about how their statistical analysis was conducted. Furthermore, none of the studies on binge eating behavior mentioned the frequency of binge eating episodes, or whether the binges were of a subjective or objective nature (Al Adawi et al., 2002; Latzer et al., 2009; Mousa, Al-Domi, et al., 2010; O'Hara et al., 2016). All the studies discussed relied on self-report measures, which are prone to socially desirable responding (Musaiger & Al-

Mannai, 2013). The collectivistic culture of the Arab world makes people hesitant to report individual desires (Raouf et al., 2015), so the use of self-report measures makes studies vulnerable to under- or overestimation of complaints (Mousa, Al-Domi, et al., 2010).

In conclusion, most of the studies included in this synthesis have limitations. These include the absence of psychometric validation of assessment tools for the Arab world, and the absence of necessary data such as demographic data, power calculation proper assessment, and description of ED-pathology.

Eating Disorder-related variables

Table 1 presents a summary of 19 studies including ED-related variables. These were: desire to be thin, body image dissatisfaction, disturbed eating behavior, and dieting (Stice et al., 2010). Disturbed eating behavior was involved in nine studies, body image dissatisfaction in ten studies, desire to be thin in seven, and dieting in five cross sectional studies. ED-related variables were identified by self-report in all studies, except for one, which used both interview ánd self- report data (Nasser, 1994). All ED-related variables were mainly assessed in female adolescents.

Disturbed Eating Behavior: Overall, the evidence suggested that disturbed eating behavior increases with age during adolescence and decreases during adulthood (Al Adawi et al., 2002; Bano et al., 2013; Eapen et al., 2006; Kayano et al., 2008; Musaiger et al., 2013; Thomas, O'Hara, et al., 2018; Viernes et al., 2007). Females (Musaiger et al.,

2013) and Saudis (Bano et al., 2013) appeared to be most at risk of disturbed eating behavior (Musaiger et al., 2013; Schulte, 2016; Thomas et al., 2010).

Dieting: The findings suggested that, as a whole, approximately 40% of the Arab population is on a diet (Bener et al., 2006; Eapen et al., 2006; Latzer et al., 2009; Sawadi et al., 2000), and this is true for adults and adolescents of both genders (Bener et al., 2006; Eapen et al., 2006; Latzer et al., 2009). Saudis were at the lowest risk of dieting (Al Subaie, 1999).

Body image dissatisfaction: Females were more vulnerable to body image dissatisfaction than male Arabs (Al-Sendi et al., 2004; Ford et al., 1990). Higher BMI was associated with greater body image dissatisfaction (Abdollahi & Mann, 2001; Madanat et al., 2011; Mariam et al., 2019; Mousa, Mashal, et al., 2010; Musaiger & Al- Mannai, 2013; Zawawi, 2014).

Desire to be thin: Though findings were quite inconsistent, overall Arabs from the UAE had the highest desire to be thin (Al Subaie, 1999; Musaiger et al., 2004; Thomas et al., 2010), whereas Qataris appeared to be minimally affected by the thin ideal (Musaiger et al., 2004). A risk factor of the desire to be thin was adulthood over adolescence (Al- Subaie, 2000; Al Subaie, 1999; Eapen et al., 2006; Ford et al., 1990; Musaiger et al., 2004; Schulte & Thomas, 2013; Thomas et al., 2010).

Table 1
Summary of studies reporting eating disorder-related variables in the Arab world

Country/ Population	Authors (year)	Participants	Study design	Measures	Eating disorder-related variables	*M* (*SD*)/OR [95% CI]/ *r*
Algeria, Jordan, Kuwait, Libya, Palestinians residing in al-Khalil, Syria, UAE	Musaiger et al., (2013)	*N* = 4698, 2240 male, 2458 female, age 15 - 18	Cross sectional	EAT 26	Disturbed eating behavior: twice as high in females than in males in Jordan, Libya, Palestinians residing in al-Khalil and Syria	Disturbed eating behavior: ($p < 0.000$), males as reference Jordan OR 2.96 [2.19 - 4.01] Libya OR 2.02 [1.37 - 2.98] Palestinians residing in al-Khalil OR 2.11 [1.39 - 3.22] Syria OR 2.75 [2.02 - 3.77]
Bahrain	Al-Sendi, Shetty, & Musaiger (2004)	*N* = 504, 249 male, 257 female, age 12 - 17	Cross sectional	FRS (self- developed)	Body image dissatisfaction: female: 50%, male: 30%	not reported
Egypt	Ford, Dolan, & Evans (1990)	*N* = 218, 61 male, mean age = 20.0, 169 female, mean age = 19.5, university students	Cross sectional	FRS (self- developed)	Thin ideal: female: ideal shape significantly thinner than their actual shape; male & female: preference for thinness	Discrepancy between current and ideal figure: $t = 3.67$, $p = 0.001$. Mean discrepancy: female 0.56-1.02, male -0.02-1.00 *M* (*SD*) = Female current 3.75 (0.9), ideal 3.19 (0.9). Male current 4.18 (1.1), ideal 4.2 (0.7)
Jordan	Madanat, Hawks, & Angeles (2011)	*N* = 800, female	Cross sectional	9- figure silhouettes	Body image dissatisfaction: 66%	not reported
Jordan	Mousa, Mashal, Al-Domi, & Jibril (2010)	*N* = 326, female, age: 10 - 16	Cross sectional	EAT 26 BSQ |Western norms	Body image dissatisfaction: 21.2%. Association between EAT and BSQ.	BSQ: *M* (*SD*) = 79.1 (34.5), 21.2% above cutoff $\chi 2$ (1, 326) = 104.8, $p < 0.01$
Jordan	Zawawi (2014)	*N* = 170, female, age: 20 - 55, fitness center users	Cross sectional	BSQ	Body image dissatisfaction: 31.01%	*M* (*SD*) = 3.19 (10.3)
Kuwait	Ebrahim, Alkazemi, Zafar, & Kubow (2019)	*N* = 400, Male, university students	Cross sectional	Body Builder Image Grid	Body dissatisfaction : 69%, desire to lose body fat associated with disordered eating attitudes	OR = 1.898 [1.214 - 2.967], $p = 0.005$
Kuwait	Musaiger & Al- Mannai (2013)	*N* = 228, female, university students, age 19 - 25	Cross sectional	Questions validated by Field et al., 2005, translated into Arabic	Body image dissatisfaction: non-obese: 30%, obese: 81%. 21.6% of non-obese perceived themselves as overweight	not reported

Country	Authors (year)	Participants	Study design	Measures	Eating disorder-related variables	M (*SD*)/OR [95% C.I.]/ r
Lebanon	Zeeni, Gharibeh, & Katsounari (2013)	*N* = 400, female, university students in Cyprus (*n* = 200) and Lebanon (*n* = 200)	Cross sectional	Dutch eating behavior questionnaire	Association between restrained and emotional eating	*M* (*SD*): restrained = 29.20 (0.71), emotional eating = 37.76 (0.98), external eating = 33.33 (0.51), $p < 0.05$,
Qatar	Bener, Kamal, Tewfik, & Sabuncuoglu (2006)	*N* = 800, male, age 14 - 19	Case control (dieting)	Adolescent dieting scale Self- reporting questionnaire	Extreme dieting: 10.1%	not reported
Qatar	Musaiger, Shahbeek, & Al-Mannai (2004)	*N* = 535, male, age 20 - 67, primary health care center visitors	Cross sectional	9- figure silhouettes	Desire to be thin: 21.6%, low education 40%, mid-level education 45%, high education 53%. Desire to be thin was associated with age and education	Thin ideal, education: $p = 0.0001$, age > 40 years $p = 0.0001$
Saudi Arabia	Al- Subaie (2000)	*N* = 1179, female, mean age = 16.1	Cross sectional	EDI 2 DT	Desire to be thin: 15.9%	*M* = 6.7, *SD* not reported
Saudi Arabia	Fallatah, Al-Hemairy, & Al-Ghamidi (2015)	*N* = 425,female, age 15 - 18	Cross sectional	EAT 26	Prevalence of dieting not reported	Dieting: 9.38 (7.0)
UAE	Eapen, Mabrouk, & bin Othman (2006)	*N* = 495, female, age 13 - 18	Cross sectional	EAT 40	Thin ideal: 66% preferred a slimmer body than their actual body. Desire to be thin associated with elevated EAT 40 scores	$p < 0.0001$
UAE	O'Hara et al., (2016)	*N* = 420, female, mean age = 23.12, university students	Cross sectional	EAT 26 Teasing frequency from Project eating attitudes and teens Weight and body related shame and guilt scale	Dieting associated with body dissatisfaction	$r = 0.66$, $p < 0.001$
UAE	Sawadi, Bener, & Darmaki (2000)	*N* = 540, female, age 11 - 19	Cross sectional	Adolescent dieting scale	Dieting: 89.4% dieting, 9.1% extreme dieting	not reported
UAE	Schulte & Thomas (2013)	*N* = 361, 284 female, 77 male, age 11 - 19, university students	Cross sectional	EAT 26	Body image dissatisfaction: 73%, female: 78%, male: 58%, body image dissatisfaction associated with desire to be thin and elevated EAT score	Desire to be thin: $\chi 2(2) = 27.083$, $p < 0.001$, EAT: $t(348)$, $p < 0.001$
UAE	Schulte (2016)	*N* = 236, mean age = 19.78	Cross sectional	Body esteem scale, emotional eating scale, Weight and body related shame and guilt scale	Disturbed eating behavior and body dissatisfaction associated with binge eating	*M* (*SD*): body related shame = 8.00 (8.00), body related guilt = 11.50 (9.00). Associations with binge eating: disturbed eating behavior: $p < 0.001$, body dissatisfaction: $p < 0.001$

Country	Authors (year)	Participants	Study design	Measures	Eating disorder-related variables	M (*SD*)/OR [95% C.I.]/ r
UAE	Thomas, Khan, & Abdulrahman (2010)	*N* = 228, female, mean age = 19.8, university students	Cross sectional	EAT 26 FRS	Body image dissatisfaction: 74.8%, association between body image dissatisfaction and disturbed eating behavior	$r = 0.27$, $p = 0.01$

Eating disorder symptoms

Table 2 provides a summary of 11 studies that examined eating disorder symptoms in the Arab world. Binge eating and restrained eating behavior were each identified in seven cross sectional studies and compensatory behavior (*n*=2) in a few studies. All ED symptoms were identified by self-report among adolescents: high school and/or university students.

Binge Eating: Kuwaiti and Egyptian Arabs appeared to be most at risk of binge eating. However, binge eating was only assessed among adolescents, and the findings with regard to gender were inconsistent (Al Adawi et al., 2002; Dolan & Ford, 1991; El-Ghazali et al., 2010; Mousa, Al-Domi, et al., 2010; Mousa, Mashal, et al., 2010; O'Hara et al., 2016; Schulte, 2016).

Restrained eating behavior: Off the seven studies included in this synthesis that studied restrained eating behavior, all of them reported restrained eating behavior in about one-third of Arabic females. Arab adolescents who reported emotional eating and Arabs with obesity were particularly at risk of restrained eating behavior (Al-Subaie, 2000; Al Adawi et al., 2002; Bano et al., 2013; Eapen et al., 2006; Fallatah et al., 2015; Mousa, Al-Domi, et al., 2010; Zeeni et al., 2013).

Compensatory Behavior: Around 7.5% of female Arab adolescents reported usage of laxatives (Latzer et al., 2009; Yahia et al., 2011).

Table 2

Summary of studies with focus on eating disorder symptoms in the Arab world

Country/ Population	Authors (year)	Participants	Study design	Measures	Eating disorder symptoms
Egypt	Dolan & Ford (1991)	*N* = 218, mean age = 20, university students	Cross sectional	BSQ Restraint scale Binge scale	Binge eating: female 82%, male 76%
Jordan	Mousa, Mashal, Al-Domi, & Jibril (2010)	*N* = 326, female, age: 10 - 16	Cross sectional	EAT 26 BSQ	Binge eating: 33%
Jordan	Mousa, Al-Domi, Mashal, & Jibril (2010)	*N* = 432, female, age: 10 - 16	Cross sectional	EAT 26 BSQ Eating habits questionnaire	Binge eating: 16.9%, self-induced vomiting: 11%
Kuwait	El-Ghazali, Ibrahim, Kanari, & Ismail (2010)	*N* = 320, 223 male, 97 female, mean age = 21.1	Cross sectional	Questionnaire for emotional eating (self- developed)	Emotional eating: female: 85.6%, male: 87.9%
Lebanon	Yahia, El- Ghazale, Achkar, & Rizk (2011)	*N* = 252, female, students	Cross sectional	BSQ	Laxatives: 8%, diet pills: 4%
Lebanon	Zeeni, Gharibeh, & Katsounari (2013)	N = 400, female, university students in Cyprus (n = 200) and Lebanon (n = 200)	Cross sectional	Dutch eating behavior questionnaire	Restrained eating Lebanese students: 30%
Jordan	Afifi- Soweid, Najem Kteily, & Shedia- Rizkallah (2001)	*N* = 954, mean age = 18, university students	Cross sectional	Self-developed questionnaire	Binge eating: 4.9%, secretly overeating: 3.7%
Jordan	Mousa, Mashal, Al-Domi, & Jibril (2010)	N = 326, female, age: 10 - 16	Cross sectional	EAT 26	Restrained: 40.5%
Oman	Al Adawi et al., (2002)	*N* = 293, 106 teenagers, mean age = 15.12, 100 adults, mean age = 38.71, 87 Western teenagers resided in Oman, mean age = 15.10	Cross sectional	EAT Bulimic Investigatory Test	Binge eating: Omani teenagers 14%, Western teenagers 18% Restrained: 33% Omani teenagers, 9% Western teenagers

Country/ Population	Authors (year)	Participants	Study design	Measures	Eating disorder symptoms
Palestinians residing in the Northern and Haifa district	Latzer, Azaiza, & Tzischinsky (2009)	*N* = 928, female, age: 12 - 18, 81.2% Islamic, 11.2% Christian, 7.6% Druze	Cross sectional	EAT 26	Laxatives: 7%, self-induced vomiting: 8%
UAE	Schulte (2016)	*N* = 236 Mean age = 19.78	Cross sectional	Body esteem scale Emotional eating scale Weight and body related shame and guilt scale	Body esteem scale: 24.4 - 35.6% Binge eating: moderate binge eating 16.9 - 24.9%, severe binge eating 6.4 - 13.2%, Emotional eating scale: emotional eating 23 - 24.5%

Eating disorders

Table 3 provides a summary of 27 studies that examined prevalence estimates of Arabs at high risk for EDs. ED-screening instruments were conducted among both males and females, and among adolescents and adults. Arabs at high risk for anorexia nervosa (AN) and bulimia nervosa (BN) were identified in different countries by seven cross-sectional studies. Only one study reported Arabs at high risk for binge eating disorder (BED) and other specified feeding or eating disorders (OSFED) (Schulte, 2016). While most ED assessment tools were self-report measures, in one cross sectional study participants were interviewed using a self-developed interview (Nasser, 1994). Another study used the Structured Clinical Interview for DSM-IV (SCID) (Raouf et al., 2015). In one case control study among health care clinic attendees, EDs were not assessed (Alkhadari et al., 2016). Scores above a clinical cut-off on ED- screening instruments were reported without classification specification in 18 studies (Table 3).

Arabs at high risk for ED: In general, 13-55% was at high risk for EDs. On ED-screening instruments, females (11.4-54.8%) displayed more to be at high risk for EDs than males (2-47.3%) (Abdollahi & Mann, 2001; Al- Subaie, 2000; Al Adawi et al., 2002; Alkhadari et al., 2016; Aoun et al., 2015; Bano et al., 2013; Eapen et al., 2006; Eladawi et al., 2018; Fallatah et al., 2015; Kayano et al., 2008; Kronfol et al., 2018; Latzer et al., 2009; Madanat et al., 2007; Mariam et al., 2019; Mousa, Al-Domi, et al., 2010; Mousa, Mashal, et al., 2010; Musaiger et al., 2014; Musaiger et al., 2013; Nasser, 1994; O'Hara et al., 2016; Raouf et al., 2015; Saleh et al., 2018; Schulte & Thomas, 2013; Thomas, O'Hara, et al., 2018; Thomas, O'Hara, et al., 2018; Thomas, Quadflieg, et al., 2016; Thomas, Lee, et al., 2016; Viernes et al., 2007). Arabs from the UAE appeared

to be more at risk for the development of EDs than Arabs from other countries (Al Adawi et al., 2002; Mousa, Al-Domi, et al., 2010; Nasser, 1986; Raouf et al., 2015).

Table 3

Summary of studies reporting the prevalence of Arabs at high risk for eating disorders

Country/ Population	Authors (year)	Participants	Study design	Measures| Norms	Elevated scores at eating disorder screeners *M (SD)*
Algeria, Jordan, Kuwait, Libya, Palestinians residing in al-Khalil, Syria, UAE	Musaiger et al., (2013)	*N* = 4698, 2240 male, 2458 female, age 15 - 18	Cross sectional	EAT 26| Saudi norms	Above clinical cut off: male:13.8-47.3%, female: 16.2%- 42.7% Algeria: 15.2%, male 13.8, female 16.2% Jordan: 31.6%, male 20.1%, female 42.7% Kuwait: 44.7%, male 47.3%, female 42.8% Libya: 26.7%, male 19.3%, female 32.6% Palestinians residing in al-Khalil: 31.7%, male 23.2%, female 38.9% Syria: 22.9%, male 14.6%, female 32% UAE: 33.5%, male 29.8% female 37.4% *M (SD)* not reported
Egypt	Eladawi et al., (2018)	*N* = 400, 112 male, 288 female, weight control center visitors	Cross sectional	EAT 40| Western norms	65% above clinical cut off *M (SD)* = 45.2 (10.2) (age 25-66)
Egypt	Nasser (1994)	*N* = 35, female, age 15 - 16, secondary school students	Cross sectional	EAT 40| Western norms Eating interview	EAT 40: 11.4% above clinical cut off *M (SD)* total sample not reported Eating interview: 1.2% BN, 3.4% subclinical BN
Iran	Abdollahi & Mann (2001)	*N* = 114, female, university students, Iranian nationals, 45 resided in LA, 59 resided in Teheran	Cross sectional	EDE-Q FRS	% above clinical cutoff not reported
Iran	Raouf et al., (2015)	*N* = 1990, 951 male, 1039 female, age 13 - 18, mean age = 15.8	Cross sectional	EAT 26| Irani norms SCID	EAT 26: 24.2% above clinical cut off *M (SD)* not reported SCID: 0.25% diagnosed with ED, 0.7% AN, 0.9% BN, 1.0% OSFED
Jordan	Madanat et al., (2007)	*N* = 800, female, mean age = 33.5	Cross sectional	EAT 26| Saudi norms Motivation for eating scale Restraint scale Sociocultural attitudes towards appearance scale Body esteem scale 9- figure silhouettes	EAT 26: 54.8% above clinical cut off *M (SD)* = 18.98 (10.76)

Country	Authors (year)	Participants	Study design	Measures| Norms	Elevated scores at eating disorder screeners *M (SD)*
Jordan	Mousa, Mashal, Al-Domi, & Jibril (2010)	*N* = 326, female, age: 10 - 16	Cross sectional	EAT 26| Western norms BSQ| Kuwaiti norms	EAT 26: 40.5% above clinical cut off *M (SD)* = 16.6 (10.7)
Jordan	Mousa, Al-Domi, et al., (2010)	*N* = 432, female, age: 10 - 16	Cross sectional	Eating habits questionnaire	OSFED: 31%, BED: 1.8%, BN: 0.6%, AN: 0% *M (SD)* not reported
Kuwait	Alkhadari et al., (2016)	*N* = 1046, 429 male, 617 female, mean age = 37.6, health care clinic attendees	Case control (health care clinic attendees)	Patient health questionnaires GAD-7	Eating disorders were not assessed
Kuwait	Ebrahim, Alkazemi, Zafar, & Kubow (2019)	*N* = 400, male, university students	Cross sectional	EAT 26| Saudi norms	46.2% above clinical cut off *M (SD)* = 20.4 (14.1)
Lebanon	Aoun et al., (2015)	*N* = 123, female, age 15 - 55, primary health care center visitors	Validation SCOFF	SCOFF	28% above clinical cut off *M (SD)* not reported
Oman	Kayano et al., (2008), Viernes et al., (2007)	*N* = 248, 135 Omani, 113 Westerners resided in Oman, age 13 - 18	Cross sectional	EAT 26| Saudi norms EDI 2 DT| Saudi norms	% above cut-off not reported EAT: Omani: *M (SD)* = 8.48 (1.64), European expatriates: *M (SD)* = 5.98 (1.83) EDI2 DT: Omani: *M (SD)* = 4.12 (0.60), European expatriates: *M (SD)* = 10.14 (0.64).
Oman	Al Adawi et al., (2002)	*N* =293, 106 teenagers, mean age = 15.12, 100 adults, mean age = 38.71; 87 Western teenagers resided in Oman, mean age = 15.10	Cross sectional	EAT 26| Saudi norms Bulimic Investigatory Test	EAT: 33% Omani teenagers, 9% Western teenagers above clinical cut off *M (SD)* not reported Bulimic Investigatory Test: 12.3% Omani teenagers, 2% Omani adults, 18.4% Western teenagers
Palestinians residing in the Northern and Haifa district	Latzer et al., (2009)	*N* = 1141, female, age: 12 - 18, 81.2% Islamic, 11.2% Christian, 7.6% Druze	Cross sectional	EAT 26| Saudi norms	25% above clinical cut off *M (SD)* age 12-13 = 16.5 (11.9), age 14-15 = 15.0 (10.5), age 16-18 = 15.2 (9.7)
Palestinians residing in Nablus	Saleh et al., (2018)	*N* = 2001, female university students	Cross sectional	EAT 26| Saudi norms SCOFF	EAT: 28.6% above clinical cut off *M (SD)* = 15.27 (10.38) SCOFF: 38.2% above clinical cut off *M (SD)* = 1.25 (1.032)

Country	Authors (year)	Participants	Study design	Measures| Norms	Elevated scores at eating disorder screeners *M (SD)*
Qatar and Lebanon	Kronfol et al., (2018)	*N* =1841, 167 Lebanon, 785 Qatar, 889 USA university students	Cross sectional	SCOFF	Arab students: 20.4% above clinical cut off American students: 6.8% above clinical cut off *M (SD)* not reported
Saudi Arabia	Al- Subaie (2000)	*N* = 1179, female, mean age = 16.1	Cross sectional	EDI 2 DT	15.9% above clinical cut off M 6.7 SD not reported
Saudi Arabia	Bano et al., (2013)	*N* = 100, female, age 18 - 25	Cross sectional	EAT 26| Western norms	Female: 24% above clinical cut off, male: 2% above clinical cut off *M (SD)* female = 16.89 (10.52), *M (SD)* male = 9.88 (13.26)
Saudi Arabia	Fallatah et al., (2015)	*N* = 425, female, age 15 - 18	Cross sectional	EAT 26| Saudi norms	32.9 % above clinical cut off *M (SD)* = 17.98 (9.29)
UAE	Eapen et al., (2006)	*N* = 495, female, age 13 - 18	Cross sectional	EAT 40| Western norms	23.4% above clinical cut off *M (SD)* =15.19 (1.94)
UAE	Musaiger, Al-Mannai, & Al-Lalla (2014)	*N* = 731, male, age 15 - 18, resided in 5 different Emirates	Cross sectional	EAT 26| Saudi norms	% above clinical cut off: Dubai 49.1%, Ajman 33.1%, Al Fujairah 48.0%, Ras al Khaima 34.8%, Um al Quain 39.7% *M (SD)* not reported
UAE	O'Hara et al., (2016)	*N* = 420, female, mean age = 23.12, university students	Cross sectional	EAT 26| Western norms Teasing frequency from Project eating attitudes and teens Weight and body related shame and guilt scale	EAT 26: 30% above clinical cut off *M (SD)* = 15.57 (9.03)
UAE	Schulte & Thomas (2013)	*N* = 361, 77 male, 284 female, age 11 - 19	Cross sectional	EAT 26| Western norms	20% above clinical cut off *M (SD)* female = 12.88 (8.91), *M (SD)* male = 11.21 (9.81)
UAE	Thomas et al., (2010)	*N* = 228, female, university students, mean age = 19.8	Cross sectional	EAT 26| Western norms FRS	24.6% above clinical cut off *M (SD)* = 13.31 (10.21)
UAE	Thomas, Khan, & Abdulrahman (2010)	*N* = 228, female, mean age = 19.8, university students	Cross sectional	EAT 26| Western norms	24.6% above clinical cut off *M (SD)* = 13.3(10.2)
UAE	Thomas, O'Hara, et al., (2018)	*N* = 1069, female, university students	Cross sectional	EAT 26| Western norms	29.0% above clinical cut off *M (SD)* = 15.80 (9.39)
UAE	Thomas, O'Hara, et al., (2018)	*N* = 209, female, university students	Cross sectional	EAT 26| Western norms	30.3% above clinical cut off *M (SD)* = 14.17 (9.40)

Correlates

Table 4 presents a summary of 32 studies on correlates of a high risk for EDs, ED symptoms and ED-related variables. In Western countries, increased affluence and obesity appear to be the major correlates (Jacobi, Abascal, et al., 2004). These factors may also play a role in Arab communities (Raouf et al., 2015), as the Arab world experiences Western and media influences (social media, TV, western advertising and magazines) (Mousa, Mashal, et al., 2010), which may be correlates of the development of EDs (Zeeni et al., 2013). Increased affluence was identified in five cross sectional studies, Western influences in 11 cross sectional studies, media use in five cross sectional studies, and obesity in nine cross-sectional studies. Most were identified by self-report. However, one study investigated the association between media use and EDs in several countries with a self-developed interview (Musaiger & Al- Mannai, 2014), and another study examined EDs with the SCID (Raouf et al., 2015).

Increased affluence: Increased affluence was associated with ED-related variables (16, 82, 93), especially among Saudis (Al-Sendi et al., 2004; Alkhadari et al., 2016; Salant & Lauderdale, 2003; WHO, 2020).

Western influences: Exposure to Western influences was associated with ED-related variables, especially the desire to be thin (Al Subaie, 1999; Fox & Mourtada-Sabbah, 2006; Ghubash et al., 2001; Latzer et al., 2009). Examples of such Western influences were media (Thomas et al., 2010; Lester, 2004), traveling abroad (Bener et al., 2006), living abroad (Al-Sendi et al., 2004; Mariam et al., 2019; Afifi- Soweid et al., 2001), and contact with expatriates (Al Subaie, 1999; Bener et al., 2006; Ghubash et al., 2001; Thomas et al., 2018). Arabs with greater assimilation with the Western culture

were potentially at more at risk for EDs (Fox & Mourtada- Sabbah, 2006). Arabs in Gulf countries (Oman, Saudi Arabia, UAE) were particularly vulnerable to Western influences. However, besides Western influences vulnerability for EDs might also be associated with industrialization, as the Gulf also has the highest level of industrialization within the Arab world (Al Subaie, 1999; Ghubash et al., 2001).

Media use: Usage of social media was associated with ED symptoms (Khalaf et al., 2015; GCC-Stat, 2016), greater body dissatisfaction, the desire to be thin (Gerbasi et al., 2014; Mirkim, 2012; Qadan, 2009), and disturbed eating behavior (Goldschmidt et al., 2008; Wong et al., 2011). Media use was a particular risk factor among adolescents (Alkhadari et al., 2016; Thomas et al., 2018; O'Hara et al., 2016; Zawawi, 2014; Zeeni et al., 2013).

Obesity: A higher BMI was positively associated with ED-related variables (Abou- Saleh et al., 1996; Hae- Jeung et al., 2013; O'Hara et al., 2016; Wardle, 1987), ED symptoms (Salant & Lauderdale, 2003; WHO, 2020) and high risk for EDs (Fox & Mourtada- Sabbah, 2006). This is of concern because the Arab world has one of the highest rates of obesity in the world (Thomas et al., 2018), in Saudi Arabia in particular (Khandelwal et al., 1995), followed by Bahrain, Egypt, Jordan, Syria and Oman (Sawadi et al., 2000).

Table 4

Summary of studies reporting correlates of eating disorders and eating disorder-related variables in the Arab world

Country/ Population	Authors (year)	Participants	Study design	Measures	Risk factors	*M (SD)*/ OR [95% CI]/ *r*
Algeria, Jordan, Kuwait, Libya, Palestinians residing in al-Khalil, Syria, UAE	Musaiger et al., (2013)	*N* = 4698, 2240 male, 2458 female, age 15 - 18	Cross sectional	EAT 26	Obesity: disturbed eating behavior 2-3 times as high in obese than in non-obese males and females	$p < 0.000$
Bahrain, Egypt, Jordan, Oman, Syria	Musaiger (2014)	*N* = 1134, female, university students, age 17 - 32	Cross sectional	Interview (self-developed)	Media use: exposure to magazines associated with dieting to lose weight in Bahrain, exposure to TV associated with desire to be thin in Egypt, Oman and Jordan, exposure to TV associated with dieting to lose weight in Egypt and Bahrain	Associations: magazines and dieting: Bahrain: OR = 2.29 [0.95–5.68], $p < 0.044$, Egypt OR = 6.29 [2.21–17.39], $p < 0.001$, Jordan OR = 5.29 [1.78–16.83], $p < 0.001$. TV and desire to be thin: Egypt OR =2.05 [1.07–3.94], $p < 0.019$, Oman $p < 0.019$, OR = 2.41[1.09–5.48]. TV and dieting: Bahrain OR = 1.98 [1.00–3.94], $p < 0.035$, Egypt OR = 2.21 [1.01–4.92], $p < 0.032$
Egypt	Eladawi et al., (2018)	*N* = 400, 112 male, 288 female, weight control center visitors	Case control	EAT 40	Increased affluence, female, rural residents, overweight, obesity associated with elevated EAT scores	Rural residents: OR =1.75 [0.95–3.22], $p = 0.044$, affluence: OR = 3.17 [0.74–13.63], $p = 0.023$, weight: $p = 0.006$; overweight OR = 2.75 [1.42–5.33], obesity OR = 1.46 [0.82–2.59]
Iran	Abdollahi & Mann (2001)	*N* = 114, female, university students, Iranian nationals, 45 resided in LA, 59 resided in Teheran	Cross sectional	EDE-Q	Western influences: difference between actual and desired BMI larger in LA sample than in Irani sample	$p < 0.05$
Iran	Raouf et al., (2015)	*N* = 1990, 951 male, 1039 female, age 13 - 18, mean age = 15.8	Cross sectional	EAT 26 SCID	BMI, age, increased affluence, female gender associated with elevated scores	Female: EAT OR = 2.52 [0.42-0.65], $p < 0.001$, AN $p < 0.001$, BN $p < 0.05$, OSFED $p < 0.001$, age: OR = 1.09 [0.99-1.17], $p = 0.036$, BMI: OR = 0.93 [0.90-0.96], $p < 0.001$, increased affluence: OR = 1.17 [1.01-1.35], $p = 0.029$

Country	Authors (year)	Participants	Study design	Measures	Risk factors	*M (SD)/* OR [95% CI]/ *r*
Jordan	Madanat et al., (2007)	*N* = 800, female, mean age = 33.5	Cross sectional	EAT 26 Motivation for eating scale Restraint scale Sociocultural attitudes towards appearance scale Body esteem scale 9- figure silhouettes	Weight status: 53.8% overweight/ obese. Obesity associated with desire to lose weight, restrained eating, emotional eating, elevated EAT scores. Western advertising and media use associated with desire to lose weight, restrained eating, emotional eating, disturbed eating behavior. Increased affluence associated with elevated EAT scores	Obesity: $p < 0.01$ Increased affluence: $p < 0.01$. Associations Western advertising and media not reported.
Jordan	Madanat, Hawks, & Angeles (2011)	*N* = 800, female	Cross sectional	9- figure silhouettes	BMI: 53.8% overweight/ obese, 66% body image dissatisfaction, association between BMI and desire to lose weight	$r = 0.858$, $p < 0.0001$
Jordan	Mousa, Mashal, Al-Domi, & Jibril (2010)	*N* = 326, female, age: 10 - 16	Cross sectional	EAT 26 BSQ	Media use associated with body dissatisfaction. BMI associated with body dissatisfaction. Residing in a Western country is protective factor for body image dissatisfaction.	Obesity: OR = 2.8 [2.1 - 3.8], p <0.01 Media: OR = 1.2 [1.1 - 1.4], $p < 0.01$, reside in Western country: [RR: 0.34 (0.12–1.1), p = 0.046].
Jordan	Zawawi (2014)	*N* = 170, female, age: 20 - 55, fitness center users	Cross sectional	BSQ	BMI: positive association between BMI and body image dissatisfaction	$r = 0.729$, $r^2 = 0.53$, $F(1, 175) = 198.6$, p<0.01
Kuwait	Ebrahim, Alkazemi, Zafar, & Kubow (2019)	*N* = 400, Male, university students	Cross sectional	EAT 26	Obesity associated with disordered eating and dieting.	Disordered eating: OR = 2.06 [1.17, 3.60], p =0.011, Dieting: OR = 2.063[1.01, 4.21], p = 0.043)
Kuwait	Musaiger & Al-Mannai (2013)	*N* = 228, female, university students, age 19 - 25	Cross sectional	Questions validated by Field et al., 2005, translated into Arabic	Use of internet and reading magazines associated with dieting to lose weight, media influence 2-3 times higher in obese than in non-obese females, watching TV not associated with body shape concern.	Dieting: OR = 3.11 [1.5 - 6.47], Media influence: OR = 2.14 [0.93 - 5.09], internet: $p = 0.000$, magazines: $p = 0.011$, media influence in obese: p = 0.000
Lebanon and Cyprus	Zeeni, Gharibeh, & Katsounari (2013)	*N* = 400, female, university students in Cyprus (n = 200) and Lebanon (n = 200)	Cross sectional	Dutch eating behavior questionnaire Perceived sociocultural influences on body image and body change questionnaire	Lebanese students greater association between body image dissatisfaction and media use. Greater emotional eating and sociocultural influences in eating behavior, greater influence of media to become slimmer, eat less and exercise to lose weight (p<0.05). Association between BMI and restraint and emotional eating in Lebanon and in Cyprus. No differences in restraint eating	Associations Lebanon: BMI and restrained r = 0.3, p <0.001, BMI and emotional eating $r = 0.2$, $p = 0.01$, media to become slimmer $t(371.66)$ = 5.02, $p < 0.001$, $r = 0.25$), eat less to lose weight $t(383.31) = 3.02$, $p < 0.001$, $r = 0.15$, exercise more to lose weight $t(380.90) = 3.53$, $p < 0.001$, r = 0.18

Country	Authors (year)	Participants	Study design	Measures	Risk factors	*M (SD)/* OR [95% CI]/ *r*
Oman	Al Adawi et al., (2002)	*N* =293, 106 teenagers, mean age = 15.12, 100 adults, mean age = 38.71; 87 Western teenagers resided in Oman, mean age = 15.10	Cross sectional	EAT Bulimic Investigatory Test	Westernization: significant difference in BMI between Omani and Western teenagers, Omani teenagers significantly more susceptible for AN and BN than Western teenagers	BMI: $p = 0.000$
Oman	Kayano et al., (2008)	*N* = 248, 135 Omani, 113 Westerners resided in Oman, age 13-18	Cross sectional	EAT 26 EDI 2 DT	Weight status: 13% obese, 27% underweight. BMI associated with desire to be thin, negative association between EDI and EAT 26 scores. Average score on EAT 26 higher in the Omani (9.2) than in the Western (5.59) group. EDI score 3 times higher in Western than in Omani group.	BMI: $r = 0.03$, $p < 0.05$, Omani higher EAT scores: $F(2,240) = 10.95$, $p < 0.001$. Europeans higher EDI 2 DT scores: $F(2,240) = 71.72$, $p < 0.001$
Oman	Viernes et al., (2007)	*N* = 248, 135 Omani, 113 Westerners resided in Oman, age 13-18	Cross sectional	EAT 26 EDI 2 DT	BMI associated with desire to be thin and guilt after eating sweets. Terrified to become fat: European expats: 81%, Omani's: 66%. higher fear of fatness. Somatic symptom presentation among Omani's.	Desire to be thin: Omani OR = 1.60 [0.92 2.79], p= 0.09, European expats: OR = 8.17 [4.63 14.41], $p = 0.00$, guilt after eating sweets: Omani OR = 0.05 [0.01 0.36], $p = 0.00$. Terrified to become fat: $F = 235.9$, $p < 0.001$. Somatic symptom presentation: Kendall's tau = 0.352, $p < 0.001$
Palestinians residing in the Northern and Haifa district	Latzer et al., (2009)	*N* = 1141, female, age: 12 -18, 81.2% Islamic, 11.2% Christian, 7.6% Druze	Cross sectional	EAT 26	Westernization: Druze subgroup higher scores on EAT	$F(2) = 2.9$, $p < 0.05$
Palestinians residing in Nablus	Saleh et al., (2018)	*N* = 2001, female university students	Cross sectional	EAT 26 SCOFF	BMI: association between BMI and EAT score. Age: negative association between age and EAT score	BMI: r =0.173, $p < 0.011$ age: $r = -0.058$, $p = .008$
Qatar	Bener & Kamal (2006)	*N* = 566, female, age 14 - 19	Cross sectional	Adolescent dieting scale	BMI associated with dieting	$p = 0.045$
Qatar	Bener, Kamal, Tewfik, & Sabuncuoglu (2006)	*N* = 800, male, age 14 - 19	Case control (dieting)	Adolescent dieting scale Self- reporting questionnaire	Obesity: 34% of dieters was overweight, TV was diet source (61.7%)	$p = 0.014$
Qatar	Musaiger, Shahbeek, & Al-Mannai (2004)	*N* = 535, male, age 20-67, primary health care center visitors	Cross sectional	9- figure silhouettes	Age and education associated with desire to be thin	Association with desire to be thin: education: $p = 0.0001$, age > 40 years $p = 0.0001$
Qatar and Lebanon	Kronfol et al., (2018)	*N* =1841, 167 Lebanon, 785 Qatar, 889 USA university students	Cross sectional	SCOFF	Risk factors: female gender, financial difficulties	$p < 0.001$

Country	Authors (year)	Participants	Study design	Measures	Risk factors	*M (SD)/* OR [95% CI]/ *r*
Saudi Arabia	Al- Subaie (2000)	*N* = 1179, female, mean age = 16.1	Cross sectional	EDI 2 DT	BMI, speaking a Western language and lived in a Western country and SES associated with dieting behavior and drive for thinness	BMI: $\chi2(3) = 97.59$, $p = 0.0001$, western language $\chi2(1) = 8.9$, $p = 0.002$, lived in western country $\chi2(1) = 10.3$, $p = 0.001$, SES $\chi2(4) = 12.32$, $p = 0.015$
Saudi Arabia	Fallatah et al., (2015)	*N* = 425, female, age 15 - 18	Cross sectional	EAT 26	Association between BMI and disturbed eating behavior	$t = 3.095$, $p < 0.0001$, df not reported
Saudi Arabia	Khalaf, Westergren, Berggren, Ekblom, & Al-Hazzaa (2015)	*N* = 663, female, mean age = 20.4, university students	Cross sectional	Self-developed questionnaire	Weight status: 19.2% underweight, 56.9% normal weight, 23.8% overweight/ obesity, BMI was associated with increased affluence	$p = 0.032$
Saudi Arabia	Rasheed (1998)	*N* = 144, female, 74 Obese, 70 non- obese, age 15 - 55	Case control study (obesity)	Adapted eating and exercise behavior questionnaire	Increased affluence: higher affluence leads to slimmer ideal body (81%) and overestimation of own body weight (29%), illiteracy more common in obese group (21.9%).	$p < 0.05$
UAE	Eapen et al., (2006)	*N* = 495, female, age 13 - 18	Cross sectional	EAT 40	BMI, age, Western TV associated with elevated EAT scores.	$p < 0.0001$
UAE	O'Hara et al., (2016)	*N* = 420, female, mean age = 23.12, university students	Cross sectional	EAT 26 Teasing frequency from Project eating attitudes and teens Weight and body related shame and guilt scale	Internalized weight stigma and teased with weight associated with elevated EAT scores	Internalized weight stigma: $r = 0.43$, $p < 0.001$, teased with weight: $r = 0.19$, $p = 0.008$
UAE	Schulte & Thomas (2013)	*N* = 361, 77 male, 284 female, age 11 - 19, university students	Cross sectional	EAT 26	Weight status: overweight: 18.6%, obesity 9.2% BMI associated with EAT scores in females	BMI: $r = 0.184$, $p = 0.005$
UAE	Schulte (2016)	*N* = 236, mean age= 19.78	Cross sectional	Body esteem scale PSS Emotional eating scale, Weight and body related shame and guilt scale	After correcting for BMI association between perceived stress and binge eating	$p = 0.043$
UAE	Thomas, Quadflieg, & O'Hara (2016)	*N* = 94, female, university students	Cross sectional	EAT 26	Implicit out group preference associated with elevated EAT scores	$t(88) = 2.83$, $p < 0.001$
UAE	Thomas, O'Hara, et al., (2018)	*N* = 1069, female, university students	Cross sectional	EAT 26	Religiosity: small effect size for religiosity in the group that scored above clinical cut off on the EAT	$U = 91{,}660$, $p < 0.001$, $r = -0.12$

Country	Authors (year)	Participants	Study design	Measures	Risk factors	*M (SD)/* OR [95% CI]/ *r*
UAE	Thomas, O'Hara, et al., (2018)	*N* = 209, female, university students	Cross sectional	EAT 26	Westernization: small effect size for out group positivity and higher Western acculturation in the group that scored above clinical cut off on the EAT	Out group positivity: $t(206) = 2.49$, $p = 0.013$, $d = 0.36$. Western acculturation: $t(206) = 3.13$, $p = 0.002$, $d = 0.46$

Cultural differences in eating disorders

Some studies suggest that, rather than causing a rise in EDs, Western influences are associated with a shift in symptomatology. The four cross-sectional studies summarized in Table 4 examined cultural differences in EDs.

Cultural differences: Interestingly, predominant identification with a Middle Eastern culture was associated with a risk for AN (Abdollahi & Mann, 2001; Al Adawi et al., 2002), while predominant identification with a Western culture was associated with a risk for BN (Abdollahi & Mann, 2001), for instance among European expatriates resident in Oman, among Omani Arabs (Al Adawi et al., 2002) and among Iranians (Abdollahi & Mann, 2001). Omani Arabs tended to express their ED symptoms somatically (e.g. bloated stomach, nausea, reduced, fluttering feeling in the stomach, throat discomfort, etc.), while Western populations were more likely to express them psychiatrically (Kayano et al., 2008; Viernes et al., 2007).

Discussion

The aim of this study was to provide estimates regarding the point-prevalence of Arabs at high risk for EDs, with ED symptoms and ED-related variables. An additional aim was to provide a comprehensive synthesis of relevant studies of correlates and ED-related variables. Although EDs occur both in Western (Smink et al., 2016) and in Arab societies (Raouf et al., 2015), there are no official statistics available for in the Arab world (GCC-Stat, 2016) and prevalence has rarely been studied (Schulte, 2016). The prevalence of full syndrome EDs have not been reported in the Arab world, except for one case study (Qadan, 2009). Perhaps this is because EDs are not viewed as common disorders in the Arab world (Alkhadari et al., 2016). This synthesis found that in the Arab world, 13-55% is at high risk for

EDs, the prevalence was higher among females than in males (Abdollahi & Mann, 2001; Al-Subaie, 2000; Al Adawi et al., 2002; Alkhadari et al., 2016; Aoun et al., 2015; Bano et al., 2013; Eapen et al., 2006; Eladawi et al., 2018; Fallatah et al., 2015; Kayano et al., 2008; Kronfol et al., 2018; Latzer et al., 2009; Madanat et al., 2007; Mariam et al., 2019; Mousa, Al-Domi, et al., 2010; Mousa, Mashal, et al., 2010; Musaiger et al., 2014; Musaiger et al., 2013; Nasser, 1994; O'Hara et al., 2016; Raouf et al., 2015; Saleh et al., 2018; Schulte & Thomas, 2013; Thomas, O'Hara, et al., 2018; Thomas, O'Hara, et al., 2018; Thomas, Quadflieg, et al., 2016; Thomas, Lee, et al., 2016; Viernes et al., 2007), and the prevalence appeared to increase during adolescence (Eapen et al., 2006; Gerbasi et al., 2014; Mirkim, 2012; Raouf et al., 2015). There were also some indications symptomatology was culturally reactive (Abdollahi & Mann, 2001; Al- Subaie, 2000; Al Adawi et al., 2002; Kayano et al., 2008; Nasser, 1986; Viernes et al., 2007).

EDs are perceived as diseases of globalization (Gordon, 2001). The rapid sociocultural changes in the Arab world (Eapen et al., 2006) since oil boom in the 1970s and the consequent increased affluence have contributed to elevated levels of non-communicable diseases including the development of ED-related variables, ED symptoms and EDs (Nasser, 1994; Pavlova et al., 2010; Thomas, O'Hara, et al., 2018; Thomas, Quadflieg, et al., 2016). In the included studies sociocultural changes were associated with changes in types of food available (higher in salt, fat and sugar) and therefore increased prevalence of obesity (Goldschmidt et al., 2008; Hae- Jeung et al., 2013; Swain, 2006; Wong et al., 2011). Obesity was associated with dieting behavior, compensatory behavior, body image dissatisfaction and binge eating behavior (Al Subaie, 1999; Eapen et al., 2006; Latzer et al., 2009; Musaiger et al., 2013; Raouf et al., 2015; Wardle, 1987; Zawawi, 2014; Zeeni et al., 2013). Another implication of the sociocultural changes was the shift from admiration of a curvy body (Zeeni et al., 2013) to that of a thin body (Afifi- Soweid et al., 2001; Ford et al., 1990; Madanat et al., 2007; Thomas

et al., 2014), and the desire to be thin was associated with compensatory behavior, binge eating behavior, dieting behavior, and body dissatisfaction (Al Subaie, 1999; Eapen et al., 2006; Latzer et al., 2009; Musaiger et al., 2013; Raouf et al., 2015; Wardle, 1987; Zawawi, 2014; Zeeni et al., 2013). The thin ideal was especially prevalent among adults (Al- Subaie, 2000; Al Subaie, 1999; Eapen et al., 2006; Ford et al., 1990; Musaiger et al., 2004; Schulte & Thomas, 2013; Thomas et al., 2010), higher educated, increased affluence Arabs (Abou- Saleh et al., 1996; Pavlova et al., 2010), and Arabs who reported Western influences (Thomas et al., 2014; Thomas, O'Hara, et al., 2018). Interestingly, societies dealing with faster industrialization appeared more vulnerable to Western influences (Thomas, O'Hara, et al., 2018; Thomas, Quadflieg, et al., 2016) and displayed greater risk for EDs (Al Adawi et al., 2002; Mousa, Al-Domi, et al., 2010; Nasser, 1986; Raouf et al., 2015). However, Qatari females appeared minimally affected by the thin ideal (Musaiger et al., 2004). There were indications that culture was associated with symptomatology (Abdollahi & Mann, 2001; Al Adawi et al., 2002; Kayano et al., 2008; Viernes et al., 2007), and the somatic symptom presentation (Kayano et al., 2008; Viernes et al., 2007) was in line with other countries dealing with rapid sociocultural changes (Khandelwal et al., 1995; Lee et al., 2001; Srinivasan et al., 1995).

In conclusion, female Arabs were most at risk for EDs and ED symptoms (Al Adawi et al., 2002; Bano et al., 2013; Eapen et al., 2006; Kayano et al., 2008; Musaiger et al., 2013; Thomas, O'Hara, et al., 2018; Viernes et al., 2007). The high rates of obesity (Goldschmidt et al., 2008; Hae- Jeung et al., 2013; Swain, 2006; Wong et al., 2011) and the desire to be thin were associated with other ED-related variables, ED symptoms and high risk for EDs (Al Subaie, 1999; Eapen et al., 2006; Latzer et al., 2009; Musaiger et al., 2013; Raouf et al., 2015; Wardle, 1987; Zawawi, 2014; Zeeni et al., 2013). Increased affluence and media use were correlates of the desire to be thin.

Clinical impact

Development of this synthesis of EDs in the Arab world has important clinical implications, as most studies examining ED prevalence used Western assessment tools (Schulte, 2016). Such utilization of potentially insensitive assessment tools and potentially inappropriate norms may lead to underestimation of symptom severity (Darcy et al., 2012), elevated rates of undiagnosed EDs, and to a lack of knowledge and (public) awareness about EDs and its correlates (Griffiths et al., 2015). This in turn hampers timely and proper treatment of EDs (Alkhadari et al., 2016). In the Arab world, the situation is further complicated by the lack of specialized therapists and treatment facilities (Qadan, 2009).

Another problematic aspect of the lack of popular knowledge about EDs is stigmatization, leading to delayed help seeking (Griffiths et al., 2015). Since it is culturally unacceptable to discuss personal matters with non-family members, only 0.3% of Arabs with an ED seek help, compared to 20% of Westerners who do so (Latzer et al., 2009). More knowledge about EDs might decrease the current preference for self- or family treatment, and therefore stigma associated with psychotherapy (Latzer et al., 2009). In order to increase knowledge psycho-education can be offered at high-schools, including a parental program. Once college and high-school social workers are better educated in recognizing EDs they can refer their students to mental health care clinics. In addition, overweight Arabs tend to seek bariatric surgery, while currently they are in general not screened for EDs. Screening for EDs and refer Arabs at high risk for EDs might reduce delayed help seeking. Last, to decrease stigmatization, it might be beneficial to let influencers share their personal story of recovery of an ED, since Arabs are extensive social media users.

Two studies in Oman reported that, as in several Asian studies (Khandelwal et al., 1995; Lee et al., 2001; Srinivasan et al., 1995), EDs were explained somatically rather than psychiatrically (Kayano et al., 2008; Viernes et al., 2007). This may lead to a failure to

accurately recognize behaviors as ED symptoms, and so to delayed help-seeking and greater symptom severity (Mond, 2014; Räisänen & Hunt, 2014). In addition, in Saudi Arabia people with EDs tended to seek help only after experiencing somatic complaints, such as kidney failure or diabetes mellitus.

Although EDs have been studied in the Arab world, there are methodological shortcomings to many of the studies currently available. Arabs who display an increased risk for EDs, are likely to benefit from preventative programs, as selective prevention programs display larger effects than universal prevention programs (Bar et al., 2017; Kindermann et al., 2017; Stice et al., 2019; Stice et al., 2007). The risk groups in the Arab world are individuals with elevated levels of body dissatisfaction, desire to be thin, and self-reported dieting (Al Subaie, 1999; Eapen et al., 2006; Latzer et al., 2009; Musaiger et al., 2013; Raouf et al., 2015; Wardle, 1987; Zawawi, 2014; Zeeni et al., 2013). In addition, the more high affluent societies and Arabs with extensive (social) media use, and more prone to Western influences are also at risk (Abou- Saleh et al., 1996; Pavlova et al., 2010). Counteracting the elevated prevalence of obesity in order to prevent associated health risks (Madanat et al., 2007), accompanied by psycho-education in order to prevent maladaptive weight-loss strategies, may be beneficial.

Future directions

Most assessment tools included in this synthesis have been devised for use in Western populations. Due to the potential bias, it is recommended to use ED-screening instruments adapted for use in the Arab world. Future research might therefore consider the development and validation of cultural sensitive assessment tools (Fallatah et al., 2015). One relevant adaptation of self- report measures is that fasting may be motivated by religion (77, 93) and should only be considered pathological if motivated by weight and shape concern. Other relevant adaptations in some Arab countries might relate to the strict gender separations and

related cultural norms and behaviors, e.g., a proper attention to distinguishing between situations where females do and don't cover themselves (Mousa et al., 2010).

Another potential bias of the studies included in this synthesis is the usage of Western norms. In general, scores on ED-screening instruments are significantly lower in Western populations than in Arab populations (Eladawi et al., 2018; Fairburn & Beglin, 2008; Madanat et al., 2007; Melisse et al., 2021), usage of Western norms might therefore reflect bias. While some assessment tools have been validated in other Arab countries, they potentially may not be sensitive to nuances across various Arab communities. Efforts to assess EDs in the Arab world have therefore potentially been limited due to the absence of psychometric validation of assessment tools, especially in clinical samples. In order to understand the culture, validation studies should be supplemented with interview data. A culturally sensitive assessment tool will help minimize inconsistencies found among studies in the Arab world.

To elucidate correlates and ED-related variables, researchers need to examine levels of acculturation, internalization of the thin ideal, increased affluence and media exposure, as they may mediate body image dissatisfaction and disturbed eating behavior. As most studies included in this synthesis were conducted in countries dealing with rapid sociocultural changes, additional studies in the Arab world with limited exposure to Western influences and limited industrialization are necessary (Campbell et al., 2005; Yang et al., 2005).

Recently, studies are beginning to address the possible somatic symptom presentation of EDs in the Arab world (Kayano et al., 2008; Viernes et al., 2007). We recommend that, during diagnostic interviews, clinicians pay attention to the possibility of this understudied phenomena. In addition, it is worth further investigating the somatic attribution of EDs in the Arab world. Confirmation of this theory will facilitate recognition of EDs in the Arab world.

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Chapter 5 Correlates of eating disorder pathology in Saudi Arabia: BMI and body dissatisfaction

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Abstract

Background: Saudi Arabia is undergoing rapid sociocultural changes, which may have led to an increase of body mass index and eating disorder pathology. The aim of this study is to investigate whether body dissatisfaction, self-esteem, having lived abroad, cultural orientation, perceived stress, media use, and socioeconomic status are correlates of eating disorder pathology with body mass index as a covariate. Additional aims are to investigate if cultural orientation is associated with symptomatology and if stress is a covariate in the association between eating disorder pathology and Western orientation.

Method: Self-report measures were administered in a convenience Saudi community sample (*N*=1225) between April 2017 and May 2018. Hierarchical multiple linear regression analyses with eating disorder pathology as dependent variable were performed to establish the associations among the variables.

Results: After adjusting for the effect of BMI, only body dissatisfaction and eating disorder pathology were moderately associated. Eating disorder pathology and body dissatisfaction were more severe among Saudi citizens with a higher BMI.

Discussion: Several explanations for the lack of associations of westernization, self-esteem, and stress with eating disorder pathology are reviewed and discussed. The majority of this convenience sample existed of young unmarried Saudi females of high socioeconomic status. Of the total sample, 35% displayed eating disorder pathology which may be a reflection of the high rates of excess weight.

Keywords: eating disorder pathology, BMI, body dissatisfaction, Saudi Arabia

Plain English Summary

Eating disorders were assumed to be rare in Saudi Arabia, however, Saudi citizens report both, increased pressure to be thin and eating disorder pathology. Saudi Arabia is dealing with rapid sociocultural changes. Consequences of these sociocultural changes, which might be associated with eating disorder pathology, are an increase of BMI, body dissatisfaction, low self-esteem, westernization, perceived stress, media use, and socioeconomic status. In addition, the increase in BMI might strengthen the associations between eating disorder pathology and body dissatisfaction, low self-esteem, perceived stress, media use, and socioeconomic status. Alternative explanations might be that cultural values are associated with different eating disorder symptoms or that eating disorder pathology is associated with stress stemming from transformation that aims to empower women and modernize Saudi society. This study showed that only BMI and body dissatisfaction were associated with eating disorder pathology, and BMI was a covariate in the association between eating disorder pathology and body dissatisfaction. Preventative programs focused on avoidance of maladaptive weight loss strategies and the improvement of body satisfaction might be beneficial in Saudi Arabia.

Background

Eating disorders have historically been associated with Caucasian women in developed Western countries (Gordon, 2001). Therefore, eating disorders have been perceived as culture bound syndromes (Pike et al., 2014), and most research on eating disorders is conducted in Western countries (Pike & Dunne, 2015). However, cultural factors are essential to understand the etiology of eating disorders (Lewis-Fernández & Kleinman, 1994). In Western countries, the main feature of eating disorders is the desire to be thin (Gordon, 2001). In Saudi Arabia traditional notions of beauty are different, with a curvy body ideal being associated with fertility and wealth. Thus, Saudi citizens are thought to be less likely to suffer from eating disorders (Ford et al., 1990). However, though data are still inconclusive, the thin ideal seems on the rise in Saudi Arabia (Al Subaie, 1999; Musaiger et al., 2004; Thomas et al., 2010). Recent studies have shown that eating disorders occur globally (Keel & Klump, 2003; Thomas, Lee, et al., 2016) and eating disorders occur particularly in cultures in transition as they tend to adopt Western values (Pike et al., 2014; Thomas, O'Hara, et al., 2018), illuminating the interplay between culture and psychopathology (van Son et al., 2006). This is especially relevant to Saudi Arabia, as it is undergoing rapid sociocultural changes (Fox & Mourtada- Sabbah, 2006; Thomas et al., 2010).

Rapid sociocultural changes are often referred to as a combination of westernization, industrialization and globalization (Gordon, 2001; Nakai et al., 2018; Salant & Lauderdale, 2003). Westernization is defined as adoption of language, lifestyle, values and beliefs of Western cultures (Salant & Lauderdale, 2003). Western oriented Arabs display greater assimilation with Western countries than those who are more Arab oriented, resulting in Saudi citizens speaking English with their relatives and friends, and finding entertainment in malls rather than in a traditional souk (Melisse, Beurs, et al., 2020). In addition, industrialization comes along with an increased sedentary lifestyle, and a dietary shift towards Western types

of foods, higher in salt, sugar and fat, all instrumental in the rise of excess weight (Madanat et al., 2007; WHO, 2006). The prevalence of high BMI has increased from below 10% around 1980 to rates of 29-58%, and Saudi Arabia currently has one of the highest prevalence rates of excess weight (Melisse et al., 2021; Qamar Farshori et al., 2015; WHO, 2006). Excess weight is associated with eating disorder pathology (Villarejo et al., 2012), as Saudi citizens with excess weight are known to be 2-3 times more likely to develop an eating disorder pathology than Saudi citizens without excess weight (Musaiger et al., 2013). Furthermore, excess weight is associated with body dissatisfaction and low self-esteem (Maclean et al., 2017). Moreover, studies found that high BMI strengthens the association of eating disorder pathology with: body dissatisfaction, low self-esteem, perceived stress, and media use (Friedman et al., 2002; Madanat et al., 2007; Musaiger et al., 2013). High BMI may serve as a covariate in the interplay between eating disorder pathology and its correlates.

Other consequences of westernization include an increase in media use, which may be associated with eating disorder pathology (Derenne & Beresin, 2018; Pike & Dunne, 2015). Media use is defined as the use of internet, social media platforms, and streaming services (Holland & Tiggeman, 2016). Saudi citizens are extensive media users, internet access has increased over 100-fold in the last 16 years, and, on average, they spend 2.7 hours daily watching streaming services, 50-100% more than in Western countries (Gulf, 2017; Outlook, 2012; Statista, 2017). In addition, social media photos and videos often promote a more Western presentation of shape and weight, potentially resulting in increased thin ideal and consequently unhealthy dietary behavior (Stice & Shaw, 2002). Furthermore, various diets are promoted on social media (Roman, 2020). However, the exact impact of westernization on the development of eating disorder pathology is still inconclusive. Some studies show that a Western orientation and having lived abroad, appeared to be risk factors for eating disorder pathology in several Gulf countries, and Gulf citizens who live in a Western country display

more severe eating disorder pathology than their counterparts who still live in their country of origin (Abdollahi & Mann, 2001; Al- Subaie, 2000; Musaiger & Al- Mannai, 2013; Musaiger et al., 2013; Thomas, O'Hara, et al., 2018; Thomas, Quadflieg, et al., 2016). In contrast, some studies show that internalization of Western values is weakly associated with eating disorder pathology in Saudi Arabia (AlShebali et al., 2020). Finally, cultural orientation might be associated with symptomatology: individuals who are predominantly Arab orientated engage more in restrictive eating behaviors, while individuals who are more westernized display more binge eating behaviors (Abdollahi & Mann, 2001; Viernes et al., 2007). The role of religion may go both ways, as the Holy Quran supports restrictive eating stating that someone should fill its body 1/3 with air, 1/3 with water and 1/3 with food. Furthermore, restrictive eating during the holy month of Ramadan does not affect eating behavior (Ali, 2011; Erol, 2008; Savas, 2014). On the other hand, social events are culturally accompanied by the intake of large amounts of food (Musaiger et al., 2000).

The contradictory results regarding westernization suggest that, rather than just westernization, conflicting cultural values related to the sociocultural, political and legal transformations that aim to empower women and modernize the relatively conservative Saudi society might cause stress (Lefdahl-Davis, 2015; Musaiger et al., 2013). Maladaptive coping mechanisms to respond to stress may contribute to the development of eating disorders, as stress is associated with binge eating, restraint eating and overeating (Järvelä-Reijonen et al., 2016). The role of perceived stress should therefore be taken into consideration as well, when examining correlates of eating disorder pathology (Rathner et al., 2001). Lastly, the sociocultural changes led to an increase in socioeconomic status (SES) of Saudi inhabitants since a free educational system is developed (Thomas et al., 2010). Consequently, level of education and employment rates of Saudi citizens increased (Al- Subaie, 2000; Al Adawi et al., 2002). However, the exact impact of SES on eating disorder pathology is unclear: in Saudi

Arabia SES appears to be associated with restrictive eating behavior (Al- Subaie, 2000), which is confirmed by studies conducted in Western countries. However, SES appears to be negatively associated with excess weight, whereas binge eating disorder appears unrelated to SES in Western societies (Burgoine et al., 2017; Gordon, 2001; Mitchison & Hay, 2014). Lastly, the increase in SES is associated with larger families and therefore an increase in youth. Median age in Saudi Arabia is 31.8 years and about 72% is aged between 15 and 64 years (O'Neil, 2022; Worldometers, 2021). The growth of the adolescent population is potentially associated with an increase in eating disorder pathology as the prevalence appears to increase among adolescent Saudi citizens (Eapen et al., 2006; Gerbasi et al., 2014; Mirkim, 2012; Raouf et al., 2015).

In sum, as Saudi Arabia is undergoing rapid sociocultural changes, several risk factors for the development of eating disorder pathology may currently apply. Though studies have identified correlates of eating disorder pathology in Western countries, few have been undertaken in Saudi Arabia (Brechan & Kvalem, 2015; Holland & Tiggeman, 2016). Once correlates of eating disorder pathology are identified targeted preventative programs can be initiated. The aim of this cross-sectional explorative study was to examine whether body mass index (BMI), body dissatisfaction, self-esteem, cultural orientation, perceived stress, media use, and SES are correlates of eating disorder pathology in Saudi Arabia. Additional aim is to investigate if a high BMI is a covariate in these potential associations. It is hypothesized that, eating disorder pathology is positively associated with greater body dissatisfaction, low self-esteem, Western cultural orientation rather than Arab orientation, increased levels of perceived stress, more time spend on media use, and increased SES, and that a larger BMI serves as a covariate in these associations. An alternative hypothesis is that a greater level of stress is a covariate in the association between eating disorder pathology and Western orientation. An additional alternative hypothesis is that cultural orientation is associated with

symptomatology, where Saudi citizens who are Arab oriented show more restrictive behavior and those with who are Western oriented more binge eating behavior.

2 Methods

2.1 Procedure

A convenience sample was recruited between April 2017 and May 2018 from students (Princess Noura bint Abdulrahman University (PNU), King Saud University, Sixth High School for Quran Memorization) in Riyadh, and through social media (Twitter, Facebook, Snapchat). Several sports facilities (NuYu gym, Sukoun yoga studio) in Riyadh, Dammam and Jeddah also shared a link among their members. Participants were also recruited through the first authors (BM) social network. Some of BMs students recruited participants through their personal network. Inclusion criteria were being a Saudi passport holder, literate and age ≥ 18 years old. The aim was to reach as many Saudi citizens as possible. As Saudi society is being perceived as a relatively culturally reclusive society (Al-Darmaki, 2003), it is hard to access its citizens, and because eating disorder pathology has only been poorly studied, data collection involved targeting Saudi citizens in the country, which has resulted in a unique sample. All participants (*N*=1229) were Saudi nationals, however four participants (3.2%) had ≥5% missing data with regard to measure items and were therefore excluded. Participants (*N*=1225) were literate, and aged between 18-81 years old, mean age 23.6 (SD=8.5) years (Table 1). Participants provided informed consent and completed anonymously an online self-report survey through Survey Monkey. Questions about the study could be sent by email to BM.

2.2 Measures

2.2.1 Eating Disorder Examination-Questionnaire

The Saudi version of the Eating Disorder Examination-Questionnaire (EDE-Q) was used to assess eating disorder pathology during the last 28 days (Fairburn & Beglin, 2008; Melisse et al., 2021). The EDE-Q is a self-report instrument of 28 items, resulting in a global score indicating the severity of eating disorder pathology and additionally measures frequency of eating disorder behaviors such as binge eating episodes. Severity of eating disorder pathology was measured on a 7 point- Likert scale (0: feature was absent, to 6: feature was markedly present or present every day) (Fairburn & Beglin, 2008). The EDE-Q was translated to Arabic and some cultural adjustments were made in the Saudi EDE-Q e.g., communal changing rooms and pools are rare and were replaced by gyms and weddings, as further explained in Melisse et al., 2021 (Melisse et al., 2021). The Saudi version has good psychometric properties (Melisse et al., 2021). However, the factor structure with four subscales has not been confirmed with factor analysis. Therefore, only the EDE-Q global score was used. The Saudi EDE-Q has a Cronbach's α of 0.89, clinical cut-of is 2.93 (Melisse et al., 2021). Cronbach's α in this study was 0.90.

2.2.2 Body Shape Questionnaire

The Body Shape Questionnaire (BSQ), measures the severity of body dissatisfaction, such as fear of gaining weight, desire to lose weight and physical- appearance related self-devaluation during the last 28 days. The BSQ is a self-report measure of 34 items on a 6 point- Likert scale (1: never, to 6: always) (Cooper et al., 1987). The overall score is the total of all items and can range between 34-204, higher scores indicate greater body dissatisfaction. Scores ≥ 80 indicate mild concern, ≥ 111 moderate concern and ≥140 marked concern with shape. The BSQ has a Cronbach's α of 0.96, a high test-retest reliability and good concurrent

validity (Rosen et al., 1996). BM and a clinical psychology student of PNU slightly adapted an Arabic version of Mousa et al., (2010) with regard to the Arabic language (Mousa, Mashal, et al., 2010). In addition, one cultural adaptation was made in question 27: as females in Saudi Arabia share cars rather than travel by bus, “bus seat” was changed to “car seat”. Cronbach’s α in this study was 0.96.

2.2.3 Rosenberg Self-Esteem scale

The Rosenberg self-esteem scale measures self-esteem with 10 items representing statements with a 4-point Likert response scale (1: strongly disagree, to 4: strongly agree), five of these items (2, 5, 6, 8, 9) were reverse scored. Higher scores indicate higher self-esteem and sum scores can range from 10-40 (Rosenberg, 1965). Cronbach’s α of the Arabic version was .71, the instrument has a high test-retest reliability and good concurrent validity (Abdel-Khalek, 2007; Al-Fayez et al., 2012; Kazarian, 2009). Cronbach’s α was 0.70 in the present study.

2.2.4 Acculturation Rating Scale for Mexican–Americans II

The revised version of the Acculturation Rating Scale for Mexican–Americans (ARMSA II) (Cabassa, 2003; Cuellar, 1995) is a westernization survey that measures two unrelated dimensions: maintenance of the original culture and identification with the recently introduced culture, originally researched among Mexican immigrants. Western and Mexican orientation were each assessed in 12 behaviorally based questions on a four point Likert scale (1: never to 4: very often) for language, media, food and consumer goods. Total scores on both cultural orientation scales ranged between 0-36, scores on both dimensions can be used separately or deducted (Cabassa, 2003). Adaptations were made similar to those of Stigler et

al., (2010) who adapted the ARMSA II for use among Indians in their country of origin. In the adapted version Cronbach's alphas were 0.84 for the Indian scale and 0.90 for the Western scale (Stigler et al., 2010).

The ARMSA II was translated to Arabic by a native speaker, a clinical psychology student of PNU, with a parallel translation by a professional translator. Minor differences between both versions were discussed and resolved, and a backtranslation was performed. The ARMSA II was adjusted, resulting in an Arab orientation and Western orientation scale. The following cultural adaptations were made by BM: language preferences involving Arabic as mother tongue, English as Western language, media preferences as Arabic versus Western shows/films/music. With regard to food/restaurants, common Western coffee houses in Saudi Arabia such as Java Time, Starbucks and Dr. Cave, and common Arabic restaurants such as Najd Village and Isteraha (desert-camp), and traditional Saudi dishes such as kabsah, maqluba, dates, samboosa and dolmah, were added. Traditional markets were mentioned as souks, as were traditional clothes, jallabiyah (for women) and thoob (for men) respectively. Cronbach's alphas were 0.82 for the Arab scale and 0.90 for the Western scale. Scores on these scales were weakly correlated (Pearson's $r = 0.27$, $p < 0.01$).

2.2.5 Perceived Stress Scale

The Perceived Stress Scale (PSS) measures subjective feelings of stress on 10 items using a 5-point Likert scale (0: never to 4: very often) during the last month. Positively stated items (4, 5, 7, 8) were reverse scored, total score range is 0-40. Higher scores indicate more severe feelings of stress (Cohen et al., 1994). The Arabic version has Cronbach's α of 0.80 and high test-retest reliability (Almadi et al., 2012). Cronbach's α in the present study was 0.83.

2.2.6 Media use

Participants completed questions about usage (time and frequencies) of internet, social media and streaming services as described in Fardouly and Vartanian (2014). They also provided information about use of streaming services, provided in Supplementary Table A. Internet and streaming services use were measured with a single item. Cronbach's α was 0.80 for social media and 0.78 for overall media use in the present sample.

2.2.7 Body Mass Index

BMI was calculated as weight in kg/ squared height in meters as reported in the EDE-Q. WHO guidelines were applied to classify BMI (WHO, 2021).

2.2.8 Socioeconomic status and demographic data

To estimate SES, questions about level of education, parental level of education, level of profession (e.g. manual, managerial) and parental level of profession were administered. Answers to these questions were administered as a Likert scale (e.g. level of profession 1: housewife/ unemployed, to 4: professional). Housewife was indicated as low SES since housewives in Saudi Arabia are generally lower educated and women of high SES are usually employed and can afford nannies, maids and drivers (Al- Subaie, 2000; Al Adawi et al., 2002; Nieva, 2015). Each item received a numeric score of which all items together resulted in a total score, global scores were averaged item scores. Higher global scores represented higher SES. Demographic data such as gender, age, marital status, nationality, and history of living abroad were also requested from the participants.

2.3 Statistical analysis

To test for multicollinearity between independent variables correlation analyses were performed. Differences in eating disorder pathology were examined by ANOVA for continuous variables (age) and chi-square for non-continuous variables (gender, marital status and education/ profession). All data met the assumptions of normality, homoscedasticity, and linearity. A hierarchical multiple linear regression analysis, forward stepwise method was performed with body dissatisfaction, low self-esteem, having lived abroad for at least six months, cultural orientation, perceived stress, media use, and socioeconomic status as independent variables and eating disorder pathology as dependent variable. In step one, BMI was entered to control for its potential cofounding effect; in step 2, the independent indices were allowed to enter, to test whether they would predict additional variance in eating disorder pathology, as reflected in the EDE-Q total score, over BMI. In addition, a Bonferroni post-hoc analysis was performed. A one-way ANOVA was used to test if severity of eating disorder pathology and body dissatisfaction significantly differed among the various BMI groups. Data were analyzed in SPSS version 25.

2.4 Ethical considerations

Ethical approval was given on May 7th, 2017 (17-0097), by the ethical review board of PNU in Riyadh, Saudi Arabia.

3 Results

All participants (*N*=1225) were Saudi nationals, literate, and aged between 18-81 years old, mean age 23.6 (SD=8.5) years (Table 1). There were several differences between the study sample compared to the general Saudi population: females were overrepresented, 85.6%

(*n*=1048) vs. 42.3%, the majority was single (76.5% vs 33.0%) and a smaller percentage married (17.2% vs 58.8%) (General Authority for Statistics, 2016a). The study sample was also more highly educated: most participants attended university (41.2% vs 4.4%) (Habibi, 2015b), and 14.9% was employed, compared to 30.2% generally (Economics, 2019). Participants were from all over Saudi Arabia (details available from BM), though most resided in the larger cities. Post-hoc calculated power, considering 13 predictors and an observed R^2 of 0.60, α= 0.05 (2 sided) was 100%.

T**able 1** Demographics

		N	*MD (S)*
Age		1225	23.6 (8.5)
	18-25 years	919 (75.0%)	
	26-40 years	228 (18.6%)	
	41-65 years	70 (5.7%)	
	66-81 years	3 (0.2%)	
Gender			
	Unknown	11 (0.9%)	
	Female	1048 (85.6%)	
	Male	166 (13.6%)	
BMI		1225	25.2 (7.0)
Marital status		1225	
	Unknown	1 (0.1%)	
	Married	211 (17.2%)	
	Unmarried	938 (76.5%)	
	Divorced	75 (6.1%)	
Occupation/ education		1225	
	Unknown	15 (1.2%)	
	High school	315 (25.7%)	
	University in country of heritage	474 (38.7%)	
	University in Arab country	25 (2.0%)	
	University in Western country	6 (0.5%)	
	Employed	182 (14.9%)	
	Unemployed	127 (10.4%)	
	Other	81 (6.6%)	
Self-report measures			
	EDE-Q	1225	2.7 (1.4)
	BSQ	1225	86.5 (36.3)
	Rosenberg self-esteem	1220	27.0 (79.4)
	ARMSA Western orientation	1222	1.1 (0.6)
	ARMSA Arab orientation	1115	1.4 (0.5)
	Perceived stress scale	1003	27.5 (71.8)
Eating disorder behaviors †, reported by *N*, (%)			
	Objective binges	1078 (88.0%)	6.8 (3.4)
	Self induced vomiting	392 (32.0%)	2.5 (6.0)
	Laxative misuse	401 (32.7%)	3.0 (0.6)
	Extensive exercise	967 (78.9%)	8.7 (9.8)

ARMSA Acculturation Scale for Mexican Americans, *BMI* Body Mass Index, *BSQ* Body Shape Questionnaire, *EDE-Q* Eating Disorder Examination- Questionnaire
†frequency of eating disorder behaviors reported during the last four weeks

3.1 Eating disorder pathology

There was no effect of age ($F(62)= 4677.95$; $p=0.510$), gender ($\chi 2(1)=107.8$; $p=0.83$) or employment/education ($\chi 2(6)= 718.18$; $p=0.052$) on the EDE-Q global score. There was an effect of marital status ($\chi 2(2, 1220)= 209.55$; $p=0.002$). Married Saudi citizens had less eating disorder pathology than unmarried Saudi citizens. Of the participants, 34.8% ($n=426$: 24.7%, $n=41$ male, 36.3%, $n=380$ female) had an EDE-Q score above the clinical cut-off of 2.93 (Melisse et al., 2021). Multiple comparisons ($F=160.39$, $p<0.001$) showed that, based on BMI, the average scores on the EDE-Q were different between Saudi citizens with a BMI < 18.5, a BMI between 18.5-24.9 and BMI between 25.0-29.9 ($p<0.001$). EDE-Q scores did not differ between Saudi citizens with a BMI between 25.0-29.9 or 30.0-39.9 ($p=0.369$) and between Saudi citizens with a BMI between 30.0-39.9 or BMI > 40 ($p=0.469$). BSQ scores of Saudi citizens with BMI < 18.5 were comparable to those with BMI between 18.5-24.9 ($p=0.405$), but differed for BMI between 25.0-29.9 ($p<0.001$) ($F=149.52$, $p<0.001$). There were no differences in BSQ scores for BMI between 30.0-39.9 and BMI > 40 ($p=0.133$) (Table 2). This suggests greater body dissatisfaction and eating disorder pathology among participants with a higher BMI.

Table 2. Means (and SDs) of EDE -Q and BSQ scores by five BMI groups and results of multiple comparisons of Tukey posthoc tests

BMI	1. BMI < 18.5		2. BMI between 18.5-24.9		3. BMI between 25.0-29.9		4. BMI between 30.0-39.9		5. BMI > 40		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
	131	11.0	562	47.3	281	23.7	281	14.6	40	3.4	
	M	SD	*M*	SD	*M*	SD	*M*	SD	*M*	SD	Pairwise comparison *p<.001*
EDE-Q total score	1.6	1.3	2.4	1.3	3.3	1.1	3.6	1.1	3.9	3.9	1<2<3=4=5
BSQ score	53.7	19.6	75.3	30.0	102.3	31.4	112.4	35.6	132.8	34.7	1=2<3=4=5

BMI Body Mass Index, *BSQ* Body Shape Questionnaire, *EDE-Q* Eating Disorder Examination- Questionnaire

3.2 Correlates of eating disorder pathology

Table 3 shows that there was no problematic multicollinearity between independent variables. Table 4 shows that in Step 1 of the hierarchical regression analysis, the association between BMI and eating disorder pathology was positive, statistically significant (p<0.001) and substantial, accounting for 35.2% of the variance in eating disorder pathology. In Step 2, body dissatisfaction, self-esteem, having lived abroad, cultural orientation, perceived stress, media use, and socioeconomic status were allowed to enter. BMI and body dissatisfaction together explained 60% of the variance in eating disorder pathology. After adjusting for BMI, body dissatisfaction was moderately associated with eating disorder pathology, and explained 24.8% of the variance. BMI appeared to serve as a covariate. However, after entering body dissatisfaction no other variables contributed to explaining variance in eating disorder pathology. Together, all variables explained 64% of the variance (R^2 =0.64, F= 41.14, p<0.001). Bonferroni post-hoc analysis did not reveal different results as all significance levels were p<.003

Table 3 Pearson correlation matrix of independent variables

	BMI	Body dissatisfaction	Low self-esteem	Lived abroad	Western orientation	Arab orientation	Western-Arab orientation	Perceived stress	Streaming services	Internet	Social media	Overall media use	SES
BMI	1.00												
Body dissatisfaction	0.27**	1.00											
Low self-esteem	0.02	0.04	1.00										
Lived abroad	0.02	0.02	0.23**	1.00									
Western orientation	-0.07	0.06	0.06	0.75	1.00								
Arab orientation	0.03	0.05	-0.14	0.01	0.27**	1.00							
Western-Arab orientation	0.07	0.22	0.11	-0.01	0.75	-0,56	1.00						
Perceived stress	-0.02	0.02	0.01	-0.16	-0.09	-0.06	0.03	1.00					
Streaming services	0.45**	0.11**	-0.04	-0.36**	-0.42**	0.13	-0.20	-0.03	1.00				
Internet	-0.09	0.03	-0.01	-0.14*	-0.05	0.12	0.02	0.04	-0.35**	1.00			
Social media	0.02	0.02	0.04	-0.23	0.06	0.04	0.001	0.04	-0.36**	-0.35**	1.00		
Overall media use	0.02	0.02	-0.04	-0.23	-0.06	-0.06	0.08	0.04	-0.36**	0.99**	1*	1.00	
SES	0.04	0.15*	0.35**	0.31	-0.20*	-0.08	-0.21	0.02	0.55**	0.18	0.38*	0.38*	1.00

BMI Body Mass Index, *SES* Socio-economic status

* $p<.05$
** $p<.001$

Pearson zero-order correlations were statistically significant but weak between EDE-Q total score and having lived abroad (r=0.28, p<0.001), use of internet (r=0.28, p<0.001), social media (r=0.28, p<0.001), and SES (r=0.38, p<0.001). The associations with self-esteem (p=0.598), Western orientation (p=0.991), Arab orientation (p=0.441), perceived stress (p=0.365), and streaming services (p=0.598) were not statistically significant. In addition, when both scales of cultural orientation were adjusted for the effect of the other (e.g. Western orientation deducted from Arab orientation) no association was found with eating disorder pathology (p=0.090). The alternative hypothesis was not confirmed: perceived stress was not a covariate in the association between eating disorder pathology and westernization (p=0.468). Linear regression analysis showed that there were no associations between Arab orientation and restrictive eating behavior as measured by the restraint scale of the EDE-Q (p=0.297), neither between Western orientation and binge eating behavior as measured by the EDE-Q open ended question regarding number of binge eating episodes (p=0.180).

Table 4 Multiple hierarchical regression with eating disorder pathology as dependent variable

	EDE-Q total score*									
							Correlations		95% confidence interval	
	β	*t*	*p*	*F*	*df*	Δ adjusted R^2	Zero order	Part *r*	lower bound	upper bound
BMI	0.12	6.41	<.001	139.65	1224	0.35	0.60	0.60	0.10	0.14
BMI	0.07	2.99	<.001	156.9	1115	0.35	0.60*	0.38	0.05	0.12
Body dissatisfaction	0.58	9.26	<.001	143.8	1115	0.60	0.75*	0.50	0.42	0.74
Self- esteem	0.003	0.53	.598	60.3	1190	NA	0.28	0.04	-0.01	0.12
Lived abroad for ≥6 months	0.169	0.10	.221	66.8	1223	NA	0.28*	0.09	-0.104	0.44
Western orientation	0.003	0.01	.991	0.1	1201	NA	-0.02	0.001	-0.50	0.51
Arab orientation	-0.26	-0.83	.410	1.3	1201	NA	-0.11	-0.06	-0.88	0.36
Western- Arab orientation	0.16	1.72	.090	0.8	1201	NA	0.10	0.20	-0.28	0.74
Perceived stress	0.02	1.04	.302	0.8	1190	NA	0.03	0.08	-0.02	0.06
Streaming services	-0.02	-0.53	.598	0.3	1223	NA	-0.02	-0.01	-0.07	0.04
Internet use	0.004	8.34	.798	69.6	1223	NA	0.28*	-0.02	-0.05	0.07
Social media	-0.02	0.61	.796	68.5	1223	NA	0.28*	-0.02	-0.14	0.11
Media use total	0.003	0.61	.542	68.7	1223	NA	0.28*	0.05	-0.01	0.13
Socioeconomic status	-0.11	-0.48	.631	80.2	1223	NA	0.38*	0.04	-0.05	0.03

BMI Body Mass Index; *EDE-Q* Eating Disorder Examination- Questionnaire
* significant at *p* <.001 level

Discussion

The main findings of this explorative cross-sectional study are that BMI, body dissatisfaction, lived abroad, media use, and SES were associated with eating disorder pathology, as was single marital status. However, when these correlates were assessed together only body dissatisfaction and BMI appeared to be associated with eating disorder pathology. The results of this study regarding body dissatisfaction and BMI are comparable to other studies (Madanat et al., 2007; Musaiger et al., 2013). Body dissatisfaction was moderately associated with eating disorder pathology after adjusting for the effect of BMI. In line with other studies (ALAhmari et al., 2019; Schulte & Thomas, 2013; Unikel Santoncini et al., 2018), body dissatisfaction was the strongest correlate of eating disorder pathology among various other correlates, and Saudi citizens with a high BMI had both, greater severity of eating disorder pathology and body dissatisfaction. Around 35% of this Saudi community sample had an EDE-Q score above clinical cut-off. Therefore, the high prevalence of eating disorder pathology may reflect the high rates of excess weight and maladaptive strategies to lose weight. This is of concern, as around half of the Saudi population has a BMI above 25 (Melisse et al., 2021). Preventative programs focused on avoidance of maladaptive weight loss strategies and the improvement of body satisfaction might be beneficial.

This study did not find an association between westernization and EDE-Q scores. Other studies found associations between westernization and EDE-Q scores. Failure of this study to reproduce the association between eating disorder pathology and westernization may be explained by the fact that only small associations were found in some other studies (AlShebali et al., 2020; Thomas, O'Hara, et al., 2018). In addition, the rapid sociocultural changes have also been associated with elevated levels of industrialization (Melisse, Beurs, et al., 2020; Thomas, O'Hara, et al., 2018). Industrialization has coincided with an increase in mental health problems including eating disorders (Ghubash et al., 2001; Thomas, O'Hara, et

al., 2018). In addition, societies dealing with faster industrialization displayed greater risk for eating disorders (Melisse, Beurs, et al., 2020; Raouf et al., 2015). Furthermore, other studies found that cultural orientation was associated with specific eating disorder pathology (Abdollahi & Mann, 2001; Al Adawi et al., 2002; Friedman et al., 2002; Musaiger et al., 2013; Viernes et al., 2007). This alternative hypothesis was also not confirmed in current study: Arab orientation and restrictive eating behavior, and Western orientation and binge eating behavior were not associated. In addition, other studies suggested the role of stress in the association between eating disorder pathology and westernization (Rathner et al., 2001). Stress was not a covariate in the association between westernization and eating disorder pathology in current study. Finally, results of current study were not in line with other studies who found associations between eating disorder pathology and self-esteem (Maclean et al., 2017), use of internet, social media and streaming services (Derenne & Beresin, 2018; Holland & Tiggeman, 2016; Pike & Dunne, 2015), and SES (Al- Subaie, 2000). However, since the association of working status (housewife versus employed) and SES of mothers appeared inconclusive (Sato, 2022) the analysis was repeated eliminating housewife from the composite SES score. This analysis did not yield different results. In addition, other studies found BMI to serve as a covariate in the associations of eating disorder pathology and perceived stress, media use, and low self-esteem (Friedman et al., 2002; Madanat et al., 2007; Musaiger et al., 2013). None of these findings were confirmed in the present study. Explanation might be that in these other studies small associations were found, most samples involved teenagers rather than adults, while severity of eating disorder pathology was inversely related to age (Mond et al., 2006; Rø et al., 2012).

Several study limitations should be taken into consideration. First, BMI was calculated on self-reported weight and height, and social desirability may have instigated participants to report lower weight than their actual weight (Gorber et al., 2007). Second, the composition of

the convenience sample differed substantially from the general Saudi population regarding gender and education level. No effect on EDE-Q total score was found of age, gender and education/occupation. In addition, results of a convenience sample are less reliable than a clinical sample and potentially impacts generalizability (Melisse, Beurs, et al., 2020; Melisse et al., 2021). Third, the sample may also be biased by participants' readiness to report their eating disorder pathology. Factors not measured may also have caused selection bias: respondents may have participated because they are more interested in health care, mental health care, or eating disorder pathology, or because they have more concerns regarding their body shape or eating behavior compared to the general population (Melisse et al., 2021). Consequently, the results should be interpreted with care, as generalizability to the overall Saudi population is limited. At the same time, this study does provide information regarding the association of eating disorder pathology, BMI and body dissatisfaction. Preventative programs can be offered to young unmarried Saudi citizens with body dissatisfaction, as selective prevention programs display larger effects than universal prevention programs (Bar et al., 2017; Kindermann et al., 2017; Stice, Johnson, et al., 2019; Stice et al., 2007). In addition, improved knowledge is likely to increase the number of people seeking treatment and decrease the stigma of psychotherapy (Melisse, Beurs, et al., 2020).

Although the Acculturation Rating Scale for Mexican–Americans II (ARMSA II) appeared reliable, there were small limitations to its internal validity: the ARMSA II originally measured acculturation among migrants in the USA rather than acculturation among populations dealing with sociocultural changes in their country of origin. However, the ARMSA II was validated and used in international studies. In addition, the overall frequency and time Saudi citizens spent on (social) media was examined. Some studies found that greater emotional investment, negative feedback seeking and social comparison were associated with eating disorder pathology rather than time spent or number of actions on

(social) media (Fardouly et al., 2015; Holland & Tiggeman, 2016). Finally, as only associations among the variables could be investigated, the cross-sectional nature of this study does not allow the drawing of inferences about causal relationships.

This study also has several strengths. It is one of the few large studies conducted in Saudi Arabia investigating eating disorder pathology and its correlates. The sample size was large, despite several challenges to collect data among Saudi citizens. Saudi Arabia is being perceived as a relatively culturally reclusive society (Al-Darmaki, 2003). Therefore, it was difficult to reach Saudi citizens, BM traveled the country to recruit participants. In addition, Saudi Arabia has to deal with stigma in relation to mental health problems, and a lack of knowledge about eating disorders (Alkhadari et al., 2016; Griffiths et al., 2015; Latzer et al., 2009). Therefore, study participation in this study was not self-evident for Saudi citizens, as feelings of mistrust, lack of knowledge, and lack of awareness were barriers for study participation in other studies (Honein-AbouHaidar et al., 2016; Schmotzer, 2012; Williams et al., 2013). Since female adolescents were overrepresented in the sample results can be potentially be generalized to the eating disorder population as eating disorders are most prevalent among female adolescents (Mitchison et al., 2020; Phillipou et al., 2020). The hypothesis regarding the covariation role of acculturative stress among Saudi citizens with a Western orientation in the development of eating disorder pathology was not confirmed. However, though many studies assume the role of Western orientation and acculturative stress in the development of eating disorder pathology but do not actually measure both constructs, this study measured both. It is also the first study in Saudi Arabia to use a validated eating disorder screening instrument. Most other self-report measures used in this study also have strong psychometric properties and have been used in other Arab populations before. Furthermore, while most studies assume in- group homogeneity based on nationality, this study examined within- group variance by means of either Western or Arab orientation.

Future research should take into account the limitations of this research, in order to draw causal conclusions, experimental designs should be used. Relating specifically to the proposed implications of this study, causal studies could estimate whether body dissatisfaction and high BMI cause eating disorder pathology or whether they are a result of eating disorder pathology. These studies should use assessor based data regarding BMI to prevent bias (Melisse et al., 2021). Future research should also investigate if an extensive focus on body dissatisfaction in therapy is actually effective in terms of reduction in eating disorder pathology and relapse rate. In addition, the association between eating disorder pathology and media use should be investigated by emotional involvement rather than time spent or number of actions on (social) media (Fardouly et al., 2015; Holland & Tiggeman, 2016) and the use of a validated ARMSA II is recommended. Furthermore, examination of correlates and risk factors of eating disorder pathology is more reliable among clinical samples. However, eating disorders are rarely recognized and treated in Saudi clinics (Alkhadari et al., 2016; Melisse, Beurs, et al., 2020). Besides, Saudi citizens suffering from eating disorders generally seek psychiatric help only after suffering from somatic complaints such as diabetes, infertility, and kidney failure (Melisse et al., 2021). In addition, although Saudi citizens are an understudied population, a more balanced community sample regarding age, and educational level would potentially increase generalizability.

In conclusion, this explorative study contributes to the current state of knowledge on eating disorder pathology and its correlates in Saudi Arabia. It indicates that BMI is a covariate in the association between eating disorder pathology and body dissatisfaction, and that Saudi citizens with a higher BMI display more severe body dissatisfaction and eating disorder pathology.

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Appendix A. Supplementary Table A Most common answers regarding the frequency of media use as reported by Saudi citizens

	Most common answer	%	*N*
On a typical day, how often in total do you check your social media accounts as Facebook, Snapchat, Instagram, twitter, MySpace etc. (even if you are logged on all day)?	Every few hours	20.7	253
Overall, how much time do you spend on your social media accounts on a typical day?	4-6 hours	24.4	298
In general how often do you update your profile picture?	Sometimes	26.9	329
In general how often do you post a photo/ picture?	Almost never or never	32.4	397
In general how often do you send/receive private messages?	Sometimes	20.9	256
In general how often do you post a status update post a link to a news story, video, web site, etc. ?	Almost never or never	27.8	338
In general how often do you view friends' photos that they've added of you ?	Sometimes	26.0	318
In general how often do you view friends' photos of themselves?	Sometimes	26.9	329
In general how often do you view friends' status updates ?	Sometimes	21.6	264
In general how often do you comment on friends' photos?	Sometimes	28.0	343
In general how often do you comment on friends' status updates ?	Sometimes	23.9	293
Overall, how much time do you spend on internet each week day (not work or homework related)?	6 hours	28.1	344
Do you have access to streaming services such as OSN and Netflix, Amazon, HBO, Food Network, Fashion TV?	No	35.7	437
If yes, on average how many hours a day you spend watching those channels?	0	68.6	840

Chapter 6 Comparing the effectiveness of Cognitive Behavioral Therapy-Enhanced between patients with different Eating Disorder classifications: a naturalistic study

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Abstract

Introduction: Cognitive behaviour therapy-enhanced (CBT-E) is an effective treatment for non-underweight patients with eating disorders. Its efficacy and effectiveness is investigated mostly among transdiagnostic samples and remains unknown for binge eating disorder. The aim of present study was to assess several treatment outcome predictors and to compare effectiveness of CBT-E among adult outpatients with bulimia nervosa (*N*=370), binge eating disorder (*N*=113), and those with a restrictive food pattern diagnosed with other specified feeding and eating disorder (*N*=139).

Method: Effectiveness of CBT-E was assessed in routine clinical practice in a specialised eating disorders centre. Eating disorder pathology was measured with the EDE-Q pre- and post-treatment, and at 20 weeks follow-up. Linear mixed model analyses with fixed effect were performed to compare treatment outcome among the eating disorder groups. Several predictors of treatment completion and outcome were examined with a regression analysis.

Results: No predictors for drop-out were found, except the diagnosis of bulimia nervosa. Eating disorder pathology decreased among all groups with effect sizes between 1.43-1.70 on the EDE-Q total score. There were no differences in remission rates between the three groups at end of treatment or at follow-up. Eating disorder severity at baseline affected treatment response.

Discussion: The results can be generalised to other specialised treatment centres. No subgroup of patients differentially benefited from CBT-E supporting the transdiagnostic perspective for the treatment of eating disorders. Longer-term follow-up data are necessary to measure persistence of treatment benefits.

Keywords: Cognitive Behaviour Therapy-Enhanced, Eating Disorders, Bulimia Nervosa, Binge Eating Disorder, Other Specified Feeding and Eating Disorder

Key learning aims

(1) What is the effectiveness of CBT-E among patients suffering from binge eating disorder?

(2) Does any subgroup of patients suffering from an eating disorder differentially benefit from CBT-E?

(3) What factors predict treatment response?

Introduction

Eating disorders, which have a significant impact on the well-being of patients (Hay et al., 2015), have a life-time prevalence of about 2% (Preti et al., 2009). Since such disorders are moderately responsive to psychological interventions, to enhance recovery rates and minimize negative consequences, the effectiveness of various treatments needs to be investigated for each eating disorder (Linardon, Wade, et al., 2017). The National Institute for Health and Care Excellence guidelines recommends cognitive behaviour therapy for eating disorders (NICE, 2017). One such evidence-based treatment is cognitive behavioural therapy-enhanced (CBT-E) (Fairburn, 2008).

CBT-E is based on a transdiagnostic model which assumes that all eating disorders share common core mechanisms (Cooper & Fairburn, 2011; Fairburn et al., 2003). CBT-E addresses these mechanisms such as over-evaluation of shape, weight and eating (Fairburn et al., 2003). However, data regarding over-evaluation of shape and weight among patients suffering from BED are inconclusive (Coffino, 2019; Linardon, 2017). Still it is assumed that all eating disorder patients with a BMI between 17.6 and 39.9 can be treated with a similar treatment (Fairburn, 2008; Fairburn et al., 2003).

CBT-E is effective among transdiagnostic samples, for patients suffering from bulimia nervosa (BN), and other specified feeding and eating disorder with a restrictive food pattern (OSFED). However, though patients suffering from binge eating disorder (BED) were included in transdiagnostic samples, no remission rates of individually offered CBT-E among adult patients suffering from BED have been reported. Remission rates based on reduction in eating disorder pathology vary between 18-70%. Full recovery, defined as abstinence of eating disorder behaviours and eating disorder pathology below clinical cut-off, varies between 14.3-50% (Supplementary Table A). Treatment response of CBT-E differ substantially at the end of treatment (EOT) and at follow-up (Berg et al., 2020; de Jong et al.,

2018; Linardon, Wade, et al., 2017). This suggests that the effectiveness of CBT-E can be improved.

Determining treatment outcome predictors of CBT-E enables prognostic information about whom CBT-E is likely to work for. Treatment outcomes can be maximized by an understanding of its predictors because more targeted and intensive treatment can be offered, thus improving clinical decision making, allowing for personalized medicine, so potentially enhancing treatment outcome (Kraemer, 2013). Although consistent findings on predictors of CBT-E are scarce, poorer treatment outcome was predicted by a lower BMI and higher frequency of eating disorder behaviours at start, longer duration of the eating disorder, and having received eating disorder treatment in the past (Cooper et al., 2016; Linardon, de la Piedad Garcia, et al., 2017; Linardon, Wade, et al., 2017; Vall & Wade, 2015).

This study involves an observational design, comparing treatment responses of BN, BED, their respective OSFED and OSFED with a restrictive food pattern, and applying alternative categorisations of clusters of diagnosis. Comparisons were made for treatment delivered in everyday clinical practice by routine outcome monitoring at fixed time intervals (de Beurs et al., 2011). Effectiveness studies tend to include a more heterogeneous patient population (Knott et al., 2015; Waller et al., 2014), including patients with complex and comorbid disorders (Leichsenring, 2004).

Data are scarce on how adult patients classified with BED respond to CBT-E when offered it individually (Berg et al., 2020; Byrne et al., 2011; Fairburn et al., 2015; Fairburn et al., 2009). Examining whether the specific eating disorder diagnosis matters enables to investigate if CBT-E works for all eating disorders. Part of the sample in this study was included in a transdiagnostic study by Van den Berg et al., (2020). The present study involves a larger sample, thus increasing statistical power and allowing investigation of several outcome predictors, including eating disorder diagnosis. To our knowledge, no previous

studies have compared the effectiveness of CBT-E for different eating disorders. Furthermore, with the exception of adolescents and group settings, remission rates for BED specifically have not been previously reported on (Dalle Grave et al., 2015; Wade et al., 2017).

The aim of present study is to compare effectiveness of CBT-E in various eating disorder subtypes, and to investigate the predictive value of potential prognostic variables for outcome. It is hypothesized that eating disorder pathology declines among all groups, and that poorer treatment response is predicted by greater eating disorder severity, higher frequency of eating disorder behaviours, and a lower BMI at baseline, having received an eating disorder treatment in the past, and longer duration of the eating disorder. Secondary eating disorder pathology and general psychopathology are expected to decrease at EOT and follow-up.

2 Methods

2.1 Design

This study had a cohort design, using between-group comparisons of patients with various eating disorder subtypes. Of the patients who received treatment for eating disorders from 1 July 2015 till 31 December 2019 at a Dutch specialised centre for eating disorders and obesity, 625 were eligible for inclusion and constituted the intent-to-treat sample. Treatment outcomes of 294 participants with a BMI between 17.6-39.9 who received treatment between 1 July 2015–31 December 2017 were also included in Berg et al., (2020). In contrast, in current study, therapy outcomes between three groups, namely BN and BED (including their respective OSFED), and OSFED with a restrictive food pattern were compared. Alternative categorisations of diagnosis were: comparing treatment outcomes for BN, BED, OSFED, OSFED BED, and OSFED BN, and: comparing one OSFED group to the BN and BED groups. Patients were assessed at start and EOT. A follow-up assessment took place 20 weeks

after conclusion of the treatment. Patients did not receive additional treatment in the follow-up period but were put on a waitlist awaiting further treatment related to other psychopathology. Patients who did not complete CBT-E phase three (less than 18/22 treatment sessions) were considered non-completers. Completion of the final phase of the treatment ("ending well, session 19-22") was not required to be deemed a completer. Thus, patients who completed at least 18 of the 22 treatment sessions were considered completers.

Figure 1 presents a flowchart of data collected.

2.2 Participants and Recruitment

Patients were recruited at Novarum after referral by their general practitioners or other clinicians. Patients were diagnosed with an eating disorder after a semi-structured clinical interview by a psychiatrist or clinical psychologist, ≥18 years, were fluent in either Dutch or English, and had BMI (kg/m^2) ≥17.5 and <40. Patients were included if they met DSM-5 criteria for an eating disorder (APA, 2013). Uncertainties about diagnosis were resolved by team discussion. Severity of eating disorder pathology and weight were both determined at the start and at the EOT. Patients were excluded if diagnosed with another psychiatric disorder needing immediate attention (e.g., acute psychosis, severe alcohol or drug abuse, or suicidal ideation).

2.3 Measures

2.3.1 Eating disorder Pathology: EDE-Q 6.0

The EDE-Q (Fairburn & Beglin, 2008), a self-report questionnaire, was used to determine eating disorder behaviours as well as general eating disorder pathology over the past four

weeks. The EDE-Q has 28 questions measured on a 6-point Likert scale. The Dutch version of the EDE-Q, which has good psychometric properties, was used (Aardoom et al., 2012). Cronbach's α of the Dutch version of the EDE-Q was 0.95 and 0.86 in present study.

For remission, a cut-off score of 2.77 on the EDE-Q global score was used, because it represents the portion of patients with a global score below the international community mean plus one standard deviation. Full recovery was defined as EDE-Q global score <2.77 and no additional eating disorder behaviours (binging, purging, laxatives, exercising) during the last month and BMI≥18.5. Clinically significant change (CSC) was defined as reliable change together with an EDE-Q global score <2.77. Reliable change index (RCI) was established as 0.69 change on the EDE-Q global score (Jacobsen & Truax, 1991).

2.3.3 Clinical Impairment Assessment

The Clinical Impairment Assessment (CIA) measures secondary impairment due to eating disorder pathology, measured at personal, social and cognitive areas of life (Bohn et al., 2008). The CIA is a self-report questionnaire, 16 items are rated on a 4 point Likert scale. The Dutch translation has good psychometric properties, Cronbach's α was 0.91 and 0.92 in present study. CIA total score was used as measure of severity.

2.3.3 Psychological and social functioning: Outcome Questionnaire 45

The Outcome Questionnaire 45 (OQ-45) is a self-report questionnaire measuring psychological and social functioning, including symptom distress (25 items), interpersonal relations (11 items), social role (9 items) and anxiety and social distress (13 items) over the past week. The items are measured on a 5-point Likert scale. The Dutch version has good

psychometric properties (Timman, 2017). The Dutch version has an α between 0.91-0.93 (de Jong, 2007) and was 0.70 in present study. OQ-45 total score was used as measure of severity.

2.3.4. The Depression Anxiety and Stress Scales

The Depression Anxiety and Stress Scales (DASS) is self-report questionnaire consisting of three subscales of 14 items to assess depression, anxiety, and stress. All 42 items are rated on a 4-point (0–3) Likert scale. The Dutch translation of the DASS has good psychometric properties and an α between 0.85-0.94 (de Beurs, 2001). Cronbach's α was 0.84 in present study. DASS total score was used as measure of severity.

2.3.5 Demographics

Demographic characteristics, including age, gender, marital status, domestic situation, level of education and occupational status, were gathered by self-report before the start of treatment.

2.5 Intervention

All patients received individually delivered outpatient CBT-E treatment (focused version), as extensively described in the CBT-E manual. CBT-E consists of 21 sessions of 50 minutes, over a 20-week period. In order to discuss further progress, a review session was offered twenty weeks after EOT (Fairburn, 2008).

2.6 Therapists

Therapists delivering CBT-E had various professional backgrounds (psychologists, psychiatrists, nurse practitioners, dieticians), and educational levels (bachelors degree, masters degree, post-doctoral degree). A web-based CBT-E training provided by the Centre for Research on Eating Disorders at Oxford (CREDO) was successfully completed by all therapists, and they studied the detailed CBT-E manual (Fairburn, 2008). To ensure adherence and familiarize themselves with CBT-E, all therapists attended weekly one-hour peer supervision sessions supervised by senior therapists.

2.7 Statistical analysis

SPSS version 25 was used for statistical analysis. To determine whether baseline scores and demographics (age, gender, level of education, eating disorder severity) predicted treatment completion, chi-square analyses for categorical variables and binomial logistic regression for dimensional variables were used. Significance of baseline differences between the eating disorder groups were examined with chi-square tests or ANOVA. Reduction in eating disorder pathology from start to EOT and 20 weeks follow up was analysed with a repeated measures ANOVA. Within group effect sizes were calculated using Cohen's *d* (0.2 small, 0.5 medium, 0.8 large) (Cohen, 1977) and adjusted for bias (Hedges, 1981). Bivariate and multiple regression analyses were performed to determine treatment outcome predictors with eating disorder pathology severity as dependent variable. To enhance power, the predictors were investigated on the continuous outcome variable of eating disorder severity as measured by the EDE-Q at EOT and at 20 weeks follow-up. Post-hoc calculated power, considering an effect size of 0.26, $\alpha = 0.05$ (2 sided), was 100%. Outliers were removed when scores were more than three standard deviations above or below the means: at the start two EDE-Q scores between 0.52-0.65, a score of 118 objective binge episodes, and a score of 140

times self-induced vomiting were removed. Linear mixed model analyses with fixed effect at the individual level were performed to examine the effect of diagnostic group on EDE-Q score at start, EOT, and at follow-up. The groups were nested in their diagnostic group (BN, BED, OSFED), and fixed effects were age and gender. The interaction between EDE-Q scores, eating disorder classification and the fixed effects were also measured. The contrasts chosen compared BN (reference group) to the BED and OSFED group. Second, the OSFED as reference group was compared to the BED and BN group. Last, the BED (reference group) was compared to the OSFED and BN group. All contrasts were compared at start, EOT and follow-up. Analyses were primarily performed according to an intention-to-treat approach (imputed dataset with 50 imputations for each missing observation), which included all patients with 29% missing data, and additionally on completers only (complete assessments available at baseline and EOT). Imputations were performed by the multiple imputation by chained equations using predictive mean matching. Multiple imputation was used for missing outcome data, under a missing-at-random assumption: analyses were first performed on the imputed datasets separately, then the outcomes of the 50 imputations were combined using Rubin's rules (Rubin, 2004).

2.8 Ethics

All patients were informed about the study, assured that their data were de-identified, and all signed an informed consent form, in accordance with the World Medical Association Declaration of Helsinki (World Medical Association, 2001). According to the Dutch Central ethical Commission on Medical Research with human subjects (Dutch abbreviation: CCMO) analysis of anonymized routine outcome monitoring data does not require additional approval from a local medical-ethical approval board.

3 Results

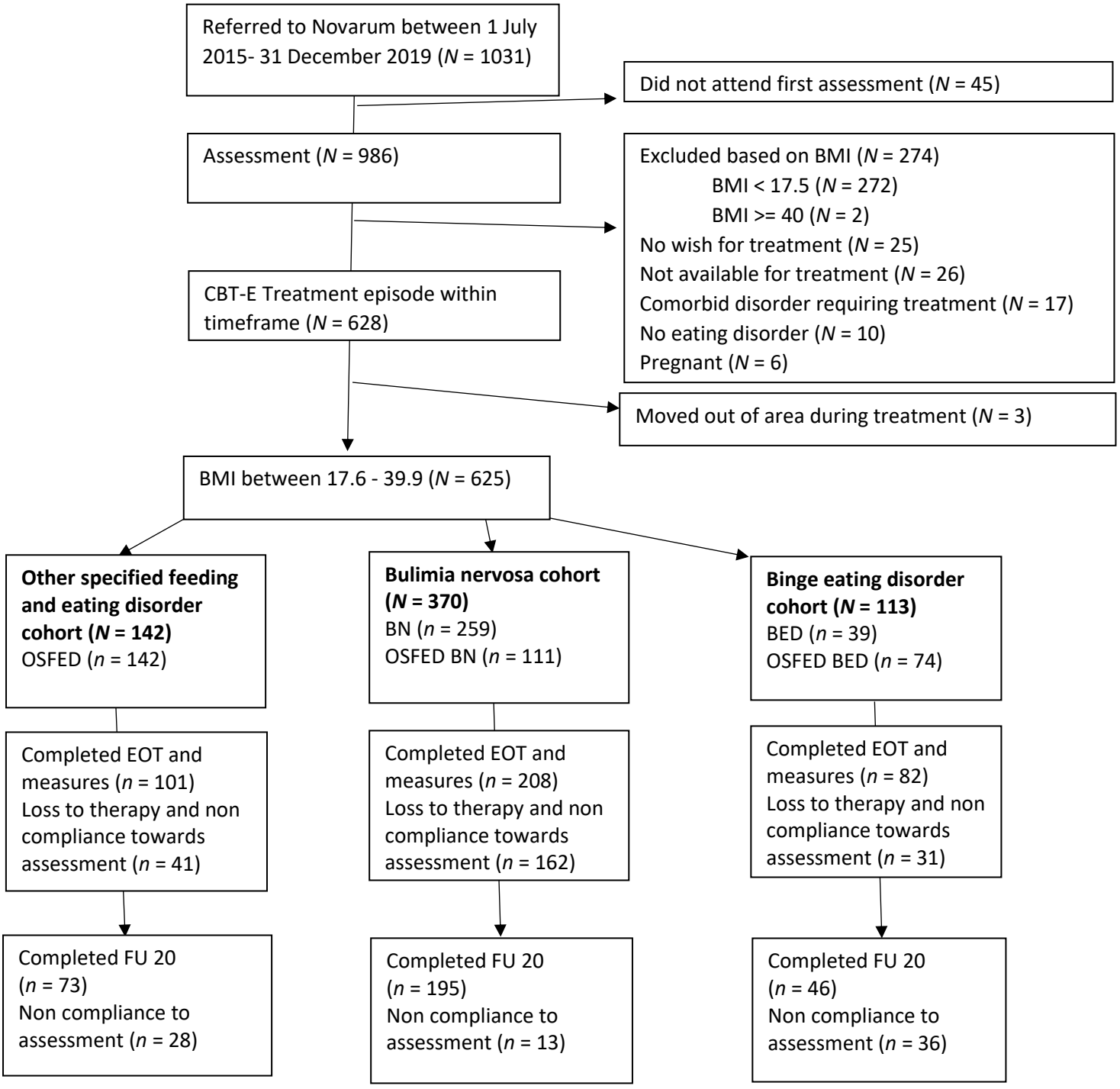

Figure 1. Flowchart of patients in study

EOT end of treatment, *FU* follow-up, *OSFED* Other specified feeding and eating disorder

3.1 Patient flow

Figure 1 shows that, of the 986 patients originally considered for CBT-E, 277 were excluded because they did not meet the inclusion criteria based on BMI. A further 84 were not included in the initial sample because they did not finalize their 22 treatment sessions within study time period. The study therefore included 625 patients, 370 of whom met criteria for BN (BN: *N*= 259, OSFED BN: *N*= 111), 113 for BED (BED: *N*= 39, OSFED BED: (*N*= 74), and 142 met criteria for OSFED (*N*= 142). Only relationship status, gender and dietary restraint differed at baseline between groups at a p=0.05 significance level. The BED group included more males and had a significantly lower dietary restraint score, and the OSFED group were less in a relationship (Table 1).

3.2 Treatment completion and compliance regarding the assessments

Of the 625 patients who started treatment, 391 (62.6%) completed the full course of treatment and showed compliance regarding completing the assessments (OSFED: *n*= 101, completion rate 71.1 %; BN: *n*= 208, 56.2 %; BED *n*= 82, 72.6 %). Non-completers completed on average 12,4 (SD= 4.10) sessions. Completion rate was significantly lower in the BN group (χ2= 18.6, p=.006). Loss to therapy was not predicted by age, waiting list duration, baseline EDE-Q global score, frequency of objective and subjective binge eating, vomiting, laxative misuse, intensive exercising, and BMI. Compliance with the 20 weeks post treatment follow-up assessments was 80.3% (BN 93.8%, BED 56.1%, OSFED 72.2%). Chi-square analyses revealed no differences between subgroups with regard to compliance at follow up (χ^2= 2165.6, p=.790).

Table 1
Patient characteristics at baseline. The data are shown as mean (SD) unless stated otherwise.

	Other specified feeding and eating disorder	Bulimia nervosa	Binge eating disorder	*p*
	N=142	*N*=370	*N*=113	
Age, mean (*SD*)	28.28 (9.35)	27.82 (7.69)	36.19 (12.16)	.370
Baseline BMI	21.61 (3.32)	23.75 (3.78)	30.23 (4.88)	.729
Gender, n (%)				.041
Male	7 (4.9%)	10 (2.7%)	12 (10.6%)	
Female	135 (95.1%)	360 (97.3%)	101 (89.4%)	
Highest level of education, n (%)				.657
Low	16 (11.3%)	38 (10.3%)	20 (17.7%)	
Middle	35 (24.6%)	95 (25.7%)	28 (24.8%)	
High	39 (27.5%)	137 (50.7%)	30 (26.5%)	
Unknown	52 (36.6%)	100 (27.0%)	35 (31.0%)	
OCCUPATION, N (%)				.575
UNEMPLOYED	20 (14.1%)	28 (7.6%)	11 (9.7%)	
JOB	38 (26.8%)	133 (35.9%)	51 (45.1%)	
STUDENT	34 (23.9%)	114 (30.8%)	16 (14.2%)	
UNKNOWN	50 (35.2%)	95 (25.7%)	35 (31.0%)	
Relationship status, n (%)				.002
No Relationship	56 (39.4%)	142 (38.4%)	39 (34.5%)	
In a relationship	37 (26.1%)	135 (36.5%)	39 (34.5%)	
Unknown	49 (34.5%)	93 (25.1%)	35 (31.0%)	
Drug treatment at start	40 (28.1%)	82 (22.1%)	37 (32.6%)	
Eating disorder pathology (EDE-Q), mean (*SD*)				
OVERALL SEVERITY	3.86 (1.32)	4.10 (1.05)	3.79 (1.00)	.018
DIETARY RESTRAINT	3.77 (1.56)	3.58 (1.27)	2.58 (1.53)	.004
EATING CONCERN	3.10 (1.36)	3.62 (1.28)	3.39 (1.24)	.384

WEIGHT CONCERN	4.04 (1.65)	4.43 (1.32)	4.43 (1.17)	.300
SHAPE CONCERN	4.51 (1.39)	4.76 (1.20)	4.78 (1.12)	.655
Eating disorder behaviour mean (*SD*) (%)				
OBJECTIVE BINGE EPISODES	8.88 (6.65) (23.9%)	16.08 (17.25) (71.4%)	13.43 (8.47) (78%)	.761
SELF- INDUCED VOMITING	9.53 (12.41) (22.5%)	18.01 (20.63) (54.3%)	3.00 (3.25) (7.1%)	.852
LAXATIVE MISUSE	14.05 (11.43) (14.1%)	9.38 (9.06) (18.4%)	3.40 (2.30) (4.4%)	.668
EXCESSIVE EXERCISE	14.21 (7.61) (59.9%)	12.68 (6.61) (53.0%)	9.65 (6.72) (30.1%)	.077

p <.05 indicates a statistical significance according to a χ^2-test or ANOVA

3.3 Remission

3.3.1 Intention to treat analysis

The intention-to-treat analysis was performed on the imputed dataset (*N*= 625, BN: *n*= 370, BED: *n*= 113, OSFED: *n*= 142). Table 2 shows that a repeated measures ANOVA revealed statistically significant improvements on the EDE-Q total score in all groups between start and EOT and start and follow up (Table 2). Since sphericity was violated in the BN group, the degrees of freedom were corrected by Huynh-Feldt estimates (□= 180.90, *p*=.005). Effect sizes for all groups were large on the EDE-Q total score (BN: *d*=1.70, BED: *d*=1.44, OSFED: *d*=1.43). Eating disorder behaviours did not always decline significantly, all eating disorder behaviours diminished only significantly in the BN group. BMI only changed in the OSFED group at EOT. Secondary eating disorder pathology and general

psychopathology reduced at EOT and follow-up, except for secondary pathology in the OSFED group at EOT.

Table 2

Changes in EDE-Q global score, eating disorder behaviours, BMI, secondary eating disorder pathology and general psychopathology over the course of treatment and follow up assessed using intention to treat analysis with multiple imputations

													Repeated measures Anova, *p*		Effect size, *d*	
Other specified feeding and eating disorder (*N* = 142)	**Start *M*(SD)**	**Range**	**Median**	**ED behavior absent among *n* (%)**	**EOT *M*(SD)**	**Range**	**Median**	**ED behavior absent among *n* (%)**	**FU 20 *M*(SD)**	**Range**	**Median**	**ED behavior absent among *n* (%)**	***F***	**Start-EOT**	**Start-FU**	**Start-EOT**	**Start-FU**
Overall severity	3.91 (1.31)	1.37-5.80	4.16	*NA*	2.30 (1.60)	0.06-5.20	2.01	*NA*	2.39 (1.67)	0.21-5.43	2.17	*NA*	61.41	<.001	<.001	1.43	1.01
Objective binges	13.86 (12.49)	2.00-30.00	10.00	109 (76.7%)	6.13 (5.34)	0.00-28.00	0.00	113 (79.5%)	3.52 (6.33)	0.00-14.00	0.00	124 (87.7%)	22.56	.056	.001	0.80	1.04
Self-induced vomiting	15.23 (16.15)	1.00-28.00	5.00	111 (78.1%)	4.26 (4.01)	0.00-15.00	0.00	128 (90.4%)	2.15 (8.52)	0.00-80.00	0.00	130 (91.8%)	0.20	.057	.665	0.93	1.01
Laxative misuse	7.57 (8.31)	2.00-28.00	9.50	130 (91.8%)	2.45 (6.44)	0.00-3.00	0.00	141 (99.3%)	0.25 (2.29)	0.00-28.00	0.00	136 (95.9%)	28.13	.163	.108	0.69	1.20
Excessive exercising	13.20 (6.51)	1.00-30.00	13.00	53 (37.0%)	8.27 (6.32)	0.00-28.00	6.00	47 (33.1%)	4.5 (6.11)	0.00-20.00	0.00	105 (73.9%)	6.91	.150	.019	0.77	1.38
BMI	20.67 (2.64)	17.29-32.70	19.81	*NA*	21.30 (2.84)	18.58-31.54	20.58	*NA*	21.01 (3.29)	17.43-21.31	20.60	*NA*	12.86	<.001	.131	0.23	0.21
CIA total score	27.82 (10.19)	8.00-44.00	29.00	*NA*	25.69 (11.23)	3.00-45.00	25.50	*NA*	18.29 (13.95)	0.00-48.00	14.50	*NA*	13.19	.080	<.001	0.20	0.78
OQ-45 total score	79.22 (23.07)	11.00-121.00	79.50	*NA*	59.71 (32.06)	8.00-135.00	51.00	*NA*	53.01 (31.73)	10.00-130.00	54.50	*NA*	21.49	<.001	<.001	0.70	0.94
DASS	56.19 (25.33)	2.00-108.00	56.00	*NA*	34.27 (30.57)	0.00-116.00	26.00	*NA*	36.19 (29.51)	0.00-110.00	30.00	*NA*	8.53	<.001	.001	0.78	0.73

													Repeated measures Anova, *p*		Effect size, *d*	
Bulimia nervosa (*N* = 370)	**Start *M*(SD)**	**Range**	**Median**	**ED behavior absent among *n* (%)**	**EOT *M* (SD)**	**Range**	**Median**	**ED behavior absent among *n* (%)**	**FU 20 *M* (SD)**	**Range**	**Median**	**ED behavior absent among *n* (%)**	***F***	**Start-EOT**	**Start-FU**	**Start-EOT**	**Start-FU**
Overall severity	4.10 (0.99)	1.40-5.75	4.25	NA	2.11 (1.24)	0.23-5.37	1.80	NA	2.30 (1.30)	0.14-5.45	2.18	NA	221.53	<.001	<.001	1.70	1.56
Objective binges	14.36 (13.80)	1.00-84.00	12.00	0 (0%)	5.89 (4.77)	0.00-20.00	2.00	192 (51.9%)	3.89 (6.81)	0.00-50.00	2.00	254 (68.6%)	44.73	<.001	<.001	0.82	0.96
Self-induced vomiting	16.40 (16.78)	1.00-60.00	12.00	91 (24.6%)	4.45 (3.96)	0.00-15.00	0.00	263 (71.1%)	2.40 (7.75)	0.00-65.00	0.00	302 (81.7%)	25.16	<.001	<.001	0.98	0.94
Laxative misuse	6.70 (7.51)	1.00-28.00	4.00	171 (46.2%)	2.57 (7.38)	0.00-28.00	0.00	359 (97.1%)	0.01 (0.10)	0.00-1.00	0.00	369 (99.7%)	20.09	<.001	<.001	0.55	1.07
Excessive exercising	13.28 (6.21)	3.00-28.00	12.00	89 (24.0%)	8.43 (6.20)	0.00-30.00	8.00	235 (63.5%)	4.13 (6.62)	0.00-30.00	0.00	198 (53.4%)	31.27	<.001	<.001	0.78	1.26
BMI	23.75 (3.68)	18.56-38.44	22.91	*NA*	24.06 (3.97)	19.37-39.76	23.01	*NA*	24.02 (3.75)	18.31-36.67	22.95	*NA*	1.60	.150	.970	0.08	0.07
CIA total score	28.43 (9.13)	7.00-41.00	29.00	*NA*	24.29 (10.28)	1.00-47.00	24.00	*NA*	15.75 (10.60)	0.00-46.00	14.00	*NA*	77.95	<.001	<.001	0.43	1.43
OQ-45 total score	133.00 (57.44)	23.00-127.00	77.50	*NA*	127.00 (77.80)	8.00-133.00	53.00	*NA*	119.00 (53.00)	7.00-119.00	49.50	*NA*	83.32	<.001	<.001	0.09	1.28
DASS	48.37 (24.79)	6.00-112.00	47.00	*NA*	27.92 (23.80)	5.00-110.00	20.00	*NA*	30.96 (3.74)	0.00-94.00	28.00	*NA*	47.32	<.001	<.001	0.84	0.98

Binge eating disorder (*N* = 113)	Start *M* (SD)	Range	Median	ED behavior absent among n (%)	EOT *M* (SD)	Range	Median	ED behavior absent among *n* (%)	FU 20 *M* (SD)	Range	Median	ED behavior absent among *n* (%)	*F*	Repeated measures Anova, *p*		Effect size, *d*	
														Start-EOT	Start-FU	Start-EOT	Start-FU
Overall severity	3.79 (1.00)	1.77-5.14	3.97	*NA*	2.06 (1.22)	0.23-5.15	1.84	*NA*	2.34 (1.60)	0.88-4.53	2.24	*NA*	28.04	<.001	<.001	1.44	1.09
Objective binges	13.61 (8.20)	1.00-30.00	12.00	0 (0%)	5.50 (5.06)	0.00-20.00	2.00	54 (47.8%)	5.68 (7.04)	0.00-20.00	3.00	79 (69.6%)	16.70	<.001	.001	1.19	1.04
Self-induced vomiting	2.00 (1.73)	1.00-4.00	1.00	110 (97.3%)	0.50 (0.71)	0.00-1.00	0.00	112 (99.1%)	0.06 (0.23)	0.00-1.00	0.00	112 (99.1%)	NA	NA	NA	1.13	1.57
Laxative misuse	1.00 (NA)	1.00-1.00	1.00	110 (97.3%)	5.00 (7.07)	0.00-10.00	0.00	112 (99.1%)	0.00 (0.00)	NA	0.00	113 (100%)	NA	NA	NA	0.80	NA
Excessive exercising	8.79 (5.29)	1.00-20.00	8.00	79 (69.6%)	8.00 (8.11)	0.00-28.00	5.00	88 (78.2%)	2.00 (3.40)	0.00-10.00	0.00	98 (87%)	1.71	.963	.283	0.12	1.53
BMI	28.80 (4.88)	19.66-38.87	28.98	*NA*	28.77 (5.03)	20.24-43.94	28.66	*NA*	29.75 (3.84)	19.22-44.62	27.73	*NA*	0.56	.386	.290	0.01	0.23
CIA total score	26.8 (8.98)	10.00-48.00	27.00	*NA*	21.26 (9.31)	5.00-39.00	23.00	*NA*	14.26 (8.86)	2.00-30.00	13.00	*NA*	14.95	.002	<.001	0.61	1.41
OQ-45 total score	77.96 (16.53)	48.00-111.00	78.00	*NA*	60.68 (23.67)	12.00-128.00	59.00	*NA*	51.49 (17.57)	17.00-85.00	55.00	*NA*	11.17	.033	.001	0.85	1.55
DASS	43.34 (17.35)	8.00-90.00	44.00	*NA*	25.94 (18.84)	0.00-90.00	24.00	*NA*	22.84 (19.68)	6.0-74.00	12.00	*NA*	10.88	.022	.002	0.96	1.11

BMI body mass index, *CIA* clinical impairment assessment, *ED* eating disorder, *EOT* end of treatment, *FU* follow up *OQ-45*, *NA* not applicable

Remission varied between 34.2%-65.2%). Full recovery was 0-37% and clinically significant change varied between 24.4-58.7% (Table 3).

Linear mixed model analysis with fixed effects showed no differences in remission based on the EDE-Q between the three groups (p>.05). Alternative categorisations of diagnosis did not yield different results: additional linear mixed model analysis with fixed effects showed that there were also no differences between groups (p>.05) when all OSFED (N = 327) patients were categorised in one group and the BN (N = 259), and BED (N = 39) group consisted only of BN and BED patients respectively, no differences were found (p>.05). There were also no differences between groups (p>.05) when patients were categorised in five groups (BN; N= 259, OSFED BN; N= 111, BED; N= 39, OSFED BED; N= 74, OSFED; N= 142).

Table 3

Remission rates for the intention to treat sample

	Start	**EOT**	**FU20**
Other specified feeding and eating disorder	***n* = 142**	***n* = 142**	***n* = 142**
EDE-Q< 2.77 (n, %)	21 (15.1%)	66 (46.6%)	49 (34.2%)
Full recovery [1] (n, %)	*NA*	0 (0.0%)	27 (19.2%)
RCI (n, %)	*NA*	75 (53.4%)	49 (34.2%)
CSC (n, %)	*NA*	55 (38.4%)	35 (24.7%)
Bulimia nervosa	***n* = 370**	***n* = 370**	***n* = 370**
EDE-Q< 2.77 (n, %)	41 (11.1%)	221 (59.6%)	146 (39.4%)
Full recovery [1] (n, %)	*NA*	115 (31.0%)	34 (9.1%)
RCI (n, %)	*NA*	247 (66.8%)	151 (40.9%)
CSC (n, %)	*NA*	190 (51.4%)	114 (30.8%)
Binge eating disorder	***n* = 113**	***n* = 113**	***n* = 113**
EDE-Q< 2.77 (n, %)	17 (15.2%)	74 (65.2%)	71 (63.2%)
Full recovery [1] (n, %)	*NA*	42 (37.0%)	30 (26.3%)
RCI (n, %)	*NA*	74 (65.2%)	34 (30.4%)
CSC (n, %)	*NA*	66 (58.7%)	26 (23.9%)

[1] Full recovery: EDE-Q< 2.77, BMI> 18.5 and no eating disorder behaviours (binges, self-induced vomiting, laxative misuse, extensive exercising)
CSC clinical significant change, *EOT* end of treatment, *FU* follow up, *NA* not applicable, *RCI* reliable change index

3.3.2 Completer analyses

All analyses were repeated on the data of the completers sample. There were no substantial differences between the results of the intention-to-treat analysis and the completers analysis. All groups showed statistically significant improvements on the EDE-Q between start and EOT and start and 20 weeks follow up. There were no further improvements or declines between EOT and follow-up. Effect sizes for all groups were large on the EDE-Q total score (OSFED: d=1.31; BN: d=1.74, BED: d=1.46). However, among the BED group the results of the intention-to-treat analysis were favourable over the completers regarding remission based on EDE-Q<2.77 (65.2% vs 55.8%), and full recovery (37.0% vs 24.6%).

3.4 Predictors of treatment outcome

In the intention-to-treat sample, higher level of education predicted better outcomes on EDE-Q total score at EOT (r= -0.14, 95% CI= -0.03-0.03, p=0.028) and males had better outcomes at follow-up (r= 0.18, 95% CI= 0.95-2.10, p=0.021). However, these associations were not substantial (See for a full account of the findings regarding predictors supplementary materials Table B).

Clinical predictors of treatment outcome regarding EDE-Q total score were investigated in the entire sample and separately for the three subgroups (if not significant for subgroups, only results for the entire sample are reported). In the intention-to-treat sample only severity of eating disorder pathology at baseline was a predictor for eating disorder severity at EOT for the complete sample (r= 0.51, 95% CI= 0.56-0.77, p<0.001), OSFED (r= 0.70, 95% CI= 0.59-0.96, p<0.001), BN (r= 0.45, 95% CI= 0.51-0.82, p<0.001) and BED (r= 0.43, 95% CI= 0.20-0.77, p<0.001).

Baseline EDE-Q score predicted eating disorder severity at follow-up for the entire sample (r= 0.55, 95% CI= 0.64-0.82, p<0.001), for BN (r= 0.47, 95% CI= 0.44-0.89, p=0.021) and OSFED (r= 0.72, 95% CI= 0.59-1.14, p=0.021), not for BED (p>0.05). BMI and frequency of eating disorder behaviours at baseline, duration of the eating disorder, and having been treated before did not predict treatment outcome (p>0.05) in any of the groups (Supplementary materials Table C).

Discussion

The aim was to determine and compare the effectiveness of CBT-E for non-underweight adults, differentiating between BN, BED, their respective OSFED, and OSFED outside the confines of an RCT. Severity at start was higher in the present study compared to other studies (Byrne et al., 2017; Poulsen et al., 2014; Wonderlich et al., 2014). Eating disorder pathology declined significantly and clinically significant change ranged between 24.4-58.7%.

With regard to the various types of remission there were no differences in treatment outcomes between the completers sample and the intention-to-treat sample, therefore, patients might also recover with a less intense form of treatment (Berg et al., 2020; Moore et al., 2021; Waller et al., 2018). Only eating disorder severity at start significantly predicted outcome. Consistent with a transdiagnostic perspective on eating disorder treatment, eating disorder diagnosis did not predict treatment outcome regarding overall pathology and full recovery.

The results of the present study replicated the findings of a transdiagnostic treatment effect by van den Berg et al (2020). Remission and full recovery rates were comparable with other effectiveness studies, while effect sizes on the EDE-Q were larger compared to other effectiveness studies (Byrne et al., 2001; Knott et al., 2015; Wade et al., 2016; Dalle Grave et

al., 2015). In addition, compared with trial studies effectiveness was somewhat lower (Supplementary Table A) (Fairburn et al., 2009; Fairburn et al., 2015).

Contrary to expectations, a lower BMI and higher frequency of eating disorder behaviours at start, longer duration of the eating disorder, and treatment in the past did not predict treatment outcome among the complete group, nor in any of the subgroups. Based on the results, it was generally not possible to identify a subgroup of patients who especially benefit from CBT-E.

Explanations why the present results regarding treatment outcome predictors differed from previous studies: first, the effect sizes of predictors, such as duration of the eating disorder, BMI (Vall & Wade, 2015) and eating disorder severity (Linardon, de la Piedad Garcia, et al., 2017) were small in other studies. Although some studies found eating disorder behaviours to predict treatment outcome, due to the large variations in the reported effects, a meta-analysis did not find their frequency predicted treatment outcome (Vall & Wade, 2015). The use of different definitions may also have impacted research on the prediction of outcome. For instance, Cooper et al (2016) investigated the prognostic effect of eating disorder duration by categorizing duration as greater or less than eight years, while this study investigated duration as a continuous variable. BMI may not have predicted treatment outcome in the present study because in the present study underweight patient were excluded. Other studies, which found that BMI predicted treatment outcome did include, underweight patients (Linardon, de la Piedad Garcia, et al., 2017; Vall & Wade, 2015). Investigation into the prognostic roles of higher levels of self-esteem (Cooper et al., 2016), impulsivity, depression (Castellini et al., 2012) and lower levels of self-control, discrepancy of actual and ideal self (Anderson et al., 2020) when offering CBT-E is also recommended because they predicted poorer treatment outcome when offering eating disorder treatment.

Overall, treatment completion and compliance to the assessments was 62.6%, and the lowest in the BN group. Treatment completion rate was comparable to other effectiveness studies, with rates between 36.3%-50% (Byrne et al., 2011; Knott et al., 2015; Signorini et al., 2018). In addition, the loss to therapy rate of 37% may have been affected by the fact that treatment payment was covered by the patients' health care insurance. In addition, efforts to ensure patients complete treatment may be more limited in effectiveness studies than in an efficacy studies (Byrne et al., 2011). In addition, since more than 50% of all patients showed compliance regarding the assessments, the results can be generalised to other eating disorder patients (de Beurs et al., 2019). Motivational sessions prior to commencing treatment might reduce dropout and enhance treatment completion among patients suffering from BN.

The limitations of the present study are as follows: our findings do not reveal whether long-term recovery was attained, as that requires a longer period of 20 weeks. Unfortunately, compliance towards the assessments was less than 30% at 60 weeks follow-up. The response rate diminishes with a longer follow-up duration, as patients are less committed to provide these data. Since response rate at follow-up was about 50%, results might be biased to patients who responded well to treatment or who relapsed. Another limitation was that outcome data were limited to patients' self-report. There was low concordance between self-reported eating disorder behaviours in the EDE-Q at baseline and during the semi-structured interview at the intake session. An increase in awareness of eating disorder symptomatology over time may lead to a higher score on the EDE-Q, diminishing the pre-to post-test change resulting from treatment (Berg et al., 2013). On the other hand, as self-report measures are most widely used, they provide data on treatment outcome in everyday clinical practice. In addition, effectiveness studies potentially deal with diminished internal study validity. One concern is confounding of outcome by extraneous factors, which is an important reason for investigating

predictors of treatment outcome in effectiveness research (Leichsenring, 2004). Finally, a limitation was the lack of a control group, as confounding factors were not measured.

This study also has several strengths. Analyses were done in a clinically relevant context, with a large sample of patients referred to a specialised eating disorder clinic. Since 80.3% of all participants who completed treatment complied with the request to complete the assessments, persistence of benefits of treatment could be assessed at 20 weeks follow up. These results can therefore be generalised to other specialised treatment centres. In addition, all therapists completed their web-centred CBT-E training, were intensively supervised and treatment integrity and protocol adherence was monitored. Since the recent acknowledgement of BED in the DSM V (APA, 2013), this is, as far as we know, the first study to report CBT-E effectiveness in adult patients diagnosed with BED compared to other eating disorders. Furthermore, additional analyses were performed to assess whether OSFED classification determined group categorization. In terms of feasibility, the present study shows that CBT-E can be delivered in everyday clinical practice in a specialised eating disorders centre.

In conclusion, CBT-E appeared a suitable eating disorder treatment for adults with a BMI between 17.6 and 39.9. Treatment benefits were maintained during 20 weeks follow up. While there were no significant differences in remission between BN, BED and their respective OSFED and OSFED with a restrictive food pattern, treatment completion was significantly lower in the BN group. The findings are consistent with a transdiagnostic treatment approach. The question for whom CBT-E works best requires further study, because the present data revealed only predictive value of pre-treatment severity of the eating disorder and no other predictors were found.

Key practice points

(1) CBT-E is an effective treatment for patients suffering from an eating disorder with a BMI between 17.6-39.9
(2) No subgroup of patients benefited differentially from CBT-E
(3) Only severity of eating disorder pathology at start predicted treatment outcome
(4) Drop-out of treatment was only predicted by the diagnosis of bulimia nervosa
(5) Patients might also recover with a less intense form of treatment

Further reading

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Supplementary Table A
Remission rates of CBT-E for various eating disorder classifications

Diagnosis	Type of Remission	Time of Measurement	Remission Rates[1]	Author, year
Transdiagnostic model				
	EDE-Q	EOT	35-69.1%	Berg., et al, 2020 ; Byrne., et al, 2011; Dalle Grave., et al, 2015; Fairburn et al., 2015; Fairburn et al., 2009; Signorini., et al, 2018; Byrne., et al, 2017; Wade et al., 2016[2]; Watson., et al, 2012
		20 weeks FU	58-65%	Fairburn et al., 2015; Fairburn et al., 2009; Signorini et al., 2018
		40 weeks FU	65-70%	Fairburn et al., 2015; Fairburn et al., 2009
	Full recovery	EOT	45%	Fairburn et al., 2015
		EOT	50%	Dalle Grave et al., 2015
		EOT	39.1%	Berg., et al, 2020
AN				
	EDE-Q	EOT	18-40%	Byrne et al., 2011; Calugi, El Ghoch, & Dalle Grave, 2017; Watson et al., 2012
	Full recovery	EOT	14.3-30%	Calugi et al., 2017; Wade et al., 2017
	BMI>18,5	EOT	31.2-36.4%	Byrne et al., 2011; Frostad et al., 2018
		One year FU	50-77.3%	Frostad et al., 2018
BN				
	EDE-Q	EOT	22.5-53%	Fairburn et al., 2009; Poulsen et al., 2014; Watson et al., 2012; Wonderlich et al., 2014
		60 weeks FU	50-69%	Fairburn et al., 2009; Fairburn et al., 2015., Wonderlich et al., 2014
BN and OSFED				
	EDE-Q	EOT	78%	Knott, Woodward, Hoefkens, & Limbert, 2015
BN and borderline personality disorder				
	EDE-Q	EOT	40-44%	Thompson-Brenner et al., 2016
OSFED				
	EDE-Q	EOT	27-54%	Fairburn et al., 2009; Watson et al., 2012
		60 weeks FU	46%	Fairburn et al., 2009

1 EDE-Q < 1SD above community norm, no remission rates for BED specifically have been reported, 2 group CBT-E

EOT end of treatment, *FU* follow-up

Chapter 7 Online Cognitive Behavioral Therapy Enhanced for Binge Eating Disorder: Study Protocol for a Randomized Controlled Trial

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Abstract

Background: Binge eating disorder is characterized by recurrent episodes of binge eating accompanied by a sense of lack of control. Of the different treatments available, Cognitive Behavioral Therapy-Enhanced and guided self-help treatment are recommended. As online treatment offers several additional advantages, we have developed a CBT-Enhanced online guided self-help intervention. The aim of this study is to determine whether this intervention reduces eating disorder pathology and increases the amount of binge free days in adults classified with binge eating disorder or other specified feeding or eating disorder- binge eating disorder, compared to an untreated waiting list condition. The experimental condition is hypothesized to be superior to the waiting list condition.

Methods: The efficacy of an online guided self-help intervention for binge eating disorder will be assessed by conducting a randomized controlled trial. The trial will target adult individuals classified with binge eating disorder or other specified feeding or eating disorder-binge eating disorder with a body mass index between 19.5 and 40, referred to an eating disorder treatment center. Dual arm allotment will be performed in a 1:1 ratio stratified for BMI above or below 30. Randomization will be blinded to the online intervention (n = 90), or to the control waiting list condition (n = 90). Assessors will be blinded and assessments will be administered at baseline, week 5, at end-of-treatment, and at 12 and 24 weeks follow-up. Primary outcome will be eating disorder pathology, operationalized as number of days on which binge eating occurred between the two conditions during the period of the intervention. Secondary outcome measures will be differences in other eating disorder pathology, clinical impairment and in quality of life, while therapeutic alliance, demographic characteristics and followed treatment module will serve as effect moderators. Several types of costs will be assessed.

Discussion: This paper presents an online guided self-help Cognitive Behavioral Therapy-Enhanced study protocol for individuals classified with binge eating disorder or other specified feeding or eating disorder. Efficacy will be examined through a Randomized Controlled Trial.

Keywords: Randomized Controlled Trial; Binge eating disorder; Guided self-help; Cognitive Behavioral Therapy-Enhanced; Waiting list

Trial registration: The study protocol is registered with the Netherlands Trial Registry NTR (NTR 7994) since 6 September 2019.

Background

Eating disorders, one of the three most common disorders in adolescents (Herpertz-Dahlmann, 2015), have a life time prevalence in the Netherlands of 1.74% (Preti et al., 2009). These disorders, which have a significant impact on the psychological and physical well-being of affected individuals (Hay et al., 2015), are characterized by over-evaluation of shape and weight (Fairburn & Harrison, 2003). Binge eating disorder (BED) is specifically characterized by recurrent episodes of binge eating accompanied by a sense of lack of control (APA, 2013). The binges occur at least once a week and, if they are less frequent, the individual is classified with other specified feeding or eating disorder (OSFED) BED (APA, 2013). Of the population in the West, 2% suffers from binge eating disorder (Morrisson, 2014), and 1.5% from OSFED (Mustelin et al., 2016).

Of the range of treatments available for eating disorders, including Cognitive Behavioral Therapy (CBT), Dialectical Behavioral Therapy (DBT) and Interpersonal Therapy (IPT), Cognitive Behavioral Therapy-Enhanced (CBT-Enhanced) (ANZAED, 2014; Fairburn, 2008; NICE, 2017) is the preferred evidence based treatment for BED (NICE, 2017). According to Fairburn, developer of CBT-Enhanced, (Fairburn et al., 2015; Fairburn et al., 2009), CBT-Enhanced treatment leads to a recovery rate of 50- 65% amongst the individuals with an eating disorder. For BED specifically, the recovery rate is 54% (Fairburn et al., 2015). However, as, according to the stepped care principle, CBT-Enhanced could be too intensive for individuals suffering from BED or OSFED BED, international guidelines have recently recommended guided self-help treatment as first step for individuals suffering from BED (NICE, 2017). Most online interventions are based on existing face to face treatment protocols (Fairburn & Patel, 2017). Guided self-help has the advantages of reduced travel costs and travel time for the patient (Becker, Hadley Arrindell, et al., 2010), less time of a specialist's invested in a single treatment (Shafran et al., 2009), and the removal of geographical distance

as a barrier to seeking treatment (Evans et al., 2011). In addition, an online guided self-help version of CBT-Enhanced (GSH CBT-E) follows all recommended evidence-based guidelines for individuals suffering from BED (NICE, 2017).

Studies have shown that several online self-help treatments, including the use of apps on different devices such as smartphones or computers, are effective when combined with therapeutic support (Abdullah et al., 2016). This is also the case for BED (Abdullah et al., 2016; Traviss-Turner et al., 2017), and a recent meta-analysis showed that 46% of the individuals classified with BED report not to suffer from binge eating episodes after self-help treatment (Hilbert et al., 2019). There are, however, differences in the efficacy of self-help treatment (Traviss-Turner et al., 2017), with guided self-help (GSH) being found to be more effective than non-guided self-help (Newman et al., 2011), and a stronger therapeutic alliance improving treatment efficacy (Abrahamsson et al., 2018; Fernandez et al., 2015). The literature further suggests therapeutic alliance to be stronger when contact is synchronous as by phone than when asynchronous as by email (Abrahamsson et al., 2018).

Responding to the absence of CBT-Enhanced based guided self- help (GSH) in Dutch, Novarum, Center for Eating Disorders in the Netherlands, has developed a CBT-Enhanced based GSH (GSH CBT-E), based on the self-help section (Part two) of *Overcoming Binge Eating, The Proven Program to Learn Why You Binge and How You Can Stop* (Fairburn, 2013). A study of GSH for BED by Ter Huurne et al., based on general Cognitive Behavioral Therapy (CBT) and Motivational Interviewing (MI), in the Netherlands have shown that, compared to a waiting list condition, an online GSH version of Cognitive Behavioral Therapy (GSH CBT), is particularly effective in reducing eating disorder pathology. At the same time, reduction in binge eating episodes, the main symptom in individuals suffering from BED, has not been reported (ter Huurne et al., 2015). Although one GSH CBT study in Germany did show a reduction of binge eating episodes of 58% (Wagner et al., 2013), the treatment

protocols used in both studies, in the Netherlands as well as in Germany, were not based on CBT-Enhanced, and a GSH version of CBT-Enhanced is expected to be more effective than GSH CBT (Abrahamsson et al., 2018; Konig et al., 2018).

To broaden the treatment method to CBT-Enhanced, in this study, contact with the participants in this study will be synchronous, using direct phone contact, unlike in Ter Huurne et al. (ter Huurne et al., 2015), where patient contact was asynchronous, through email (Abrahamsson et al., 2018; Fernandez et al., 2015; ter Huurne et al., 2015). Again extending Ter Huurne et al. (ter Huurne et al., 2015), which was conducted with only female participants (ter Huurne et al., 2015), this study will include both male as well as female participants. Thus, even though gender is not expected to influence treatment efficacy (Shapiro et al., 2007), the results will be relevant to both genders. Finally, where Ter Huurne et al. (ter Huurne et al., 2015) used self-report questionnaires to classify study participants and assess eating disorder pathology, including pre- and post-treatment binge eating behavior, this study will use the Eating Disorder Examination (EDE) interview (Cooper et al., 1989) as well as self-report questionnaires (Fairburn & Beglin, 2008).

The primary aim of this study is to examine the efficacy of online GSH CBT-E with regard to eating disorder pathology, operationalized as difference in the number of binge-free days among men and women classified with BED and/ or OSFED BED after treatment compared to a waiting list control group. The secondary aim is to examine the efficacy with regard to other eating disorder pathology, clinical impairment and quality of life between GSH CBT-E and a waiting list control group after treatment and during the follow-up period. Tertiary aim is to calculate direct treatment costs for the GSH CBT-E intervention for means of transparency, direct comparison with the waiting list condition, and indirect comparisons with other interventions. Efficacy will be examined through a parallel group randomized controlled trial.

It is hypothesized that GSH CBT-E is superior to the waiting list condition with regard to a decrease in eating disorder pathology and clinical impairment. GSH CBT-E is also expected to be superior to the waiting list with regard to increase in the number of binge free days and quality of life.

Methods

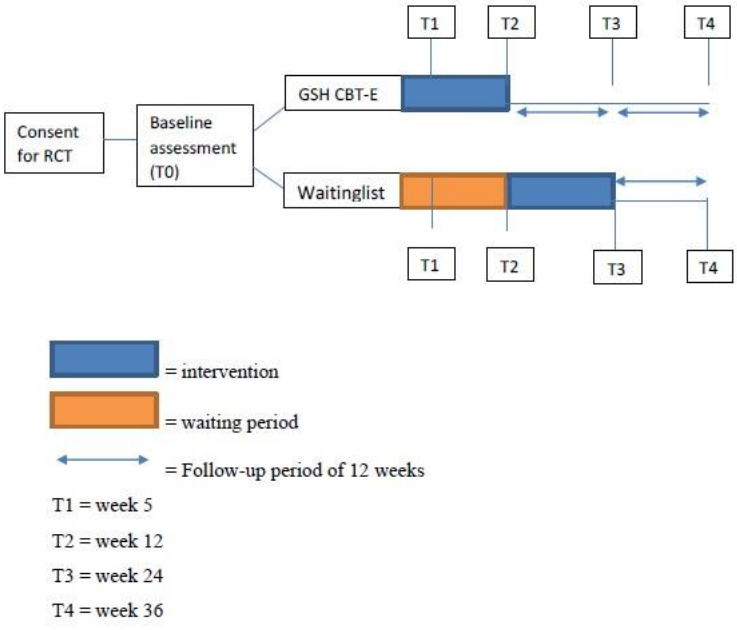
2.1. Trial design

A single center randomized controlled trial (RCT) will be conducted at Novarum, center for eating disorders in Amsterdam, the Netherlands. Participants in the experimental condition (GSH CBT-E) will be compared to the waiting list control condition. To our knowledge this is the first study examining efficacy of GSH CBT-E, since only efficacy results of GSH CBT have been reported (Carrard et al., 2011; de Zwaan et al., 2017; Grilo et al., 2005). Therefore, outcome of GSH CBT-E will first be compared to waiting list control condition. Figure 1 presents a flowchart of this study.

Participants are referred for treatment by general practitioners, secondary care health professionals or general hospitals. All potential participants are over 18 years of age and are being treated voluntarily. All potential participants classified with BED or OSFED BED, assessed by a clinical psychologist or psychiatrist, are invited to participate in the study. If a potential participant meets all inclusion and none of the exclusion criteria, agrees to the terms and conditions of the study and has provided informed consent, a baseline assessment (T0) will be scheduled. After the baseline assessment is completed, participants will be randomized to either the experimental condition (GSH CBT-E) or the waiting list control condition. Randomization will be blinded and stratified for body mass index (BMI) above or below 30. BMI will be calculated as weight in kg/ height in m^2. Participants assigned to the experimental condition will start their treatment directly after they read the mandatory

literature. The control group will start treatment after a waiting list period of 12 weeks, the same duration as the intervention. After baseline (T0), assessments will take place four times during and after treatment: at week 5, which is the evaluation-point of treatment for GSH CBT-E (T1); at the end of treatment for GSH CBT-E/ start of treatment for waiting list control group (week 12, T2); at 12 weeks after treatment for GSH CBT-E/ End of treatment for the waiting list condition (week 24, T3); and at 24 weeks after treatment for GSH CBT-E/, 12 weeks after treatment for waiting list control group (week 36, T4). The initial screening, before consent to study participation will take place at Novarum, but the intervention and assessments will take place at any location where participants have internet connection and are able to focus on their sessions. Since a large proportion of the Dutch population (96.7%) had internet access in 2018 (Statline, 2018), the participants' personal location can be anywhere in the Netherlands. Obtained close- out period will be 1.5 years.

Figure 1 Flow chart of planned intervention and assessment



2.2. Participants and recruitment

2.2.1. Inclusion

In order to be eligible to participate in this study, a participant must meet the following criteria:

(1) DSM- 5 BED or OSFED BED classification;

(2) age at least 18;

(3) BMI between 19.5 and 40;

(4) moderate proficiency in Dutch and ability to read part one of the Dutch translation of *Overcoming Binge Eating, The Proven Program to Learn Why You Binge and How You Can Stop*, by Christopher Fairburn (Fairburn, 2016), which involves psychoeducation;

(5) willingness to provide contact details, including phone number, internet access, possession of a computer or tablet, and willingness to use it for treatment and research purposes;

(6) willingness to sign the informed consent form.

2.2.2. Exclusion

Primary exclusion criteria are:

(1) acute psychosis, assessed via Structural Clinical Interview by the DSM 5 (SCID-5) (First et al., 2016);

(2) acute depression, assessed via SCID-5;

(3) suicidal ideation, assessed via SCID-5 or

(4) self-induced vomiting as compensatory behavior, as reported at initial session or EDE-interview at baseline.

(5) having received eating disorder treatment during the past 6 months,

(6) being pregnant

(7) reported use of medication with the potential to influence eating behavior such as, Lithium, Mitrazepine and anti-psychotic stimulants (Barthel & Bauer, 2018; Correll et al., 2011).

2.2.3. Recruitment

Recruitment will take place between September 2019 and December 2020. Potential participants will be referred to Novarum, center for eating disorders by other health care specialists. After being referred for specialized eating disorder treatment, potential participants have an initial screening consisting of an interview about eating disorders symptoms, other general psychiatric symptoms, life events and demographics. Weight and height will be measured in order to calculate their BMI. All eligible potential participants receive written study information during an advisory session, during which they receive an informed consent description, explaining the research goals and information about participation in the study. When willing to participate they sign the informed consent form and their baseline assessment will be planned. As an incentive for participating, participants will receive €10,- in gifts cards after completion of T2 (12 weeks), after completion of T3 (24 weeks) and €20,- after measurement at T4 (36 weeks). Participants who complete all follow-up questionnaires will thus receive a total amount of €40 in gifts cards as compensation for participating in the study.

2.3. Intervention and procedure

All participants will receive GSH CBT-E: the experimental group will receive treatment immediately after baseline assessment, and the control group after a 12 weeks waiting period. GSH CBT-E is an online guided self-help version of CBT-Enhanced (Fairburn, 2008), based on *Overcoming Binge Eating, The Proven Program to Learn Why You Binge and How You Can Stop* (Fairburn, 2013), whose second part, a self-help guide, has been transformed into an online intervention.

2.3.1. Development of the intervention

The GSH CBT-E protocol was converted into an online program by CBT-Enhanced trained specialists at Novarum, center for eating disorders. A software team implemented the protocol on a website. During the pilot phase of the initial version, through an interactive process involving participants and therapists feedback, the website was further developed in terms of user friendliness, ease of navigation, lay-out and reduction in eating disorder pathology, measured by the Eating Disorder Examination-Questionnaire (EDE-Q) (Fairburn & Beglin, 2008). A risk inventory was performed (CETool, 2020) and GSH-CBT-E appeared to be a medical device involving minimal risks, therefore it was not necessary to gain permission with the Dutch Health Care Inspectorate (DutchHealthCareInspectorate, 2020).

2.3.2. Procedure

Therapists

Therapists activate an account and participants log into their digital environment through my.karify.com. Both categories have to register with a personal username and password. Both

categories are able to access the intervention at any time. Once the patient completes an assignment, the therapist receives a notification by email and can access the assignments. All therapists are trained CBT-E therapists, successfully completed a web based CBT-Enhanced training provided by Centre for Research on Eating Disorders at Oxford (CREDO) and worked through the detailed CBT- Enhanced guide (Fairburn, 2008). The therapists have different disciplinary backgrounds and have completed a post doc degree (mental health care psychologist), a masters degree (psychologist), or a bachelors degree (dietician and social worker). A manual explaining all intervention modules in detail is available to all GSH CBT-E therapists. After completing their CBT-Enhanced training by CREDO, all therapists received two days of training, including background information, program navigation, working with scripts, treatment content and communication skills. All therapists will receive supervision once a week, including general guidelines, discussion of adverse events and participants' treatment progress. Therapists will not be blinded.

Intervention

GSH-CBT-E is based on Cognitive Behavioral Therapy- Enhanced, focused version, offered in a guided self-help format consisting of CBT-Enhanced key interventions, inevitably however less complex and with a shorter duration as in CBT-Enhanced focused. Before participants are eligible to start treatment, they have to read Part one of *Overcoming Binge Eating, The Proven Program to Learn Why You Binge and How You Can Stop* (Fairburn, 2013), or the Dutch translation *Overwin je eetbuien, waarom je te veel eet en hoe je daar mee kunt stoppen* (Fairburn, 2016). This contains psycho-education about eating disorders and will be referred to during treatment. Participants will be asked if they have read part one before start of treatment. If the patient has not, they will be asked to read it during the first week(s) of treatment. In addition, before starting treatment, baseline assessment will take place. The EDE

will be conducted by phone and participants will be sent a link to the self-report questionnaires, which they can complete at home on a computer. After baseline assessment and reading part one of *Overcoming Binge Eating The Proven Program to Learn Why You Binge and How You Can Stop* (Fairburn, 2013), the patient will be ready to start GSH CBT-E. Just like regular CBT-Enhanced, GSH CBT-E comprises three main stages; the first stage focuses on establishing regular eating and alternatives for binge-eating, using real-time self-monitoring as central intervention, and events, moods and eating. After joint review of progress & designing rest of treatment in the second stage, the third stages focuses on dietary restraint or shape concern and finally ending well with a firm focus on minimizing the risk of relapse in the long term. GSH CBT-E is a 12 week program. Once a week there will be a therapy session. All sessions will be conducted by phone. Participants have to start reading information online, to monitor their eating behavior, and to schedule, once a week, weighing, and, twice a week, self-evaluation sessions. The program is interactive, participants have to upload assignments and the therapist can monitor them. In addition, patient and therapist do interact weekly. Therefore, it differs from merely reading an e-book. A few days after start of treatment, participants will have a 20 minutes phone session with their therapist. To ensure consistency between therapists, these phone sessions are pre-scripted. During the first four weeks, participants will have to monitor their eating behavior, including their thoughts and feelings and establish a regular eating pattern. They will also introduce alternative activities for binge eating and work on problem-solving skills. During week 5, they will fill out assessment questionnaires, sent to them by a link, and their progress will be assessed, by both themselves and their therapist. This session will enable them to decide whether to add a module on body evaluation or dietary restraint during week 6-11 in addition to monitoring, regular eating, alternatives for binge eating and problem solving (table1). From week six onwards the program modifies to the user, based on the maintaining factors of their binge

eating disorder. Before the 12th session participants will have to fill out the questionnaires. Results will be discussed during session 12, when they will also discuss what to do to prevent set-backs. The post treatment EDE will be conducted by phone. GSH CBT-E treatment will not be altered or interfered with during the study. As GSH CBT-E is a 100% guided self-help treatment without face to face sessions. After conclusion of the treatment, participants can still access the treatment module. To ensure data protection GSH- CBT-E is only available through a HTTPS protocol and secured by a 256-bit encrypted SSL- certificate. The online environment (Karify) is ISO 27001 and NEN 7510 certified.

However, when another disorder than BED becomes the participants' primary complaint and interferes with GSH CBT-E this will be considered as an adverse event. When the participant meets the criteria of Bulimia Nervosa instead of Binge Eating Disorder, as reported at the initial session or EDE-interview at baseline (Cooper & Fairburn, 1987) the participant will no longer partake in the protocol and will be offered face to face treatment. In addition, patients will report on the frequency of their eating disorder behaviors on a weekly basis, monitored by their therapist. Although sessions are conducted by phone, all therapists will pay close attention to adverse events and patients will receive face-to-face treatment when dealing with adverse events. If presence of another psychiatric disorder interferes with GSH CBT-E, the participant will first consult a psychiatrist and receive face to face treatment or will be offered treatment in or outside our institutions.

Table 1 Overview of timing of interventions in GSH CBT-E

Step	**Focus**	**Period (12 weeks total)**
Step 1	Starting well	1 week
Step 2	Establish a regular eating pattern	1 week
Step 3	Alternatives for binge eating	1 week
Step 4	Problem solving	1 week
Step 5	Evaluation	1 week
Step 6	Module: dietary restraint	Distributed over 6 weeks
Step 6	Module: shape concern	Distributed over 6 weeks
Step 8	Ending well	1 week

Experimental treatment group

Participants assigned to the experimental condition will start their GSH CBT-E intervention directly after baseline assessment.

Waiting list control group

Participants assigned to the non- experimental (waiting list) condition will start their GSH CBT-E treatment 12 weeks after baseline. This control condition will be a minimal intervention. Participants will be called every six weeks for a short conversation (10 minutes at most), which will include checking on the eating disorder symptoms and other important areas of the participant's life. This is necessary as, under Dutch law, monitoring participants during their waiting list period is mandatory at least every six weeks.

2.4. Outcome measures and assessment

2.4.1. Outcome measures

Primary outcome measure

The primary outcome measure will be difference in eating disorder pathology, operationalized as the amount of days binge eating occurred, post treatment versus the waiting list control condition. Due to the absence of purging behavior, participants experience difficulty to recall the number of binge eating episodes. Therefore, participants suffering from BED were asked to report the number of days binge eating occurred rather than number of episodes (de Zwaan et al., 2012; König et al., 2018). This is in line with the primary outcome measure chosen in another study (de Zwaan et al., 2012). Amount of binge free days will be measured by the EDE (Cooper et al., 1989) and EDE-Q (Fairburn & Beglin, 2008). If a discrepancy arises between binge free days on the EDE and EDE-Q, the EDE will be chosen over the EDE-Q, because it is the golden standard for assessing eating disorder pathology (Berg et al., 2011).

Secondary outcome measure

As secondary outcomes, differences in other eating disorder pathology defined as restraint, eating concern, weight concern and shape concern (Cooper & Fairburn, 1987; Fairburn & Beglin, 2008), quality of life and clinical impairment will be assessed. Eating disorder pathology will be measured by the EDE (Cooper et al., 1989) and EDE-Q (Fairburn & Beglin, 2008). Quality of life will be measured by the three-level variant of the five-dimensional EuroQol instrument (EQ-5D- 3L) (Herdman et al., 2011). Clinical impairment will be assessed through the Clinical Impairment Assessment (CIA) developed by Bohn et al. (Bohn

et al., 2008).

Costs

The economic evaluation will be performed in line with the ISPOR guidelines (Ramsey et al., 2015) and the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement (Husereau et al., 2013). Several types of costs will be assessed: utilization of health care, costs stemming from productivity losses due to absenteeism or reduced efficiency while at work (presenteeism) and GSH CBT-E costs. Utilization of health care, other than for GSH CBT-E and utilization of health care within Arkin will be assessed by the questionnaire for Costs associated with Psychiatric Illness (TiC-P) (Hakkaart-van Roijen et al., 2002). Health care use will be multiplied with standard cost prices (van Hakkaart Roijen et al., 2011). In addition, the participants electronic file will be searched to make additional calculations on costs other than GSH CBT-E within Arkin. Regarding productivity losses, we will use the Dutch guideline for economic evaluation (Zorginstituut, 2016), and rely on the standard cost prices reported therein. Productivity losses will be based on the gender- and age-specific friction costs. In addition, costs of GSH CBT-E (expressed in euros) will be established for each participant by multiplying standard Dutch cost prices (Zorginstituut, 2016), with the number of patient contacts. Since the time horizon of this study, mean time frame between start and end of treatment, is under a year, no discounting for future costs / effects will be applied.

Other study outcome measures

The variables that will be investigated as moderators of treatment effect are: therapeutic alliance, demographic variables, and the online module followed by the participant (dietary

restraint or shape concern). Therapeutic alliance, hypothesized to be a moderator, will be measured through the Working Alliance Inventory (WAI) (Horvath & Greenberg, 1989). Gender is not expected to influence treatment outcome (Shapiro et al., 2007).

2.4.1. Assessment

All assessments will be conducted by phone (EDE) or via a link provided by e-mail (EDE-Q, CIA, EQ-5D-3L, WAI). The EDE will be conducted at start (week 0) and post treatment (week 12). These assessments will be conducted by research assistants who will be blinded. If blinding is broken, the assessment will still be completed, and the results compared with results of the other participants in the same condition. If the results of the participant with broken blinding are outliers, they will not be taken into account in the analyses. All other assessments will be conducted at start, during week 5, week 12 and at week 24 and 36 (see also figure 1 and 2). Since treatment effect is expected to continue after end of treatment (Fairburn et al., 2015; Fairburn et al., 2009), follow up measures will be conducted. If a participant does not complete the online assessments they will be called by a research assistant in order to motivate them. All assessments will be processed in Castor EDC (https://www.castoredc.com/) which is ISO 27001/27002/9001 and NEN 7510 certified. In addition, staff conducting the assessments do not offer GSH-CBT-E themselves.

2.4.2 Assessment of primary and secondary outcomes: number of binge free days and other eating disorder pathology

EDE

The Eating Disorder Examination (EDE) (Cooper et al., 1989) is a semi- structured interview assessing eating disorder pathology during the last 28 days, including binge eating behavior. The EDE, considered to be the golden standard for eating disorder assessment, has good discriminative and concurrent validity (Rosen et al., 1990), internal consistency (Cooper et al., 1989), and test-retest reliability (Rizvi et al., 2000). Eating disorder symptoms are measured on a 7 point Likert scale (Cooper & Fairburn, 1987).

EDE-Q

The Dutch version of the Eating Disorders Examination-Questionnaire 6.0 (EDE-Q) (Aardoom et al., 2012; Fairburn & Beglin, 2008) will be used to asses eating disorder pathology. The EDE-Q, consists of four subscales: restraint, eating concerns, weight concerns and shape concerns (Fairburn & Beglin, 2008). The Dutch version of the EDE-Q,has good psychometric properties (Aardoom et al., 2012). The EDE-Q is a self-report questionnaire of 36 items, measuring bingeing behavior during the last four weeks. Eating pathology will be measured on a 7 point-Likert scale (Fairburn & Beglin, 2008).

2.4.3. Assessment of secondary outcomes: quality of life and clinical impairment

EQ-5D-3L

Quality of life will be measured by the threee-level variant of the five-dimensional EuroQol instrument (EQ-5D-3L) (Herdman et al., 2011). A Dutch version of the EQ-5D-3L has been made available (Versteegh et al., 2016). Psychometric properties for the Dutch version are known to be reliable for a set of different countries, including the Netherlands (Janssen et al., 2013).

CIA

Due to eating and compensatory behavior as well as concerns regarding shape, weight and eating patterns, eating disorders occur with several psychosocial impairments. In this study, clinical impairment will be assessed through the Clinical Impairment Assessment (CIA) developed by Bohn et al. (Bohn et al., 2008), which differentiates between eating disorder psychopathology and the impairment secondary to ED psychopathology. The CIA assesses clinical impairment across specific areas of life: personal, social and cognitive. The CIA is a 16 item self-report questionnaire, with items rated on a 4 point Likert scale. The Cronbach's Alpha is .97 and convergence validity .68 (Bohn et al., 2008). This study will employ the Dutch translation, which has been shown to have good psychometric properties (Schlochtermeier, 2021).

2.4.4 Costs

TiC-P

Health care costs and productivity gains/losses will be measured using the TiC-P (Bouwmans et al., 2013). The TiC-P is a self-report questionnaire measuring healthcare consumption and production losses as a consequence of psychiatric disorders. The first part of the TiC-P includes 14 structured no/yes questions on the amount of health care utilization. The second part measures productivity gains/losses by measuring absence from work and reduced efficiency of paid and unpaid work (Bouwmans et al., 2013; Hakkaart-van Roijen et al., 2002; van Hakkaart Roijen et al., 2011).

2.4.5 Other measures regarding the intervention

Demographics

Demographic characteristics, including age, gender, marital status, domestic situation, level of education and occupational/ student status, will be asked of the participants. These socio-demographic characteristics, which will serve as a moderator, will be assessed by phone during the baseline assessment.

Therapeutic Alliance (WAI)

Therapeutic alliance will be measured through the Working Alliance Inventory (WAI), a 36-item self-report questionnaire addressing working alliance between patient and therapist. The items are scored on a 7 point Likert scale, resulting in three dimensions: Bonds, Tasks and Goals (Horvath & Greenberg, 1989). The WAI has high internal reliability (Mallinckrodt & Tekie, 2016) and Cronbach's Alpha is 0.95 (Hatcher & Gillaspy, 2006). In this study, only the patient's perspective will be assessed.

2.5. Sample size and power calculation

Effects of GSH CBT-E are expected to be comparable to other self-help treatments targeting eating behavior, i.e. a 46% decrease in binge eating episodes with an effect size of Cohen's d = 0.47 between the experimental and control condition (Hilbert et al., 2019). Since self-help treatment for BED has an overall drop-out of 24% (Hilbert et al., 2019), 25% more participants are included to obtain sufficient power. Sample size calculation has been conducted using R package 'pwr'. The sample size without correction is N = 144 (n = 72 per arm). The sample size corrected for drop-out will be N = 180 (n = 90 per arm), with a power of 80%, to find an effect size of d = 0.47, α = 0.05 (2-sided).

2.6. Randomization

Randomization will take place after baseline assessment. Dual arm allocation will be

performed in a 1:1 ratio, stratified for BMI score. Strata will be defined based on BMI: 19.5≥ BMI< 30 or 30≥ BMI< 40 by randomly selected block sizes of four, six and eight. Randomization will be performed digitally using Castor EDC (https://www.castoredc.com/) by an independent Arkin data processor not involved in this study. Participants will be informed about their allocation by email by the second author. All other authors will be blinded.

2.7. Statistical Analysis

The number of binge free days, other eating disorder pathology, quality of life, clinical impairment and therapeutic alliance will be reported as means (standard deviations); and effect sizes between the two conditions will be reported as Cohen's *d*. Direct costs of the eating disorder treatment will be reported in euros. Cost-effectiveness analysis with number of binge- free days as effect measure and a cost- utility analysis using QALYs will be performed. The QALYs will be derived from the Dutch version of EQ-5D-3L (Herdman et al., 2011). Generalized Linear Mixed Models (GLMM) will be used for the analysis of intervention outcomes. The variable BMI 19.5≥ BMI< 30 and 30≥ BMI< 40 will be included in the GLMM models as covariate. Analyses will be conducted on the entire randomized sample (i.e. intention to treat), and on the per protocol/ treatment completers sample. The primary endpoint for the study is 12 weeks post-randomization. As there are no multiple primary endpoints, there will be no Bonferroni correction or other correction for the significance level applied. Missing data will be handled using multiple imputation. All analyses will be carried out using SPSS version 22+ and R version 3.0+ by an independent Arkin data processor. Results are planned to be published in international peer reviewed journals.

Figure 2 Schedule for timing of the intervention and different assessments

	STUDY PERIOD							
	Enrolment	**Allocation**	**Post-allocation**					**Close-out**
TIMEPOINT	**$-t_1$**	**0**	**T_0** week 0	**T_1** week 5	**T_2** week 12	**T_3** week 24	**T_4** week 36	**t_x** 1.5 years
ENROLMENT:								
Eligibility screen (BED/ OSFED BED classification)	X							
Informed consent	X							
Baseline assessment	X							
Read mandatory literature	X							
Allocation		X						
INTERVENTIONS:								
GSH CBT-E			◆—	—◆				
Waiting list control condition			◆—	—◆				
Treatment after waiting list control condition					◆—	—◆		
ASSESSMENTS:								
Socio demographic characteristics			X					X
Days with binge eating episodes (EDE)	X				X			X
Other eating disorder pathology (EDE-Q)			X	X	X	X	X	X
Clinical impairment assessment (CIA)			X		X	X	X	X
Quality of life (EQ-5D-5 L)			X		X	X	X	X
Therapeutic alliance (WAI)			X		X			X
Treatment Inventory of Costs (TiC-P)			X		X			

2.8. Ethical approval

Study approval was given in August 2019 by the Medical Research Ethics Committees United (*MEC-U*) (reference number NL 6958.100.19) in Nieuwegein, the Netherlands.

Discussion

This paper presents a study protocol of an RCT on the efficacy of online GSH CBT-E treatment for individuals suffering from BED and/or OSFED BED. GSH CBT-E is the first treatment in the Netherlands to follow all NICE (NICE, 2017) guidelines for BED: according to these guidelines is CBT-Enhanced the preferred treatment and that treatment should be offered through the stepped care principle, and recommending guided self-help treatment. The primary goal of GSH CBT-E is to increase the amount of binge free days; secondary goals are to decrease eating disorder pathology and clinical impairment related to the eating disorder and to improve quality of life. Short term efficacy will be assessed directly post treatment, long-term effects will be assessed 12 and 24 weeks post treatment. Direct treatment costs of the intervention will also be calculated.

GSH CBT-E has several strengths. A guided self-help variation of CBT-Enhanced, it meets all recent guidelines for individuals suffering from BED. In addition, since participants can participate in their personal environment, GSH- CBT-E enables individuals to overcome barriers they may experience with face to face treatments, such as stigma, travel time and costs and availability (Becker, Hadley Arrindell, et al., 2010; Evans et al., 2011; Shafran et al., 2009). GSH CBT-E will also reduce specialist's time invested in a single treatment (Shafran et al., 2009). Based on the number of referrals, we expect to include 12 patients a month, which should be sufficient to result in a final sample size of 180 participants, allowing for a drop-out rate of 25% (Hilbert et al., 2019).

This study may also face some challenges. Participants and therapists might not feel comfortable working in an environment that is solely online and phone based due to a lack of face to face contact, or because they might face challenges navigating within the program. Therapists and participants might also experience issues with wireless connection, reception and malware. Therapists may also find it challenging to adapt to the role of guiding self-help therapy rather than providing face to face therapy. Although after the initial session, there is no face to face contact between assessors, therapists and participants, attention will be paid to adverse events, harms or differences in disease state.

If proven effective, evidence-based online GSH CBT-E treatment meeting all NICE (NICE, 2017) guidelines can be offered in the Netherlands. This will potentially extend treatment availability for individuals classified with BED and/or OSFED BED, reduce waiting lists and decrease costs of offering and receiving treatment. If GSH CBT-E is indeed effective in treatment of BED and/or OSFED BED, it will be the first evidence based guided self-help treatment based on CBT-E in the Netherlands. Results from this study will be provided according to the CONSORT guidelines.

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Chapter 8 Efficacy Web- based Guided Self-help Cognitive Behavioral Therapy- Enhanced for Binge- Eating Disorder: a Randomized Controlled Trial

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Abstract

Background: Owing to the gap between treatment supply and demand, there are long waiting periods for patients with binge eating disorder, and there is an urgent need to increase their access to specialized treatment. Guided self-help cognitive behavioral therapy–enhanced (CBT-E) may have great advantages for patients if its efficacy can be established.

Objective: The aim of this study is to examine the efficacy of guided self-help CBT-E compared with that of a delayed-treatment control condition.

Methods: A single-blind 2-arm randomized controlled trial was designed to evaluate guided self-help CBT-E according to an intention-to-treat analysis. A total of 180 patients were randomly assigned to guided self-help CBT-E (n=90) or the delayed-treatment control condition (n=90) for which guided self-help CBT-E was provided after the initial 12-week delay. The primary outcome was reduction in binges. The secondary outcome was full recovery at the end of treatment, as measured using the Eating Disorder Examination during the last 4 weeks of treatment. A linear mixed model analysis was performed to compare treatment outcomes at the end of treatment. A second linear mixed model analysis was performed to measure between- and within-group effects for up to 24 weeks of follow-up. The Eating Disorder Examination–Questionnaire and clinical impairment assessment were conducted before and after treatment and during follow-up. In addition, dropout rates were assessed in both conditions.

Results: During the last 4 weeks of treatment, objective binges reduced from an average of 19 (16) to 3 (5) binges, and 40% (36/90) showed full recovery in the guided self-help CBT-E group. Between-group effect size (Cohen *d*) was 1.0 for objective binges. At follow-up, after both groups received treatment, there was no longer a difference between groups. Of the 180 participants, 142 (78.9%) completed treatment. Overall treatment dropout appeared to be

associated with gender, level of education, and number of objective binges at baseline but not with treatment condition.

Conclusions: This is the first study to investigate the efficacy of guided self-help CBT-E. Guided self-help CBT-E appeared to be an efficacious treatment. This study's findings underscore the international guidelines recommending this type of treatment for binge eating disorder.

Trial registration: The study protocol is registered with the Netherlands Trial Registry NTR (NTR 7994) since 6 September 2019.

Ethics: Study approval was given in August 2019 by the Medical Research Ethics Committees United (MEC-U) (referencenumber NL 6958.100.19) in Nieuwegein, the Netherlands

Keywords: Randomized Controlled Trial; Binge- eating disorder; Guided self-help; Cognitive Behavioral Therapy-Enhanced

Background

Binge- eating disorder (BED), recently included in the DSM 5, is characterized by recurrent episodes of binge eating. The binges are accompanied by a sense of lack of control and feelings of shame, guilt and disgust. However, the binges are not followed by inadequate compensatory behavior (APA, 2013; Mustelin et al., 2016). BED is the most common eating disorder and has an estimated life-time prevalence of 2% (Keski-Rahkonen & Mustelin, 2016), and up to 30% among people with excess weight (Van der Horst et al., 2019). BED has a significant impact on psychosocial functioning, affecting the personal, social and cognitive domain of affected individuals (Bohn et al., 2008). Recently, the estimated prevalence of BED has increased, and patients seeking help display more severe symptoms, which is possibly related to the Covid-19 pandemic (Termorshuizen et al., 2020). Around 33-48% of the patients reported increased eating disorder symptomatology (Accurso et al., 2015; Fernández-Aranda et al., 2020). Potential reasons for this increase during the pandemic are social isolation, and decreased social support (Niu & Xu, 2020). Other potential reasons include increased stress, restricted access to health care, and food insecurity (Murphy et al., 2020). Finally, increased social media exposure resulted in increased exposure to the thin ideal (Sabik, 2020), and an uptick in phat-phobic messages which leads to dieting behavior (Murphy et al., 2020) and therefore an increase in binges (Fairburn, 2008).

Cognitive behavioral therapy-enhanced (CBT-E) is a recommended treatment for BED (Cooper & Fairburn, 2011; Fairburn, 2008; Fairburn et al., 2003) and has remission rates of 50-68% in efficacy trials (Fairburn et al., 2015; Fairburn et al., 2009). International guidelines recommend guided self-help based on cognitive behavioral principles for BED (ANZAED, 2014; LSMR, 2017; NICE, 2017). Only a few studies have examined the efficacy of guided self-help interventions for patients with BED. Guided self-help studies based on regular CBT report abstinence of binge eating after treatment among 46% of the participants, and a

sizeable reduction in eating disorder pathology of a medium effect size (Carrard et al., 2011; Hilbert et al., 2019). However, the efficacy of web- based guided self-help CBT-E has not yet been investigated.

Owing to the lack of specialized therapists in the Netherlands, as in many parts of the world, there is a gap between treatment supply and demand (Melisse et al., 2020), resulting in long waiting periods for patients with BED. Therefore, there is an urgent need to increase access to treatment (Abrahamsson et al., 2018). This situation worsened during the Covid-19 pandemic, when waiting times for treatment increased further and access to care decreased (Devoe et al., 2022). A remotely offered guided self-help version of CBT-E has the potential to offer treatment with reduced therapist involvement (Crow et al., 2013). This in turn will enhance treatment availability and thus potentially reduce waiting-time before treatment can commence, because long waiting times are unfavorable and associated with a negative treatment outcome (Carter, 2012).

Guided self-help CBT-E has advantages for the patient, such as the removal of geographical barriers, reduced travel costs and time, as communication with the therapist is enabled regardless of location (Abrahamsson et al., 2018; Becker et al., 2010; Evans et al., 2011; Linardon et al., 2021).However, there are, potentially some disadvantages too, such as higher attrition rates, less adherence, and a less credible image in both patients and therapists (Nordgreen et al., 2010; Titov et al., 2008; Waller & Gilbody, 2009).

The aim of this study was to examine the efficacy of guided self-help CBT-E compared with that of a delayed-treatment control condition through a randomized controlled trial (RCT) in patients with BED. The primary outcome is reduction in binge eating episodes, and the secondary outcome is the full recovery rate after treatment, as measured during the last 4 weeks of treatment. Web-based, guided self-help CBT-E is hypothesized to be superior to the control condition in reducing binge eating episodes and achieving full recovery. Follow-up

measures will be conducted to measure the persistence of treatment benefits. It is hypothesized that treatment gains persist during the 12-week and 24-week follow-up and that there will be no differences between the groups after both groups received treatment.

2. Methods

2.1 Trial design

A superiority RCT to examine the efficacy of web- based guided self-help CBT-E at end-of-treatment (EOT) among patients with BED or other specified feeding or eating disorder (OSFED)-BED. Parallel groups were randomly assigned to one of two conditions: (i) guided self-help CBT-E (N = 89) or to (ii) a delayed treatment control condition (N = 91), in which guided self-help CBT-E was offered after a waiting period of 12 weeks. The assessors were blinded to the randomization. In addition, allocation was balanced (1:1), and randomization was stratified for body mass index (BMI) below 29.9 or above 30. The guided self-help CBT-E group was assessed at baseline (T0: week 0), week 5 (T1: intermediate evaluation of treatment), week 12 (T2: post-treatment), week 24 (T3: 12 weeks follow-up), and week 36 (T4: 24 weeks follow-up). The delayed treatment control group was assessed at baseline (T0: week 0), week 5 (T1: during waiting time), week 12 (T2: start of delayed treatment), week 24 (T3: post-treatment), and week 36 (T4: 12 weeks follow-up). The study was performed in line with the updated CONSORT guidelines for reporting parallel group randomized trials (Schulz et al., 2010).

2.2 Participants

Eligible patients were aged 18 or over, with a DSM-5 BED or OSFED-BED diagnosis (APA, 2013) and had a BMI between 19.5 and 40, since CBT-E was explicitly designed for non-underweight patients with a BMI up to 40 (Fairburn, 2008). Sufficient proficiency in Dutch and internet access were required. Exclusion criteria were eating disorders other than BED or OSFED-BED, acute psychosis, clinical depression and/or suicidal ideation, having received eating disorder treatment in the past six months, being pregnant, and use of medication that might influence eating behavior. For example mirtazapine, olanzapine, clozapine, quetiapine, trazodone, and lithium increase appetite, while medications including methylphenidate, dexamphetamine decrease appetite (2022). The Dutch version of the semi-structured interview SCID-5-CV, assessing DSM-5 diagnoses (APA, 2013; First et al., 2016) was employed to establish the presence of diagnostic exclusion criteria. The interview sections for mood disorders and psychotic disorders were administered. The study was conducted at Novarum, the Dutch eating disorders and obesity department of Arkin, a large mental health care provider in Amsterdam. All eligible potential participants received verbal and written study information during an advisory session, including an informed consent description, explaining the research goals and information about participation. After patients provided informed consent, a baseline assessment (T0) was scheduled. Recruitment took place between September 2019 and October 2020. Diagnostic interviews were held in-person until March 15, 2020, after which, due to the Covid 19 social distancing measures, all interviews were held through videoconferencing.

2.3. Intervention

Treatment was offered by therapists with various backgrounds and educational levels (Bachelors degree for dieticians and nurse practitioners; Masters and post-doctoral degree for psychologists). All therapists successfully completed a web-based CBT-E training provided

by the Centre for Research on Eating Disorders at Oxford, United Kingdom. They first familiarized themselves with the detailed CBT-E manual and the guided self-help CBT-E manual (Fairburn, 2008). They also attended a two-day workshop provided by authors BM and MdeJ. To ensure treatment adherence, all therapists attended weekly 45 minutes supervision sessions with BM, and rated their level of adherence after each session on a scale ranging from "not at all" (0) to "excellent" (5). Self-rated therapist adherence was very good, with 94.7% of all sessions obtaining the maximum score of excellent adherence.

2.3.1 Guided self-help CBT-E condition

Guided self-help CBT-E started in the same week as the baseline assessment. Before commencing treatment, patients were required to read the psycho-educational section of the Dutch version of *Overcoming Binge Eating, The Proven Program to Learn Why You Binge and How You Can Stop.* Guided self-help CBT-E is a translated and digitalized version of Part Two of the self-help book *Overcoming Binge Eating* (Fairburn, 2013). The intervention included psychoeducation, daily assignments and two self-evaluations each week. When patients did not complete their daily assignments, they received reminders. Patients uploaded their assignments in the web- based therapy environment. Therapists were able to track when the patients logged in, read the psychoeducational parts and started the assignments. Once patients completed their home work assignments the therapist received a notification. Subsequently, feedback on the assignments was given by the therapists during a weekly telephone session of 20 minutes. In the telephone session, completed assignments were discussed, as well as upcoming assignments and compliance to treatment. The sessions were scripted in accordance with the treatment manual as developed by EvdB and BM, and offered by therapists through the telephone.

Like CBT-E guided self-help CBT-E consisted of four phases; the first stage focused on establishing regular eating and alternatives for binge-eating, using real-time self-monitoring as central intervention, and events, moods and eating. After joint review of progress & designing rest of treatment in the second stage, based on the patients reported symptoms and maintaining mechanisms of their BED, the third stage focused on either dietary restraint or shape concern and finally ending well with a firm focus on minimizing the risk of relapse in the long term.

2.3.2 Delayed treatment control condition

Participants assigned to the delayed treatment control condition started guided self-help CBT-E 12 weeks after baseline. Thus, their treatment started after a waiting period with the same duration as the intervention. Similar to the experimental condition, patients randomized to the control condition were advised to read the psycho-educational section of *Overcoming Binge Eating, The Proven Program to Learn Why You Binge and How You Can Stop* (Fairburn, 2013) prior to commencing treatment. This was recommended to bridge the 12-week waiting period and keep them involved and enrolled with the study. However, these patients did not receive any treatment assignments during this period and did not have access to the web-based treatment environment. Participants were called once after six weeks for a short conversation, 10 minutes at most: checking on the eating disorder symptoms and other important areas of life, and answering questions about the recommended reading assignment.

2.4 Outcomes

The primary outcome indicator was reduction of binge eating at T2. Binge eating was measured during the last 28 days with the Dutch Eating Disorder Examination (EDE), a

validated expert interview. Secondary outcome indicator was full recovery at T2 which was defined as an EDE global score <1.77 as well as abstinence from binge eating during the last 28 days (Turner et al., 2015). The cut-off on the EDE global score of <1.77 was based on the community mean plus one standard deviation (Cooper et al., 1989; Jansen et al., 2000). Other outcome measures were reliable change index (RCI) and clinical significant change (CSC) (Jacobson & Truax, 1991; Moore et al., 2021). RCI was established as RCI= 0.54 on the EDE global score and CSC was defined as EDE global score < 1.77 as well as a pre-to-posttest change > RCI (Cooper et al., 1989; Jacobson & Truax, 1991). Outcome measures on self-report data were reduction of binge eating during the last four weeks measured at T2, T3, and T4 with the Dutch version of the Eating Disorder Examination-Questionnaire (EDE-Q), a validated self-report questionnaire (Aardoom et al., 2012; Fairburn & Beglin, 2008). Full recovery was defined as EDE-Q global score under 2.77 (based on the community mean plus one standard deviation) combined with the absence of binges as described in Turner, 2015 (Calugi et al., 2017; Dalle Grave et al., 2015; Turner et al., 2015). Cutoff on the EDE-Q was 2.77 and RCI was 0.63 on the EDE-Q global score, together they defined CSC (Fairburn & Beglin, 2008; Jacobson & Truax, 1991). Last outcome measure was reduction of secondary impairment due to eating disorder behavior during the last 28 days, as measured by the Clinical Impairment Assessment (CIA) (Bohn et al., 2008). Interview data (EDE) were collected at baseline and after conclusion of guided self-help CBT-E of the experimental group (T0 and T2). Data from self-report measures (EDE-Q, CIA) were collected at T0, T2, and at T3 and T4. In addition, the EDE-Q was also completed at T1, five weeks after treatment commenced, in order to evaluate treatment progression between patient and therapist. Interviews were held by phone, self-report measures were administered on the web All assessments were processed in Castor EDC (CASTOR & EDC) ISO 27001/27002/9001 and NEN 7510 certified.

2.5 Sample size estimation

Based on other self-help interventions, a decrease of 46% in binge eating behavior was expected over time (Hilbert et al., 2019). Expected effect size was Cohen's $d = 0.47$ between the experimental and control condition (Cohen, 1977; Hilbert et al., 2019). For sufficient power ($\beta = 0.8$), the required sample size was $N = 144$ ($n = 72$ per arm). As 20% drop-out was estimated (Hilbert et al., 2019), more participants were included: $N = 180$ ($n = 90$ per arm) resulting in $n = 72$ expected completers, yielding a power of $\beta = 0.8$, with an effect size of $d = 0.47$, at $\alpha = 0.05$ (2-sided). Sample size was calculated using *R* package 'pwr' (Champely, 2020).

2.6 Randomization and blinding

Randomizations were performed by administrative staff members of another department in Castor EDC (CASTOR & EDC) by a 4, 6, 8 block design. Assessors were research assistants with a Master degree in psychology who were blinded to the allocated treatment condition, as were the staff members performing randomizations. In addition, when offering treatment therapists were not aware whether patients previously had been allocated to the experimental or control condition.

2.7 Statistical analysis

Baseline differences: Significance of baseline differences between groups were examined with chi-square tests or ANOVA.

Treatment adherence: Regression analyses were conducted to assess if baseline scores (number of objective binges, eating disorder severity, and BMI) and demographics (age, gender, level of education, profession, country of birth) predicted treatment completion.

2x2 design: Primary outcome was treatment effects based on interview data (EDE) with regard to reduction in binge eating episodes and full recovery at post-test between the experimental and delayed treatment control group, which were compared after 12 weeks, when the experimental group had concluded treatment (T2). Since patients were initially supposed the be nested within their BMI group as described in the protocol (Melisse, Berg, et al., 2021), for the primary outcome measures a 2x2 design was employed using a generalized linear mixed model analysis (Field et al., 2012), with group as between subjects factor and time of assessment as the within factor at the primary endpoint. Since full recovery was a binary variable, a negative binomial model with log link was used.

2x5 design: Self-report data (EDE-Q and CIA) were analyzed with a 2x5 generalized linear mixed model analysis (Field et al., 2012), with group as between subjects factor and time of assessment as the within factor, which also measured persistence of treatment benefits after EOT. For full recovery (binary variable), a negative binomial model with log link was used.

Effect sizes: Effect sizes for both designs were calculated between and within groups using Cohen's *d* (0.2 small, 0.5 medium, 0.8 large) (Cohen, 1977).

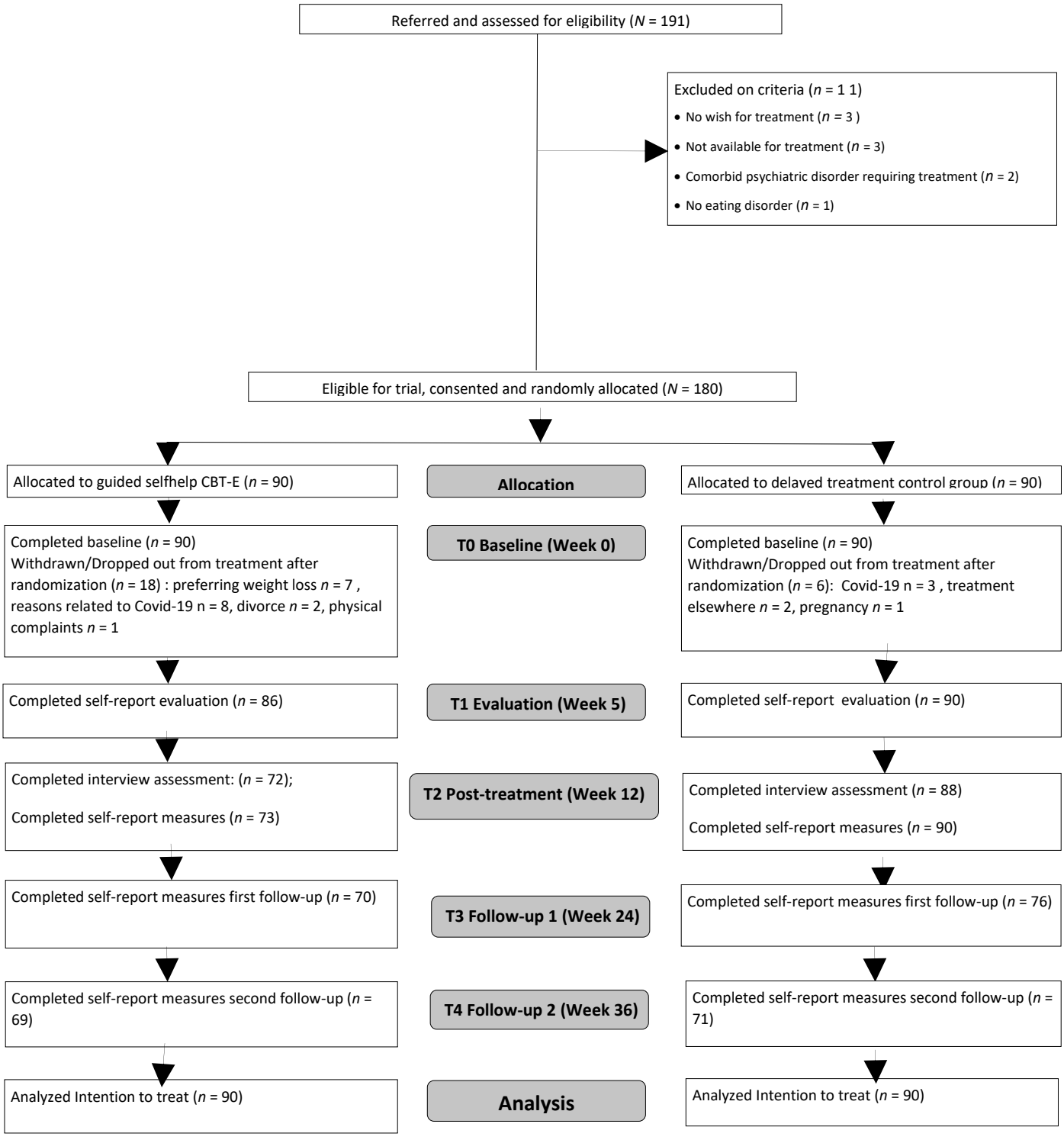
Imputation and software: Analyses were performed according to an intention-to-treat (ITT) approach (imputed dataset with 25 imputations for each missing observation) (Rubin, 2004). Imputations were performed with the multiple imputation by chained equations, using predictive mean matching combining 25 imputations in R package 'mice' (Van Buuren, 2011). All other statistical analyses were performed with SPSS version 25 and 28.

Results

3.1 Patient flow

Potential participants (N=191) were recruited between September 2019 and October 2020. In total, 180 patients were randomized, excluding 11 who did not meet the inclusion criteria or met the exclusion criteria; 176 were diagnosed with BED of which 4 had a history of bariatric surgery, had smaller binges, and were therefore diagnosed with OSFED-BED. The CONSORT flow diagram (Figure 1) shows participant enrollment and flow throughout the study, and Table 1 summarizes participant characteristics at baseline. The treatment conditions were comparable; there were no significant differences between the 2 conditions ($P>.05$). One patient withdrew before the baseline assessment was completed. Last therapy concluded in April 2021, and last follow-up data were completed in August 2021. No serious adverse events occurred during the trial.

Figure 1 Flowchart of patients in study



T0 assessment week 0, *T2* assessment week 12, *T3* assessment week 24, *T4* assessment week 36

Table 1 Patient characteristics at baseline.

	Total sample *N* = 180	Experimental condition *n* = 90	Delayed treatment control group *n* = 90	*p*
Age, mean (SD)	39.4 (13.1)	39.2 (13.6)	40.6 (13.5)	.762
Baseline BMI, mean (SD)	33.4 (5.3)	34.0 (5.6)	32.9 (5.0)	.514
Gender, *n* (%)				.547
Women	163 (90.6%)	82 (95.1%)	81 (92.6%)	
Men	17 (9.4%)	7 (8.2%)	10 (12.3%)	
Highest level of education, *n* (%)				.605
No education	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Primary school	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Lower vocational eduction	5 (2.8%)	4 (4.9%)	1 (1.2%)	
Lower general secondary education	7 (3.9%)	5 (6.6%)	2 (2.5%)	
Senior general seondary education/ university prepatory education	15 (8.3%)	5 (6.6%)	10 (12.3%)	
Secondary vocational education	51 (28.3%)	23 (26.2%)	27 (29.6%)	
Higher professional education	63 (35.0%)	33 (37.7%)	30 (34.6%)	
University	35 (21.1%)	16 (19.0%)	19 (21.0%)	
Unknown	1 (0.6%)	0 (0.0%)	1 (1.2%)	
Profession, *n* (%)				.051
Student	19 (10.6%)	9 (9.8%)	10 (12.3%)	
Employed	120 (66.7%)	55 (63.9%)	65 (74.1%)	
Volunteer job	6 (3.3%)	4 (4.9%)	2 (2.5%)	
Unemployed	12 (6.7%)	1 (1.6%)	8 (8.6%)	
Other	23 (12.8%)	17 (19.7%)	6 (6.2%)	
Civil status, *n* (%)				.985
Single	101 (56.6%)	45 (50.8%)	48 (53.1%)	
Registered partnership	12 (6.7%)	6 (8.2%)	6 (7.4%)	
Married	56 (31.1%)	31 (34.4%)	29 (32.1%)	
Divorced	11 (6.1%)	5 (6.6%)	6 (7.4%)	
Duration of eating disorder (years), mean (SD)	25.04 (4.15)	23.07 (3.85)	26.23 (4.36)	.373
Eating disorder treatment in the past, *n* (%)				.490
Yes	30 (16.7%)	14 (16.4%)	19 (21.0%)	
No	150 (83.3%)	74 (83.6%)	71 (79.0%)	
Comorbid diagnosis, *n* (%)				.769
No	77 (42.2%)	33 (37.7%)	44 (44.4%)	
I don't know	25 (13.9%)	14 (18.0%)	11 (13.9%)	
Mood disorder	24 (13.3%)	10 (11.5%)	14 (16.0%)	
Anxiety disorder	11 (6.1%)	7 (9.8%)	4 (4.9%)	

Attention deficit (hyperactive) disorder	11 (6.1%)	5 (6.6%)	6 (7.4%)	
Post traumatic stress disorder	6 (3.3%)	5 (6.6%)	1 (1.2%)	
Personality disorder	11 (6.1%)	9 (9.8%)	2 (2.5%)	
Autism	6 (3.3%)	6 (8.2%)	0 (0.0%)	
Other	15 (8.3%)	6 (8.2%)	9 (11.1%)	
Use of medication, *n* (%)				
Yes	45 (25.6%)	23 (27.9%)	22 (25.9%)	.588
No	134 (74.4%)	64 (72.1%)	67 (74.1%)	
Eating disorder pathology (EDE), *M* (SD)				
Total score	3.03 (0.9)	3.4 (1.0)	3.0 (0.9)	.492
Dietary restraint	2.2 (1.2)	2.9 (1.1)	2.0 (1.3)	.088
Eating concern	2.5 (1.3)	3.5 (1.3)	2.3 (1.2)	.596
Weight concern	3.6 (1.1)	3.6 (1.1)	3.6 (1.1)	.849
Shape concern	3.8 (1.2)	3.8 (1.3)	3.8 (1.1)	.672
Eating disorder pathology (EDE-Q total score), *M* (SD)	3.5 (1.0)	3.9 (1.0)	3.5 (1.0)	.476
Binge eating (EDE), *M* (SD)				
Objective episodes	17.9 (14.5)	19.4 (16.3)	16.0 (13.8)	.398
Subjective episodes	14.5 (20.2)	17.8 (25.6)	14.7 (17.9)	.108
Days with objective episodes	14.3 (8.8)	15.46 (8.8)	12.9 (8.1)	.314
Days with subjective episodes	9.4 (10.2)	11.1 (11.3)	9.7 (10.1)	.113
Secondary pathology (CIA), *M* (SD)				
Total score	22.3(8.6)	23.21 (8.4)	22.0 (8.2)	.579
Personal	13.2 (4.2)	13.63 (3.7)	13.3 (4.0)	.498
Social	4.8 (2.7)	5.01 (2.6)	4.6 (2.8)	.719
Cognitive	4.3 (3.4)	4.55 (3.8)	4.7 (3.2)	.362

BMI body mass index, *CIA* clinical impairment assessment, *EDE* eating disorder examination, *EDE-Q* eating disorder examination- questionnaire, *M* mean, *SD* standard deviation

3.2 Treatment adherence

Participants were considered completers once they attended 11 sessions. Of the participants who started treatment (N=180), 142 completed at least 11 sessions (overall completion rate: 142/180, 78.9%; experimental condition: 69/90, 77.5%; control condition: 73/90, 80.2%). As only 10.7% (19/180) of the participants had a BMI <30 kg/m^2, no subgroup analyses based on stratification below and above BMI 30 kg/m^2 were performed. Treatment dropout was higher among men (χ^2_1=7.6, *P*=.011), less-educated patients (χ^2_5=18.8, *P*=.005), and patients who displayed a greater number of objective binges at the start (*t*=49.90, *P*=.023). Treatment completion was not predicted by treatment condition (*P*=.541), age (*P*=.507), profession (*P*=.451), marital status (*P*=.179), eating disorder treatment in the past (*P*=.268), medication use (*P*=.474), BMI (*P*=.638), EDE restraint (*P*=.733), EDE eating (*P*=.375), EDE weight concern (*P*=.282), EDE shape concern (*P*=.189), and EDE global score (*P*=.213). Study dropout among participants who completed treatment was 2.8% (5/180, 3 patients (3/180, 1.7%) did not complete the follow-up measures at T3 weeks and T4 weeks, and for 2 additional patients (2/180, 2.8%), no assessments at T4 were available.

3.3 Outcomes

3.3.1 Binges

Table 2 shows that at EOT, as measured by the EDE, the guided self-help group had 3 objective binges during the last 28 days and the delayed-treatment group had 13 binges during the last 28 days of their wait time. At T2, in total, 48% (42/90) of the participants assigned to the guided self-help CBT-E showed abstinence of binge eating during the last 4 weeks. A 2×2 generalized linear mixed model analysis with fixed effects showed differences between the experimental and control groups at T2. There was an interaction effect between time and treatment condition ($F_{2,178}$=18.55, *P*<.001). Comparable results were found for subjective

binges ($F_{2,178}$=10.08, P<.001). When the same analysis was repeated for objective binges as measured by the EDE-Q, a 2×5 generalized linear mixed model analysis with fixed effects showed an interaction effect between time and treatment condition ($F_{7,173}$=108.82, P<.001). However, the difference disappeared when both groups received treatment at T3 (P=.587) and T4 (P=.690). Results from both analyses indicated that objective binges reduced faster in the guided self-help group than in the delayed-treatment group. Assessments at T3 and T4 showed persistence of treatment benefits for patients of the experimental condition. There were no differences between the ITT and the completers sample.

3.3.2 Full recovery

As measured by the EDE, at EOT, full recovery was achieved in 40% (36/90) during the last 28 days in the guided self-help group and 6.7% (6/90) fully recovered during the last 28 days of their wait time (Table 3). Clinical significant change was achieved by 56% (50/90) and 7% (35/90) in the experimental and control conditions, respectively. An interaction effect between time and treatment condition at T2 ($F_{2,178}$=7.90, P=.006) was found in a 2×2 generalized linear mixed model analysis with fixed effects. This indicated greater recovery based on the EDE in the guided self-help CBT-E group than in the delayed-treatment group. A 2×5 analysis based on EDE-Q data showed an interaction effect between time and treatment condition ($F_{7,173}$=14.02, P<.001). This difference disappeared when both groups received treatment at T3 (P=.986) and T4 (P=.991). Both results indicate that the guided self-help group recovered faster than the delayed-treatment group.

Table 2 Changes in binge eating behaviors and EDE scores over the course of treatment assessed using intention to treat analysis with multiple imputations

	Guided self-help CBT-E (*n* = 90)					Delayed treatment control condition (*n* = 90)					Between groups at T2	
	T0 *M*(SD)	T2 *M*(SD)	*F*	Within groups T0-T2 EMD [95% CI]	Within groups T0-T2 Effect size, Cohens *d* [95% CI]	T0 *M*(SD)	T2 *M*(SD)	*F*	Within groups T0-T2 EMD [95% CI]	Within groups T0-T2 Effect size, Cohens *d* [95% CI]	EMD [95% CI]	Effect size, Cohens *d*
Number of objective binges	19.4 (16.3)	2.6 (5.2)	78.9*	-16.8 [-20.4--13.2]	1.4 [1.1-1.7]	16.0 (13.8)	13.1 (13.8)	4.3	-3.0 [-1.0-7.0]	0.2 [-0.1-0.5]	-10.4 [-13.6--7.3]	1.0
Days objective binges	15.5 (8.8)	2.2 (3.5)	121.7*	-13.3 [-15.2--11.3]	2.0 [1.6-2.3]	12.9 (8.1)	10.3 (8.1)	7.6	-2.6 [-5.0--0.3]	0.3 [0.0-0.6]	-8.1 [-9.9--6.2]	1.3
Number of subjective binges	17.8 (25.6)	4.7 (8.8)	13.7*	-13.1 [-18.8--7.4]	0.7 [0.4-1.0]	14.7 (17.9)	14.9 (24.1)	0.1	-0.8 [6.4-6.0]	0.0 [-0.3-0.3]	-10.3 [-15.6--4.9]	0.6
Days subjective binges	11.1 (11.3)	4.0 (5.9)	19.5*	-7.1 [-9.8--4.4]	0.8 [0.5-1.1]	9.7 (10.1)	9.9 (10.5)	0.0	0.0 [-3.1-3.0]	0.0 [-0.3-0.3]	-5.9 [-8.4--3.4]	0.7
EDE global score	3.4 (1.0)	1.7 (0.9)	125.8*	-1.7 [-2.0--1.4]	1.8 [1.4-2.1]	3.0 (0.9)	2.8 (0.9)	3.6	-0.2 [-0.1-0.4]	0.2 [-0.1-0.5]	-1.1 [-1.4--0.8]	1.2
EDE dietary restraint	2.9 (1.1)	0.7 (0.9)	106.0*	-2.2 [-2.5--1.9]	2.1 [1.7-2.5]	2.0 (1.3)	1.6 (1.2)	5.4	-0.4 [-0.8--0.0]	0.3 [0.0-0.6]	-0.9 [-1.2--0.5]	0.8

	Guided self-help CBT-E (*n* = 90)					Delayed treatment control condition (*n* = 90)					Between groups at T2		
	T0 *M*(SD)	T2 *M*(SD)	*F*	Within groups T0-T2 EMD [95% CI]	Within groups T0-T2 Effect size, Cohens *d* [95% CI]	T0 *M*(SD)	T2 *M*(SD)	*F*	Within groups T0-T2 EMD [95% CI]	Within groups T0-T2 Effect size, Cohens *d* [95% CI]	EMD	[95% CI]	Effect size, Cohens *d*
EDE eating concern	3.5 (1.3)	1.1 (1.0)	84.2*	-2.4 [-2.8--2.1]	2.1 [1.7-2.5]	2.3 (1.2)	2.3 (1.3)	0.1	0.1 [-0.4-0.4]	0.0 [-0.3-0.3]	- 1.2 [-1.6--0.9]		1.1
EDE shape concern	3.8 (1.3)	2.5 (1.2)	69.0*	-1.3 [-1.7--0.9]	1.0 [0.7-1.3]	3.8 (1.1)	3.8 (1.1)	0.5	-0.1 [-0.2-0.4]	0.0 [-0.2-0.6]	-1.3 [-1.6--0.9]		1.1
EDE weight concern	3.6 (1.1)	2.5 (1.2)	56.0*	-1.2 [-1.5--0.8]	1.0 [0.7-1.3]	3.6 (1.1)	3.5 (1.1)	0.6	-0.1 [-0.2-0.4]	0.1 [-0.2-0.6]	- 1.03 [-1.4--0.7]		0.9

* $p < .001$

** $p < .05$

CBT-E cognitive behavior therapy- enhanced, *EDE* eating disorder examination, *EMD* estimated mean difference, *CI* confidence interval, *M* mean, *SD* standard deviation, *T0* assessment week 0, *T2* assessment week 12

Table 3 Remission rates for the intention to treat sample

Guided self-help CBT-E (*n* = 90)		**T0**	**T2**	**T3**	**T4**
	Absence of objective binges (*n*, %)	5 (5.5%)	43 (47.8%)	*NA*	*NA*
	EDE global< 1.77 (*n*, %)	5 (5.5%)	56 (62.2%)	*NA*	*NA*
	Full recovery [1] (*n*, %)	0 (0.0%)	36 (40.0%)	*NA*	*NA*
	RCI (*n*, %)	*NA*	71 (78.9%)	*NA*	*NA*
	CSC [2] (*n*, %)	*NA*	51 (56.7%)	*NA*	*NA*
	Unchanged (*n*, %)	*NA*	5 (5.5%)	*NA*	*NA*
	Deteriorated (*n*, %)	*NA*	13 (14.8%)	*NA*	*NA*
	EDE restraint< 1.75 (*n*, %)	27 (30.0%)	74 (82.2%)	*NA*	*NA*
	EDE eating concern< 0.86 (*n*, %)	7 (7.8%)	49 (54.4%)	*NA*	*NA*
	EDE shape concern< 2.43 (*n*, %)	16 (17.7%)	48 (53.3%)	*NA*	*NA*
	EDE weight concern< 2.11 (*n*, %)	4 (4.4%)	36 (40.0%)	*NA*	*NA*
EDE-Q	Absence of objective binges (*n*, %)	0 (0.0%)	20 (22.2%)	42 (46.7%)	38 (42.2%)
	EDE-Q< 2.77 (*n*, %)	2 (2.2%)	71 (78.9%)	64 (71.1%)	58 (64.4%)
	Full recovery [3] (*n*, %)	0 (0.0%)	19 (21.1%)	35 (38.9%)	32 (35.6%)
	RCI (*n*, %)	*NA*	71 (78.9%)	70 (77.8%)	65 (72.2%)
	CSC [4] (*n*, %)	*NA*	59 (65.6%)	58 (64.4%)	51 (56.7%)
	Unchanged (*n*, %)	*NA*	6 (6.6%)	4 (4.9%)	13 (14.8%)
	Deteriorated (*n*, %)	*NA*	3 (3.3%)	6 (6.6%)	6 (6.6%)
CIA	CIA<16 (*n*, %)	22 (24.4%)	68 (75.6%)	65 (72.2%)	64 (71.1%)
Delayed treatment control group (*n* = 90)					
EDE	Absence of objective binges (*n*, %)	3 (3.3%)	9 (10.0%)	*NA*	*NA*
	EDE global< 1.77 (*n*, %)	10 (11.1%)	11 (12.2%)	*NA*	*NA*
	Full recovery [1] (*n*, %)	1 (1.1%)	6 (6.7%)	*NA*	*NA*
	RCI (*n*, %)	*NA*	21 (23.5%)	*NA*	*NA*
	CSC [2] (*n*, %)	*NA*	6 (6.7%)	*NA*	*NA*
	Unchanged (*n*, %)	*NA*	36 (40.0%)	*NA*	*NA*
	Deteriorated (*n*, %)	*NA*	11 (12.2%)	*NA*	*NA*
	EDE restraint< 1.75 (*n*, %)	37 (41.1%)	53 (58.0%)	*NA*	*NA*
	EDE eating concern< 0.86 (*n*, %)	7 (7.8%)	9 (10.0%)	*NA*	*NA*
	EDE shape concern< 2.43 (*n*, %)	9 (10.0%)	12 (13.3%)	*NA*	*NA*
	EDE weight concern< 2.11 (*n*, %)	8 (8.9%)	11 (12.2%)	*NA*	*NA*
EDE-Q	Absence of objective binges (*n*, %)	1 (1.1%)	7 (7.8%)	28 (31.1%)	28 (31.1%)
	EDE-Q< 2.77 (*n*, %)	20 (22.2%)	29 (32.2%)	69 (75.5%)	58 (64.2%)
	Full recovery [3] (*n*, %)	1 (1.1%)	3 (3.3%)	26 (28.9%)	25 (27.8%)
	RCI (*n*, %)	*NA*	28 (31.1%)	76 (84.4%)	61 (67.8%)
	CSC [4] (*n*, %)	*NA*	19 (21.1%)	65 (72.2%)	52 (57.8%)
	Unchanged (*n*, %)	*NA*	40 (44.4%)	10 (11.1%)	11 (12.2%)
	Deteriorated (*n*, %)	*NA*	6 (6.6%)	1 (1.1%)	6 (6.6%)
CIA	CIA<16 (*n*, %)	26 (28.9%)	27 (30.0%)	62 (68.9%)	63 (70.0%)

[1] Full recovery: EDE< 1.77, BMI> 18.5 and no binge eating,

[2] Clinical significant change combination of EDE< 1.77 and reliable change: reduction of 0.54 on the EDE global score

[3] Full recovery: EDE-Q< 2.77, BMI> 18.5 and no binge eating

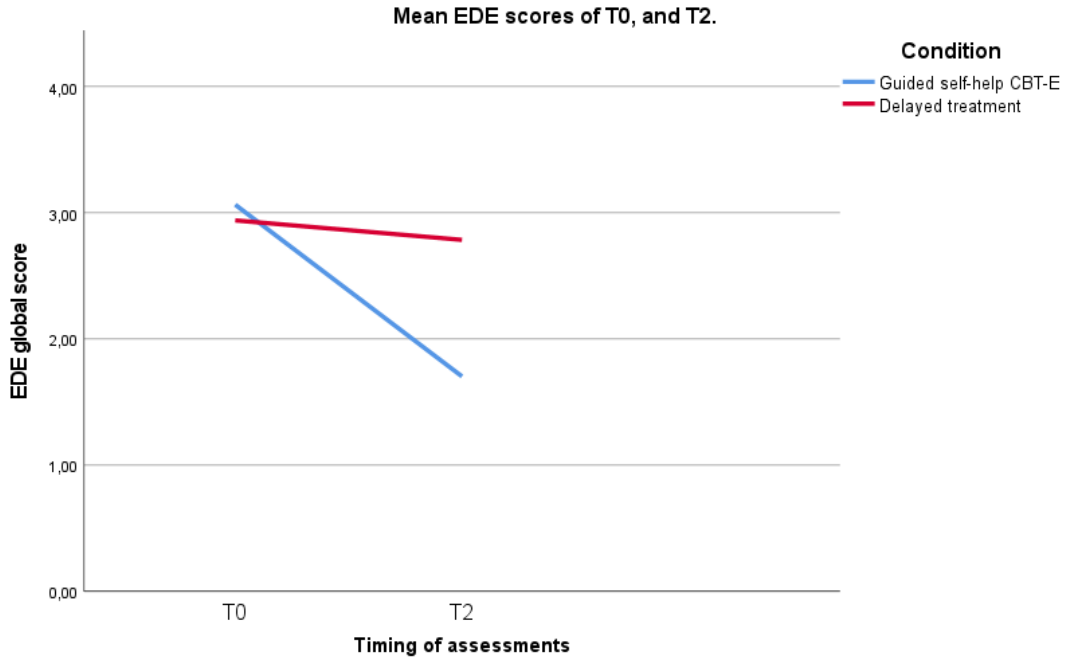
[4] Clinical significant change: combination of EDE-Q< 2.77 and reliable change: reduction of 0.63 on the EDE-Q global score

CIA clinical impairment assessment, *CSC* clinical significant change, *CBT-E* cognitive behavior therapy – enhanced, *EDE* eating disorder examination , *EDE-Q* eating disorder examination-questionnaire, *NA* not applicable, *RCI* reliable change index, *T0* assessment week 0, *T2* assessment week 12, *T3* assessment week 24, *T4* assessment week 36

3.3.4 Global scores on eating disorder measures

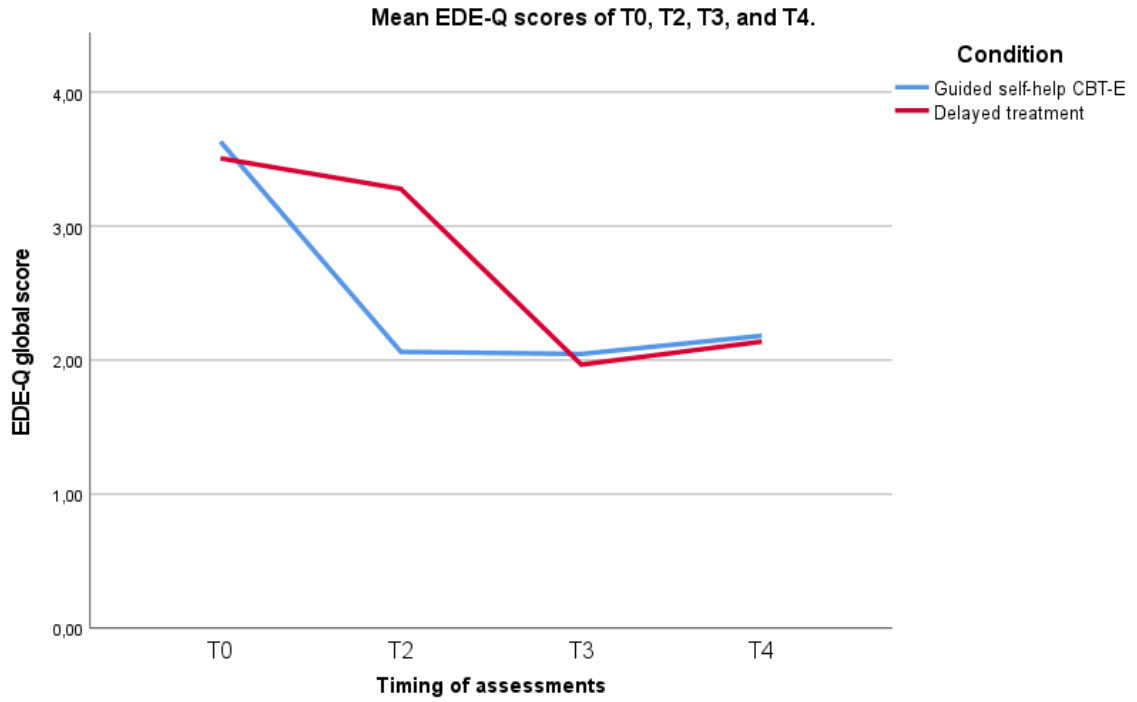
Figure 2 shows that a 2×2 generalized linear mixed model analysis with fixed effects showed differences in the EDE global score between the experimental and control group at T2. An interaction effect between time and treatment condition at T2 ($F_{2,178}$=73.50, P<.001) was found. This indicated that over time, patients in the guided self-help CBT-E condition had a greater reduction in their EDE scores than those in the control condition (Table 3). In addition, a 2×5 generalized linear mixed model analysis with fixed effects based on the EDE-Q global score showed an interaction effect between time and treatment condition ($F_{7,173}$=42.65, P<.001). This difference disappeared when both groups received treatment at T3 (P=.521) and T4 (P=.312). Assessments at T3 and T4 showed the persistence of treatment benefits for patients in the experimental condition. Figure 3 and Table 4 show that patients randomized to the delayed-treatment control condition remained stable in the experimental phase of the trial (for them, the waiting period) but showed a delayed treatment effect very similar to the guided self-help group, consistent with the delayed design: eating disorder pathology decreased at T3 in the control condition and benefits persisted until T4.

Figure 2 Mean EDE global scores of the intention to treat sample at T0, and T2



CBT-E cognitive behavior therapy – enhanced, *EDE* eating disorder examination, *T0* assessment week 0, *T2* assessment week 12

Figure 3 Mean EDE-Q scores of the intention to treat sample at T0, T1, T2, T3, and during T4



CBT-E cognitive behavior therapy – enhanced, *EDE-Q* eating disorder examination-questionnaire, assessment week 0, *T1* assessment week 5, *T2* assessment week 12, *T3* assessment week 24, *T4* assessment week 36

Table 4 Changes in binge eating behaviors, EDE-Q scores, BMI and secondary eating disorder pathology over the course of treatment and follow up assessed using intention to treat analysis with multiple imputations

							Within groups				Between groups			
	T0 *M*(SD)	**T1 *M* (SD)**	**T2 *M*(SD)**	**T3 *M*(SD)**	**T4 *M*(SD)**	***F***	**T0-T1 Effect size, Cohens *d***	**T0-T2 Effect size, Cohens *d***	**T0-T3 Effect size, Cohens *d***	**T0-T4 Effect size, Cohens *d***	**Effect size T1, Cohens *d***	**Effect size T2, Cohens *d***	**Effect size T3, Cohens *d***	**Effect size T4, Cohens *d***
Guided self-help CBT-E (*n* = 90)														
EDE-Q Objective binges	15.8 (11.8)	7.7 (7.3)	3.4 (3.7)	3.4 (4.9)	3.2 (4.7)	21.6*	0.8	1.4	1.4	1.4	0.4	1.2	0.0	0.2
EDE-Q global score	3.9 (1.0)	2.9 (0.9)	2.0 (1.0)	2.1 (1.2)	2.2 (1.3)	46.9*	1.0	1.9	1.7	1.5	0.5	1.3	0.1	0.1
BMI	34. (5.6)	34.4 (6.1)	35.4 (7.2)	33.9 (6.1)	33.9 (6.1)	0.8	0.1	-0.2	0.0	0.0	0.2	0.2	0.1	0.1
CIA total score	23.2 (8.4)	*NA*	12.0 (8.8)	11.3 (9.2)	12.1 (9.8)	45.0*	*NA*	1.3	1.4	1.2	*NA*	1.1	0.2	0.0
CIA personal	13.6 (3.7)	*NA*	7.7 (4.3)	7.1 (4.6)	7.9 (5.3)	37.4*	*NA*	1.5	1.5	1.3	*NA*	1.1	0.3	0.1
CIA social	5.0 (2.6)	*NA*	2.1 (2.3)	2.0 (2.5)	2.2 (2.7)	31.5*	*NA*	1.2	1.2	1.1	*NA*	0.9	0.1	0.0
CIA cognitive	4.6 (3.8)	*NA*	2.2 (3.0)	2.2 (1.3)	2.1 (2.8)	19.2*	*NA*	0.7	0.8	0.7	*NA*	0.8	0.1	0.1

Waitinglist (*n* = 90)	**T0 *M*(SD)**	**T1 M(SD)**	**T2 *M*(SD)**	**T3 *M*(SD)**	**T4 *M*(SD)**	***F***	**Within groups T0-T1 Effect size, Cohens *d***	**Within groups T0-T2 Effect size, Cohens *d***	**Within groups T0-T3 Effect size, Cohens *d***	**Within groups T0-T4 Effect size, Cohens *d***
EDE-Q Objective binges	14.6 (10.1)	11.6 (7.7)	10.6 (8.1)	3.3 (4.4)	4.6 (7.0)	38.2*	0.3	0.4	1.5	1.2
EDE-Q global score	3.5 (1.0)	3.4 (0.9)	3.3 (1.0)	2.0 (1.1)	2.1 (1.3)	87.6*	0.1	0.3	1.5	1.2
BMI	32.9 (5.0)	33.1 (7.2)	33.9 (8.8)	33.3 (4.9)	33.1 (4.9)	0.9	0.1	-0.2	-0.1	-0.1
CIA total score	22.0 (8.2)	*NA*	21.5 (8.6)	13.0 (8.1)	12.2 (9.9)	40.9*	*NA*	0.1	1.1	1.1
CIA personal	13.3 (4.0)	*NA*	12.6 (4.4)	8.2 (4.1)	7.6 (5.2)	45.4*	*NA*	0.2	1.3	1.2
CIA social	4.6 (2.8)	*NA*	4.3 (2.7)	2.3 (2.0)	2.3 (2.7)	23.4*	*NA*	0.1	1.0	0.9
CIA cognitive	4.1 (3.2)	*NA*	4.6 (3.3)	2.5 (2.9)	2.3 (3.1)	17.4*	*NA*	-0.2	0.5	0.6

* $p < .001$

** $p < .05$

BMI body mass index, *CIA* clinical impairment assessment, *EDE-Q* eating disorder examination- questionnaire, *M* mean, *SD* standard deviation

T0 assessment week 0, *T2* assessment week 12, *T3* assessment week 24, *T4* assessment week 36

3.3.5 Clinical impairment

On the basis of CIA scores, there was an interaction effect between time and treatment ($F_{7,173}$=90.36, P<.001). This indicated that over time, patients' CIA scores reduced faster in the guided self-help CBT-E condition than in the control condition. The difference disappeared at T3 (P=.976) and T4 (P=.909), when both groups received treatment.

3.3.6 Effect sizes

Table 2 shows large effect sizes between both conditions at T2 regarding objective binges (Cohen d=1.0-1.3) and EDE global score (Cohen d=1.2). Effect size was medium regarding subjective binges (Cohen d=0.6-0.7). Table 4 shows the effect sizes of the self-report measures.

Discussion

Principal Findings

The aim of this study was to examine the efficacy of guided self-help CBT-E compared with a delayed-treatment control group regarding reduction in objective binges. The efficacy of guided self-help CBT-E was demonstrated by its superiority in outcome over the delayed-treatment control condition at T2. On the basis of reduction in binge eating, a large effect size (Cohen d=1.0) was observed. Binge eating reduced from an average of 19 objective binges 28 days before assessment to 3 binges after completion of guided self-help CBT-E, compared with 16 to 13 binges in the control group. In the guided self-help condition, abstinence from binge eating at T2 was reported by 47.5% (43/90) of the participants according to the EDE interview.

Recovery rates for all other outcome measures were superior at T2 in the guided self-help condition than in the delayed-treatment control condition. In the guided self-help condition, 40% (36/90) of the participants showed full recovery according to the EDE interview, and eating disorder pathology score was below the clinical cutoff of 62.5% (56/90). Of them, 78.7% (71/90) reported an eating disorder pathology score below the clinical cutoff on self-report data. Follow-up data revealed no differences between the groups after both groups had received treatment. Treatment benefits persisted at T3 and T4 for the experimental condition and at T4 for the control condition. BMI did not change over the course of treatment, which can be interpreted as the prevention of weight gain.

Reduction of binges (Fairburn et al., 2015; Wade et al., 2017) and abstinence from binges rates (Dalle Grave et al., 2015; Fairburn et al., 2015; Poulsen et al., 2014; Wade et al., 2017) were comparable to in-person CBT-E at EOT and follow-up (Hilbert et al., 2019; Poulsen et al., 2014). However, current study had larger effect sizes with regard to reduction in binges compared to in-person CBT-E (Knott et al., 2015; Melisse, Dekker, et al., 2022). It should be noted that owing to a lack of studies focusing on the BED populations specifically, comparisons of this study results with in-person CBT-E could mostly be made with samples of transdiagnostic patients or bulimic patients. Moreover, the abstinence from binges rates in this study was comparable with other guided self-help interventions of regular CBT for BED at EOT and follow-up (Hilbert et al., 2019). Furthermore, within-group effect sizes were large in this study but medium in studies examining the efficacy of regular CBT for BED (Carter & Fairburn, 1998; Grilo et al., 2005; Hilbert et al., 2019). Therefore, with regard to reduction in binges, it can be concluded that guided self-help CBT-E could be as effective as in-person CBT-E and other guided self-help interventions based on regular CBT.

The proportion of patients with eating disorder pathology scoring below the cut-off on the eating disorder measures indicated that guided self-help CBT-E is at least as effective as

guided self-help interventions based on regular CBT (Hilbert et al., 2019; ter Huurne et al., 2015). Superiority based on the EDE in comparison with in-person CBT-E was inconclusive: Fairburn et al., (2015) showed greater remission, while efficacy in the studies by Poulsen et al, (2014) and Thompson-Brenner (2016) was equal, but efficacy was lower in Wonderlich et al., (2014). In contrast, our study showed that guided self-help CBT-E appeared to be at least as effective at EOT, based on EDE-Q data (Byrne et al., 2011; Dalle Grave et al., 2015; Knott et al., 2015; Signorini et al., 2018; Wade et al., 2017). Reliable change index and clinical significant change were larger in this study than in in-person CBT-E effectiveness studies (Berg et al., 2021; Melisse, Dekker, et al., 2022).

We found that the severity of binge eating, eating disorder pathology, and secondary impairment in our study were comparable with those of previous studies that included patients with BED and transdiagnostic samples (Dalle Grave et al., 2015; de Zwaan et al., 2017; Fairburn et al., 2015; Melisse, Dekker, et al., 2022; ter Huurne et al., 2020). Therefore, the results of this study were not due to lower severity at baseline. However, it should be noted that guided self-help CBT-E was offered in a specialized eating disorder center. Enrolled patients had more severe BED compared with those from non-specialist centers (Melisse, Blankers, et al., 2022). Furthermore, patients received guided self-help CBT-E from highly trained therapists, which might have affected the results. Therefore, these results may not be generalizable to non-specialized settings. Eventually, further study is needed to investigate the efficacy of the present treatment when delivered by less specialized therapist to less severely ill patients.

Treatment drop-out was 21.1% (38/180), the majority dropped-out during the Covid-19 pandemic (34/180, 89.5%), with one-third owing to reasons related to the Covid-19 pandemic. Treatment drop-out rate was comparable with other studies including a waiting-list

control condition (Hilbert et al., 2019). Patients with a lower education had a higher chance of dropping out from the treatment. A negative attitude towards psychological treatments may have played a role, which might be reduced by offering psycho-education (Thompson-Brenner et al., 2013). Furthermore, these patients may have perceived some of the interventions as challenging and extra assistance in overcoming such barriers may help to keep them involved (Puls et al., 2020).

Strengths and limitations

This study has several strengths. It was conducted in a specialized mental health care setting acknowledged for its highly structured treatment and evidence-based approach. Guided self-help CBT-E was a manualized treatment, offered by trained specialists and treatment adherence was assessed. Standardized interview data (Cooper & Fairburn, 1987) were collected by independent assessors, including the EDE at T2. Internationally used valid self-report instruments (Bohn et al., 2008; Fairburn & Beglin, 2008) were used, and the study was adequately powered. As patients came from all over the Netherlands, the sample can be deemed representative of patients seeking specialized eating disorder treatment. The Covid-19 pandemic deserves a special mention. The study barely started when the Covid-19 pandemic spread in the Netherlands in mid-March 2020. Fortunately, however, because of the treatment delivery mode (eMental Health) that was evaluated in this study, the social distancing measures of the pandemic had a limited impact on the study's execution. Nevertheless, the COVID-19 pandemic might have negatively affected the outcomes of the treatments, as many patients reported that it was a challenge to combine therapy, work, and homeschooling children at the same time. This suggests that guided self-help CBT-E might demonstrate even better outcomes under less adverse circumstances.

A limitation of this study might be that the follow-up data were measured by self-report, and interview data are generally viewed as more reliable, especially when measuring binge eating

behavior (Berg et al., 2012; Melisse, van Furth, et al., 2021). In addition, our study showed differences in reports on interviews and self-report data. Objective binges between the interview and self-report data in this study showed a moderate correlation (r=0.6, P<.01) at T2. The study's design with a delayed-treatment control group implies that expected treatment benefits may have played a role in bringing about the difference in outcomes at the second assessment (Constantino, 2018). However, the extent of this effect could not be established, as treatment expectancy was not assessed. Next, between-group comparisons were impacted since the control group started treatment after the 12-week delay. Therefore, the long-term impact of withholding treatment could not be assessed. The control group showed a delayed treatment effect very similar to that of the guided self-help group, consistent with the delayed design. Furthermore, only within-group comparisons were meaningful during follow-up, although this was taken into consideration when choosing statistical analyses. As most of the participants who dropped out from treatment could not be assessed and also became study dropouts, no EOT and no follow-up data were available from them. In addition, before the Covid-19 pandemic, patients had in-person intake sessions, including measurements of their weight and height. During the pandemic, the study relied on the patients' self-reported weight and height. Although BED is more equally prevalent across genders than other eating disorders (Kessler et al., 2013), with only 10% men, the sample was biased by gender. However, no effect of gender was found on eating disorder pathology and the frequency of binges. The underrepresentation of men is common to most eating disorder studies and limits the generalizability of the findings (Shingleton et al., 2015). Finally, therapists' protocol adherence was measured by self-report of the therapist, whereas the use of an adherence checklist, which recently became available for CBT-E (Bailey-Straebler et al., 2022), or adherence assessment by an independent rater would have yielded more valid information regarding treatment integrity (Lopez-Alcalde et al., 2022).

Clinical implications

Guided self-help CBT-E appears to be an efficacious treatment for patients with BED seeking help from specialized treatment centers. Results of this study underscore the international guidelines following the stepped care model (NICE, 2017) and suggest that web-based guided self-help is a viable first step. If guided self-help CBT-E would appear non-inferior to CBT-E, Dutch national guidelines recommending CBT for BED (Zorgstandaard, 2021) should be revised. In addition, guided self-help CBT-E offers several benefits in delivering psychotherapy to patients with BED, such as reduced barriers to treatment, and if it is non-inferior to in-person CBT-E, it will diminish specialist's time needed for a single treatment. In addition, guided self-help CBT-E has the potential for treatment delivery in a stepped care model to reduce waiting times for in-person treatment (Abrahamsson et al., 2018; Becker et al., 2010; Evans et al., 2011; Linardon et al., 2021). Furthermore, patients who experience stigma appreciate the greater anonymity of remote treatment (Bird, 2019). As such, guided self-help CBT-E potentially increases help-seeking behavior among men (Thapliyal & Hay, 2014) and patients with excess weight (Talumaa et al., 2022). These benefits of guided self-help CBT-E facilitate treatment delivery, preventing the severity of BED from increasing if left untreated. It is recommended to offer guided self-help CBT-E in specialized settings and experiment with its application in nonspecialist settings. When the findings of this study could be replicated in nonspecialist settings, delivery can be extended to nonspecialist settings. However, supervision of an eating disorder specialist is recommended to address protocol adherence and prevent therapist drift

Implications for research

Guided self-help treatment holds the promise of being a cost-effective alternative to traditional treatment. As an extension of this study we are currently performing an economic evaluation alongside the RCT (Melisse et al., 2023). In addition, several studies showed that

guided self-help was inferior to in-person CBT at end of treatment, but was non-inferior (de Zwaan et al., 2017; Zerwas et al., 2017) or superior (Bailer et al., 2004) at long-term follow-up. Subsequently, a logical next step for future research is to compare the effectiveness of guided self-help CBT-E with in-person CBT-E in an RCT. We recommend that future studies to assess recovery beyond 24 weeks after EOT and collect interview data as this is deemed more reliable (Berg et al., 2012). As guided self-help CBT-E has several additional advantages over traditional treatment provision, such as reduced therapist time required and removal of geographical barriers to treatment, it is strongly recommended to compare its efficacy with in-person CBT-E. Knowledge of guided self-help predictors or moderators, enhances decision making by offering in-person or guided self-help CBT-E or a different type of treatment (Kraemer, 2016). Examining whether guided self-help CBT-E reduces general psychopathology is of interest. Once guided self-help CBT-E shows long-term effectiveness including general psychopathology, investigating its effect among other eating disorder populations, such as patients with non-purging bulimia nervosa is recommended.

Conclusions

In conclusion, guided self-help CBT-E appeared to be an efficacious treatment alternative to waiting lists regarding to reduction in binge eating and eating disorder pathology among patients with BED, and benefits remained over a 12 and 24 weeks follow-up period. These findings reflect international guidelines, recommending guided self-help for BED. If future research would demonstrate equal effectiveness of guided self-help CBT-E to in person treatment, it would be a viable alternative and can reduce waiting-time to commence treatment and therefore potentially enhances faster recovery for patients with BED.

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Chapter 9 Economic Evaluation of Web-based Guided Self-help Cognitive Behavioral Therapy- Enhanced for Binge- Eating Disorder Compared to a Waiting-List: a Randomized Controlled Trial

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Abstract

Introduction: The aim is to perform an economic evaluation alongside a randomized controlled trial comparing guided self-help Cognitive Behavioral Therapy- Enhanced (CBT-E) for binge-eating disorder (BED) to a waiting-list control condition.

Methods: BED patients (*N*=212) were randomly assigned to guided self-help CBT-E or to the three-month waiting-list. Measurements took place at baseline and at the end-of-treatment. The cost-effectiveness analysis was performed using number of binges during the last 28-days as outcome indicator according to the Eating Disorder Examination. A cost-utility analysis was performed using the EuroQol-5D.

Results: The difference in societal costs over the three-months of the intervention between both conditions was €641 [CI -86-1,393]. The incremental costs associated with one incremental binge prevented in the guided self-help condition was approximately €17 [CI -2-40]. From a societal perspective there was a 96% likelihood that guided self-help CBT-E led to a greater number of binges prevented, but at higher costs. Each additional QALY gained was associated with incremental costs of €33,000 [CI -4619-151,393]. With a 95% likelihood guided self-help CBT-E led to greater QALY gain at higher costs compared to waiting for treatment. Based on the NICE willingness-to-pay threshold of €35,000 per QALY, guided self-help CBT-E can be considered cost-effective with a likelihood of 95% from a societal perspective.

Discussion: Guided self-help CBT-E is likely a cost-effective treatment for BED in the short-term (three-months course of treatment). Comparison to treatment-as-usual is recommended for future research, as it enables an economic evaluation with a longer time horizon.

Public significance statement: Offering treatment remotely has several benefits for patients suffering from binge-eating disorder. Guided self-help CBT-E is an efficacious and likely

cost-effective treatment, reducing binge-eating and improving quality-of-life, albeit at higher societal costs.

Keywords: Randomized Controlled Trial; Binge-eating disorder; Guided self-help; Cognitive Behavioral Therapy-Enhanced; Cost-effectiveness; Cost-utility, Economic evaluation

Trial registration: The study protocol is registered with the Netherlands Trial Registry NTR (NTR 7994) since 6 September 2019.

Ethics: Study approval was given in August 2019 by the Medical Research Ethics Committees United (MEC-U) (reference number NL 6958.100.19) in Nieuwegein, the Netherlands.

Introduction

Binge-eating disorder (BED) is characterized by recurrent episodes of binge-eating accompanied by a sense of lack of control. Inadequate compensatory behavior such as self-induced vomiting and laxative misuse are absent. After binge-eating, patients experience feelings of shame, guilt, and disgust (APA, 2013). BED is associated with decreased quality-of-life, increased risk of excess weight, diabetes mellitus, and other non-communicable diseases. In addition, patients with BED experience poorer psychosocial functioning and poorer somatic health compared to individuals who merely suffer from excess weight (Melisse et al., 2020; Mond & Hay, 2007). The medical conditions associated with BED will potentially result in increased health care utilization and other societal costs including productivity losses (Aardoom et al., 2016; Agh et al., 2015; Striegel et al., 2012; van Hoeken & Hoek, 2020). Efficacious treatments are important in order to reduce the personal and societal burden of BED (Lynch et al., 2010). However, the exact reduction in quality-of-life of BED and costs of quality-of-life gain after treatment are unknown. When evaluating the economic impact of treatment for BED, such costs should also be considered.

Cognitive behavior therapy-enhanced (CBT-E) is an evidence-based treatment for eating disorders (Fairburn, 2008; Melisse et al., 2022). However, the BED international guidelines recommend guided self-help (ANZAED, 2014; NICE, 2017). Therefore, a promising web-based guided self-help version of CBT-E (guided self-help CBT-E) was developed (Melisse et al., 2023). Guided self-help CBT-E has several benefits for patients compared with in-person CBT-E, such as the removal of geographical barriers (Abrahamsson et al., 2018; Becker et al., 2010; Evans et al., 2011; Linardon et al., 2021). Furthermore, guided self-help CBT-E requires less therapist involvement, and is briefer than in-person CBT-E, and therefore associated with lower costs of offering treatment. For example, costs of offering guided self-help based on regular CBT vary between €630- €900, whereas costs for in-person CBT-E are

around €3,500 (Jenkins, 2021; König et al., 2018; van den Berg et al., 2020). In addition, a cost-effectiveness study of guided self-help for BED estimated the willingness-to-pay per binge-free day, representing the maximum amount that society is willing to pay for an additional unit of health outcome, between €118-177 (Jenkins, 2021).

Guided self-help CBT-E has been shown to be an efficacious treatment for BED (Melisse et al., 2023; Striegel-Moore et al., 2010). In order to distinguish the efficiency of the various eating disorder treatments (Streatfeild, 2021), it is important to evaluate the cost-effectiveness of guided self-help CBT-E. There is only limited economic evidence for the effect of BED treatments, for both in-person and guided self-help versions of CBT (König et al., 2018). In addition most economic evaluations face marked limitations: they do not involve BED (Striegel-Moore et al., 2008) and predominantly focus on younger patient populations, whereas BED affects patients of all ages (Ling et al., 2017; Streatfeild, 2021). Furthermore, most studies neglect costs outside of the health-care system (Streatfeild, 2021). Society's monetary valuation of health care benefits are represented by a willingness-to-pay (Steigenberger et al., 2022) for one quality-adjusted-life-year (QALY). One QALY is defined as one extra year lived in perfect health based on mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (EuroQol-Group, 1990). One study showed that guided self-help for BED was likely to be cost-effective compared to treatment-as-usual, with an estimated willingness-to-pay per QALY gained of around €50,000 (König et al., 2018). No study has yet to provide an economic evaluation of web-based guided self-help CBT-E for BED compared to a waiting-list. Comparison to a waiting-list allows to examine if the costs and effects of guided self-help CBT-E are a reasonable investment compared to the costs of waiting for treatment.

The aim of present economic evaluation is to determine cost-effectiveness (costs per binge prevented) and cost-utility (costs per QALY gain) of web-based guided self-help CBT-

E for BED as compared to a waiting-list control condition. This will be measured alongside a randomized controlled trial (RCT) primarily examining the efficacy of guided self-help CBT-E. The economic evaluation will be performed from a societal perspective, covering all effects and costs of guided self-help CBT-E on the whole of society. It's expected that from a societal perspective guided self-help CBT-E will be more effective (binges prevented and increase in quality-of-life) compared to waiting for treatment, however, this will come at higher costs which are associated with the guided self-help CBT-E intervention.

2. Methods

2.1 Design

This economic evaluation of guided self-help CBT-E was performed using data obtained from a two-arm efficacy RCT among patients with BED or other specified feeding or eating disorder (OSFED)-BED. An extensive description of the study protocol (van den Berg et al., 2020) and efficacy results were published elsewhere (Melisse et al., 2023). The RCT had a balanced allocation (1:1) to either (i) guided self-help CBT-E (N = 106) or to (ii) a waiting-list with a delayed treatment control condition (N = 106). Participants (N=180) were recruited to take part in the efficacy study (Melisse et al., 2023). However, the first 51 participants were not administered the questionnaire on health care utilization and productivity losses (TiC-P; Hakkaart-van Roijen et al., 2002). Therefore, their data could not be used for the economic evaluation. Hence, an additional 83 participants were recruited (N= 212). The economic evaluation will focus on the three-month phase before the wait-listed participants received guided self-help CBT-E. The study protocol is registered with the Netherlands Trial Registry (NTR 7994), and was approved by the Medical Research Ethics Committees United (NL6958.100.19). The economic evaluation was performed and reported in line with the CHEERS guidelines (Husereau et al., 2013) and the ISPOR guideline for economic evaluation alongside RCTs (Ramsey et al., 2015).

2.2 Procedure

Potentially eligible patients referred to Novarum center for eating disorders (part of Arkin Mental Health Care) were invited to participate in the study. After the patients signed the informed consent, a baseline assessment was administered to assess for exclusion criteria, and to measure the severity of BED. Patients who met all inclusion criteria and no exclusion criteria were randomly allocated to the guided self-help CBT-E or waiting-list control condition. Randomization was performed in Castor EDC (CASTOR & EDC) by a 4,6,8 block design, and stratified for body mass index (BMI: kg/m^2) below 29.9 or above 30. Participants were informed about their study allocation. All treatment appointments were confirmed by email and those randomized to guided self-help CBT-E were informed on how to use the digital treatment environment. The time horizon was three months: assessments took place at baseline (week 0) and at three months post-randomization by interview and self-report questionnaires. Interviews were held by phone, and self-report measures were administered on the web, both of which were processed in Castor EDC (https://www.castoredc.com), which is ISO 27001/27002/9001 and NEN7510 certified. Non-responders were repeatedly contacted by phone. Participants received a €10 gift card after completion of the post-treatment assessments.

2.3 Participants and recruitment

Eligible patients were >18 years old, diagnosed with BED or OSFED-BED (APA, 2013) and had a BMI between 19.5 and 40. They also had internet access, a desktop or laptop computer and had sufficient proficiency in Dutch. Exclusion criteria were acute psychosis, clinical depression and/or suicidal ideation, as assessed by the Dutch version of the semi-

structured interview SCID-5-CV (APA, 2013; First et al., 2016), eating disorders other than BED/OSFED-BED, having received eating disorder treatment in the past six months, pregnancy or use of medication that might influence eating behavior. Inclusion period was September 2019-December 2020.

2.4. Intervention

All 17 therapists successfully completed a web-based CBT-E training provided by the Centre for Research on Eating Disorders at Oxford, United Kingdom (Fairburn, 2008), before they attended a two-day workshop provided by authors BM and MdeJ. Weekly 45-minutes supervision sessions with BM were offered to ensure protocol adherence. Therapists self-rated their level of adherence after each session on a scale ranging from 0-5 ("not at all" to "excellent"), and 94.7% of all sessions obtained the maximum score of adherence.

Guided self-help CBT-E is a three-month program and is a translated, digitalized version of part two of the self-help book *Overcoming Binge Eating* (Fairburn, 2013). Further details regarding the intervention are described elsewhere (Melisse et al., 2023; van den Berg et al., 2020). The intervention started in the same week as the baseline assessment. Before they commenced treatment, patients were instructed to read the psycho-educational section of the Dutch version of *Overcoming Binge Eating* (Fairburn, 2013). The intervention included psychoeducation, daily assignments and two self-evaluations each week. Feedback on the assignments was given by the therapists during 13 weekly telephone sessions of 20 minutes. In the telephone sessions, completed assignments were discussed, as well as upcoming assignments and compliance to treatment. The sessions were scripted in accordance with the treatment manual as developed by EvdB and BM, and offered by therapists.

Patients in the waiting-list group commenced treatment with a three month delay. They were instructed to read the psycho-educational section of *Overcoming Binge Eating* (Fairburn, 2013), and were called once for a 10-minute conversation in which questions about the recommended reading, BED, and other important areas of life were answered.

2.5 Outcomes

2.5.1 Effect measures

The primary outcome measure for the cost-effectiveness analysis was the number of binge eating episodes during the last 28 days. This was measured by the Eating Disorder Examination (EDE) (Cooper & Fairburn, 1987; Jansen, 2000), a semi-structured interview, with good psychometric properties (Cooper & Fairburn, 1987; Jansen, 2000; Rosen et al., 1990).

The outcome measure for the cost-utility analysis was the number of QALYs gained between randomization and post-treatment. To calculate QALYs, quality-of-life was measured using the Dutch three-level variant of the five-dimensional EuroQol instrument (EQ-5D-3L) (EuroQol-Group, 1990), which has good psychometric properties (Janssen et al., 2013; Rabin & Charro, 2001). The EQ-5D-3L determines health related quality-of-life based on five dimensions: mobility, self-care, usual activities, pain/discomfort, anxiety/depression. For each dimension one of three levels is chosen: “no problems”, “some problems” and “extreme problems” (Dolan, 1997). The Dutch tariff (Lamers, 2005) was used to translate the EQ-5D-3L score to health utilities: utility weights were assigned which reflected the patient’s health state between 0 (death) and 1 (perfect health). One QALY corresponds to one year living in perfect health; for the calculation of QALYs gained or lost for each individual, the studies’ time horizon of three months was taken into account.

2.5.2 Resource use and valuation

The costs of offering the intervention were based on Dutch standard prices in Euros (Zorginsituut, 2016). The costs of delivery of guided self-help CBT-E were based on (i) direct contacts between patients and therapists, and (ii) indirect contacts, which involved consultations between therapists concerning the patients. All contacts within Arkin were derived from the patients' electronic health records from Arkin Mental Health Care. Other care received by the patients included all types of healthcare such as inpatient mental health care, outpatient mental health care (other than within Arkin), other healthcare such as physiotherapy and alternative medicine, and the use of medication. Healthcare contact data that could not be derived from the patients' electronic health records were collected by the first section of the Questionnaire on healthcare Consumption and productivity loss in patients with a Psychiatric disorder (TiC-P) at pre- and post-treatment (Bouwmans et al., 2013; Hakkaart-van Roijen et al., 2002; van Hakkaart Roijen et al., 2011). The TiC-P has a four-week recall period, and in line with Hakkaart-van Rooijen et al. (2007), TiC-P data were extrapolated to the three-months intervention period. All healthcare resource utilization was valued based on Dutch standard unit cost prices in Euros (Zorginsituut, 2016). The number of health care contacts were multiplied by Dutch standard unit costs, medication costs were calculated by multiplying the reported drug dose with its unit cost price (Drost, 2014; Medicijnkosten, 2020; Zorginsituut, 2016).

Non-health care related costs such as productivity losses, decreased functioning professionally, and reduced efficiency of paid and unpaid work (presenteeism) were measured by the second section of the TiC-P (Bouwmans et al., 2013; Hakkaart-van Roijen et al., 2002; van Hakkaart Roijen et al., 2011). The four-week recall period was extrapolated to the three-months intervention period. Hours of productivity loss were multiplied by the average hourly

labor costs (women: €31.60, men: €37.90 in 2014) (Hakkaart-van Roijen et al., 2002; Zwaap et al., 2015). The friction-cost method estimates the indirect costs of presenteeism and absenteeism and takes the possibility to replace long-term absentees into account. The friction-cost method was used to value productivity losses (Koopmanschap, 1995). A maximum friction-cost period of 85 days was applied based on the amount of open and filled vacancies as derived by the Dutch authority of statistics (Hakkaart-van Roijen et al., 2015). An elasticity factor of 0.8 was applied to correct for the fact that reduction of labor-time causes less than a proportional decrease in productivity (Koopmanschap, 1995). Future costs after randomization were not calculated since follow-up data could not be used as both groups received the same treatment when follow-up measures were conducted. Cumulative inflation correction up until the index year 2021 was applied, and Organisation for Economic Co-operation and Development standard purchasing power parities for the study's index year 2021 (105% for the Netherlands) were applied to all costs (OECD, 2022).

2.6 Sample size

Sample size was based on the expected effect on the primary outcome measure (reduction of binges; Melisse et al., 2023). In order to detect an effect size of Cohen's d = 0.47 (Cohen, 1977; Hilbert et al., 2019) with sufficient power (β = 0.8), the required sample size was at least N = 144 (n = 72 per arm), and N = 180 (n = 90 per arm) to correct for expected drop-out. Sample size was calculated using *R* package 'pwr' (Champely, 2020).

2.7 Statistical analyses

Main analyses were performed according to an intention-to-treat (ITT) approach, with missing observations multiple imputed (10 times). Imputations were performed with the

multiple imputation by chained equations package in *R* (Van Buuren, 2011), using random forests as the prediction method; 10 iterations were sufficient to achieve convergence. Results from the analyses obtained from the 10 imputed datasets were combined using Rubin's rules (Rubin, 2004). The societal perspective of this economic evaluation was considered the base case scenario, including all costs (costs of guided self-help CBT-E, medication, all other health care costs and of productivity gains/ losses) for each patient. This analysis was repeated from a health care perspective only, in which productivity costs were excluded. Units of health care and productivity losses were multiplied with their associated costs for all patients. Differences in costs and effects between guided self-help CBT-E and the waiting-list condition were calculated as the difference in cumulative costs (in Euros) and effects over the three months of the intervention.

Incremental cost-effectiveness ratio (ICER) was calculated as: ICER = (Costs Guided self-help CBT-E – Costs waiting-list) / (Effects Guided self-help CBT-E – Effects waiting-list), where effects were QALYs gained or binges prevented. First, we applied multiple imputation to account for missing data. Next, we constructed (multilevel) regression models for costs and effects separately. In these models, costs or effects were the dependent variable, a random intercept to account for the nesting of multiple (in this case, 2) measurements within participants was included in the model, as was a Time (baseline or three months after) X Condition (guided self-help CBT-E or waiting list) interaction term. For the corrected model, we also included baseline costs and effects in the model. From this regression model, we were interested in the regression coefficient for the Time X Condition interaction term. Based on the estimate and standard error of this coefficient, a distribution of the incremental costs and incremental effects was created. using resampling (10,000 samples) (main analysis).

As an alternative approach, 10,000 non-parametric bootstrapped samples were extracted from the imputed datasets (bootstrapped analysis), of which for each incremental

costs, incremental effects, and ICER were calculated. The resulting costs, effects and ICERs were used for further calculations and plotted on a cost-effectiveness plane to present the differences between costs and effects of both conditions, of which the waiting-list control condition is positioned in the origin of the cost-effectiveness plane. In addition, cost-effectiveness acceptability curves (CEACs) were plotted based on the distribution of the ICERs over the cost-effectiveness planes (Van Hout et al., 1994) using the net benefit regression approach (base case). CEACs show the probability that the cost-effectiveness of guided self-help CBT-E is greater than a waiting-list by a willingness-to-pay for each additional unit of effect (QALYs or binges). Willingness-to-pay for each additional unit of effect generally ranges between €20,000-80,000 per QALY (Zwaap et al., 2015) in the Netherlands, and €22-110 per binge free day in the United-Kingdom and United-States (Jenkins, 2021; Lynch et al., 2010).

In a sensitivity analysis, baseline measures of the dependent variables in the model were also included in the linear mixed models of the main costs analyses. We also conducted a health care perspective scenario analysis, in which only health care related costs were taken into account. As a final sensitivity analysis, we assessed the impact of missing data to our results by performing the analyses using a dataset without imputed values (i.e. comprising of only the observed data). Analysis were performed in *R* version 4.2.1, lme4 package in *R* (Bates et al., 2015) and SPSS version 28.

Results

Participants

For the current study, 230 potential participants were recruited, of which 212 were randomized; *n* = 18 didn't meet in- or met exclusion criteria; *n* = 208 were diagnosed with BED, *n* = 4 had a history of bariatric surgery, had smaller binges and were therefore

diagnosed with OSFED-BED. Like in the efficacy study, as only a small proportion (17.5%;37/212) of participants had a BMI<30, no subgroup analyses based on stratification of 30>BMI≥30 were performed. **Fig. 1** shows participant enrollment and flow through the study; Table 1 summarizes participant characteristics at baseline.

Drop-out from treatment (i.e., non-adherence) was 15.1% (*n*=16/106) in the guided self-help CBT-E and, 3.7% (*n*= 4/106) in the waiting-list. Non-response for the measurements (i.e., non-adherence to complete the assessments) at three months was 15.1% (*n*= 16/106) in the experimental condition and, 2.8% (*n*= 3/106) in the waiting-list. Therefore, the overall study's measurement non-response was 8.9%.

Figure 1 Flowchart of patients in study

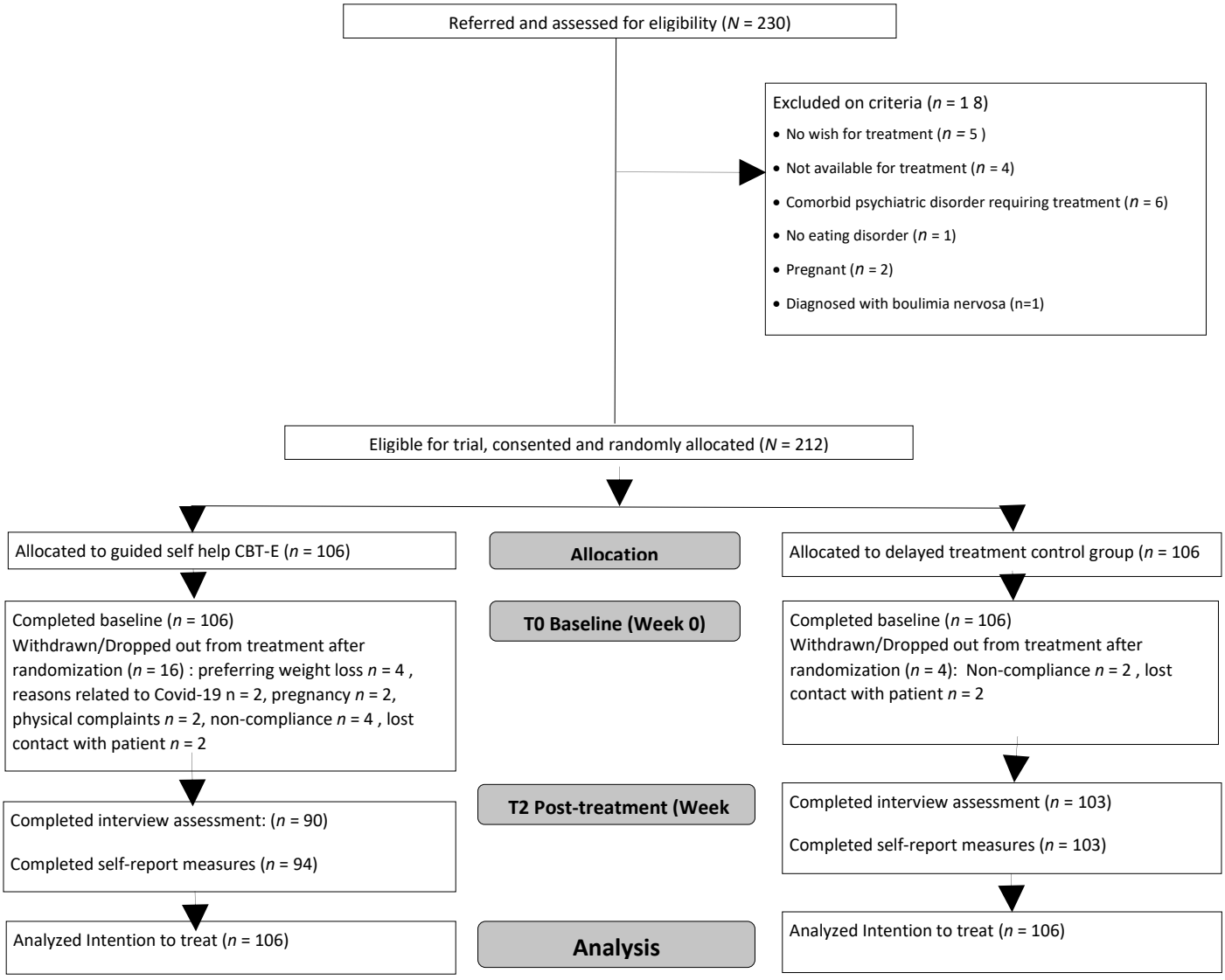


Table 1 Patient characteristics at baseline.

	Total sample *N* = 212	Experimental condition *n* = 106	Waiting-list condition *n* = 106
Age, mean (SD)	38.7 (13.3)	38.0 (13.4)	39.4 (13.2)
Baseline BMI, mean (SD)	33.4 (5.7)	33.4 (6.3)	33.5 (5.0)
Gender, *n* (%)			
Female	190 (91.1%)	95 (89.6%)	95 (89.6%)
Male	22 (9.9%)	11 (10.4%	11 (10.4%)
Highest level of education, *n* (%)			
Lower vocational education	4 (1.9%)	2 (1.9%)	2 (1.9%)
Lower general secondary education	16 (7.5%)	6 (5.7%)	10 (9.4%)
Senior general secondary education/ university preparatory education	23 (10.8%)	13 (12.3%)	10 (9.4%)
Secondary vocational education	59 (27.8%)	28 (26.4%)	31 (29.2%)
Higher professional education	70 (33.0%)	37 (34.9%)	33 (31.1%)
University	38 (17.9%)	18 (17.0%)	20 (18.9%)
Unknown	2 (0.9%)	1 (0.9%)	1 (0.9%)
Profession, *n* (%)			
Student	22 (10.4%)	13 (12.3%)	9 (8.5%)
Employed	139 (65.5%)	63 (59.4%)	76 (71.7%)
Volunteer job	4 (1.9%)	3 (2.8%)	12 (0.9%)
Unemployed	15 (7.1%)	5 (4.7%)	10 (9.4%)
Other	31 (14.5%)	21 (19.8%)	10 (9.4%)
Unknown	1 (0.5%)	1 (0.9%)	0 (0.0%)
Civil status, *n* (%)			
Single	123 (58.0%)	59 (55.7%)	64 (60.4%)
Registered partnership	18 (8.5%)	10 (9.4%)	8 (7.5%)
Married	56 (26.4%)	30 (28.3%)	26 (24.5%)
Divorced	14 (6.6%)	6 (5.7%)	8 (7.5%)
Unknown	1 (0.5%)	1 (0.9%)	0 (0.0%)
Duration of eating disorder (years), mean (SD)	22.6 (14.6)	21.9 (14.7)	23.3 (14.6)
Eating disorder treatment in the past, *n* (%)			
Yes	34 (16.0%)	14 (13.2%)	20 (18.9%)
No	177 (84.0%)	91 (85.8%)	86 (81.1%)
Comorbid diagnosis, *n* (%)			
No	91 (42.9%)	45 (42.5%)	46 (43.4%)
I don't know	30 (14.2%)	14 (18.0%)	14 (13.2%)
Mood disorder	32 (15.01%)	14 (13.2%)	18 (17.0%)
Anxiety disorder	7 (3.3%)	4 (3.8%)	3 (2.8%)
Attention deficit (hyperactive) disorder	14 (6.6%)	7 (6.6%)	7 (6.6%)
Post traumatic stress disorder	8 (3.8%)	4 (3.8%)	4 (3.8%)
Personality disorder	10 (4.7%)	6 (5.7%)	2 (2.5%)
Autism	7 (3.3%)	6 (7.5%)	1 (0.9%)

Obsessive compulsive disorder	1 (0.5%)	1 (0.9%)	
Other	18 (8.5%)	8 (7.5%)	10 (9.4%)
Use of psychopharmacology, *n* (%)			
Yes	53 (25.5%)	25 (23.6%)	28 (26.4%)
No	158 (74.5%)	80 (75.5%)	78 (73.6%)
Eating disorder pathology (EDE), *M* (SD)			
Global score	3.1 (1.0)	3.1 (0.9)	3.1 (0.9)
Objective binge episodes[1]	59.5 (51.0)	47.1 (43.7)	53.3 (47.4)
Quality of Life (EQ 5D NL), *M* (SD)	0.7 (0.2)	0.7 (0.2)	0.7 (0.2)
Health care costs in euros[2], *M* (SD)		712 (1391)	578 (808)
Costs of absenteeism[2], *M* (SD)	1767 (2647)	2017 (3065)	1516 (2229)
Costs of presenteeism[2], *M* (SD)	1062 (2420)	1218 (2777)	905 (2063)

[1] Number of binges during the last four weeks extrapolated over the last three months before randomization
[2] Presenteeism and absenteeism over the last three months before randomization
BMI body mass index, *EDE* eating disorder examination, *EQ 5D NL* Dutch three-level variant of the five-dimensional EuroQol instrument

Costs

Table 2 shows the costs and effects during the three months trial (from pre- to post-treatment). The only difference in costs between both conditions, was found for outpatient mental health care costs (p=.009). Mean overall costs were higher in the guided self-help CBT-E condition; the difference in societal costs (p=.095) was €641 [95% confidence interval (CI) -86-1393]. The differential health care costs (p<.001) was € 893 [CI 671-1123].

Table 2. Costs and effects between baseline and three months after per cost category

	Guided self-help CBT-E (*n*=106)			Waiting-list control condition (*n*=106)		
Cumulative costs in €	Mean	SD	Reported by *n*	Mean	SD	Reported by *n*
Outpatient mental health care within Novarum	1,313.01	339.15	106	284.39	198.20	94
Other outpatient mental health care	144.38	805.19	22	81.15	221.54	21
Inpatient health care	0.14	4.44	0	42.54	214.02	6
Other healthcare	171.11	306.13	63	132.47	219.22	63
Medication	84.95	272.11	52	97.28	319.05	58
Productivity	1,161.92	2,670.98	42	1,098.21	2.072.54	45
Societal costs	2,875,.51	2,945.72	106	1,736.06	2.161.78	106
Overall health care costs	1,713.59	1,136.97	106	637.85	541.46	106
Effects[1]						
Binges last three months	16.96	33.80	106	42.78	46.14	106
QALYs	0.02	0.06	106	-0.00	0.05	106

Note base case model, based on the imputed dataset
[1]Effects extrapolated over the last three months
QALY quality-adjusted-life-year

Effects

Based on the linear mixed models in which the effect outcomes were evaluated between baseline and three months post-baseline, a significant Time x Group interaction for QALYs (*B*=0.020, SE=0.008, *p*=0.009) as well as for number of binges (*B*=-38.212, SE=7.454, *p*<0.0005) was found in the uncorrected model. In the baseline-corrected model, the Time x Group interaction term for QALYs was also significant (*B*=0.020, SE=0.007, *p*= 0.006), as was the Time x Group interaction term for the number of binges (*B*=-38.512, SE=6.899, *p*<0.0005). See also Table 2 for descriptives of costs and effects. These effects indicated that the decline in number of binges was stronger in the guided self-help CBT-E condition than in the wait-list condition, as well as the increase in number of QALYs.

Cost- effectiveness and cost- utility

The results of the cost-effectiveness and cost-utility analyses are presented in Table 3, Figure 2 presents the cost-effectiveness planes and the CEACs. The cost-effectiveness analysis over the three months trial showed that from a societal perspective, the incremental costs associated with one incremental binge prevented in the guided self-help CBT-E condition (ICER) was approximately €17 [CI -2-40]; this was €23 [CI 15-39] from a health care perspective. Figure 2 (north-east quadrant) shows that from a societal perspective there was a 96% likelihood that guided self-help CBT-E led to a greater number of binges prevented at additional societal costs compared to the control condition. There was a 4% likelihood that guided self-help CBT-E led to a greater number of binges prevented at lower societal costs compared to the wait list (south-east quadrant). From a healthcare perspective there was a >99% likelihood that guided self-help led to a greater number of binges prevented than the control condition, at higher health care costs (north-east quadrant).

The cost-utility analyses from a societal perspective (Table 3, Figure 2) indicated an ICER of €32,515 [CI -4619-151,393]. There was a 95% likelihood that guided self-help CBT-E led to a larger gain in QALYs at higher societal costs than the control condition (north-east quadrant) (Figure 2). Based on the NICE willingness-to-pay threshold of €35,000 per QALY (NICE, 2023), guided self-help CBT-E would be slightly preferrable over wait list in terms of cost-effectiveness. Figure 2 (north-east quadrant) shows that from a health care perspective there was a >99% likelihood that guided self-help led to a larger gain in QALYs at higher costs than the wait list control condition.

Sensitivity analyses

The robustness of the results was attested since the results of the sensitivity analyses were similar to those of the primary analyses, as can be observed from Table 3.

Table 3 Incremental costs, effects, and ICER after three months of to guided self-help CBT-E (*n*=106) or waiting list (*n*=106)

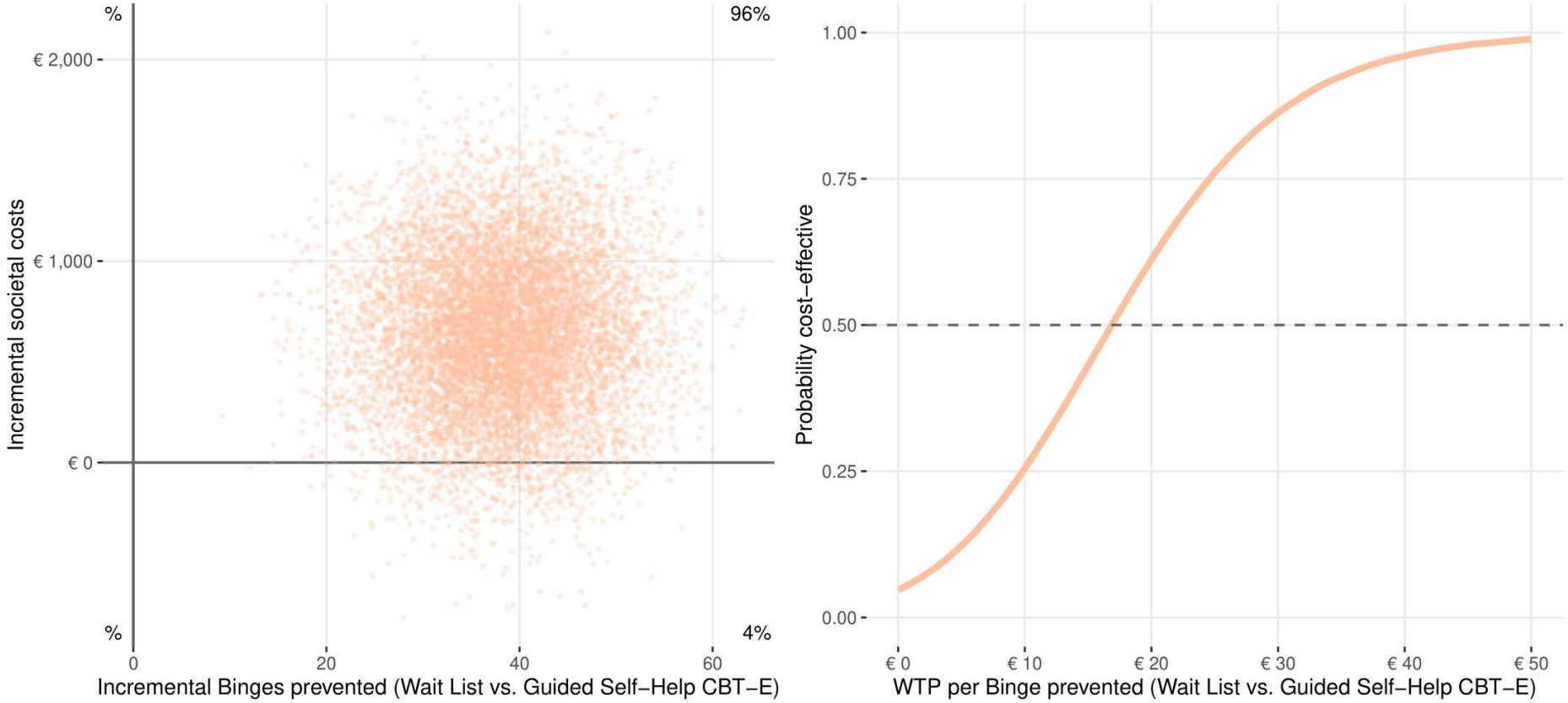
Outcome[1]		societal mean [95% C.I.]	societal bootstrapped mean [CI	societal baseline corrected mean [CI	societal complete cases mean [CI	healthcare mean [CI]
	Incremental costs[1]	641 [-86-1,393]	637 [-79-1,332]	641 [-39-1,345]	783 [55-1,573]	893 [671-1,123]
QALY						
	QALY [2]	0.02 [0.00-0.04]	0.02 [0.00-0.03]	0.02 [0.00-0.03]	0.02 [0.01-0.04]	0.02 [0.01-0.04]
	ICER[3]	32,515 [-4,619-151,393]	31982 [-3,885-159,278]	32,523 [-1,938-131,782]	3,2952 [2,306-92,691]	45,206 [23,981-186,654]
Binges						
	Binges	38.2 [23.4-52.8-]	38.1 [26.0-51.0]	38.2 [24.5-51.7]	42.1 [29.2-54.9]	38.2 [23.4-52.8]
	ICER[3]	17 [-2-42]	17 [-2-40]	17 [-1-40]	19 [1-40]	23 [15-39]

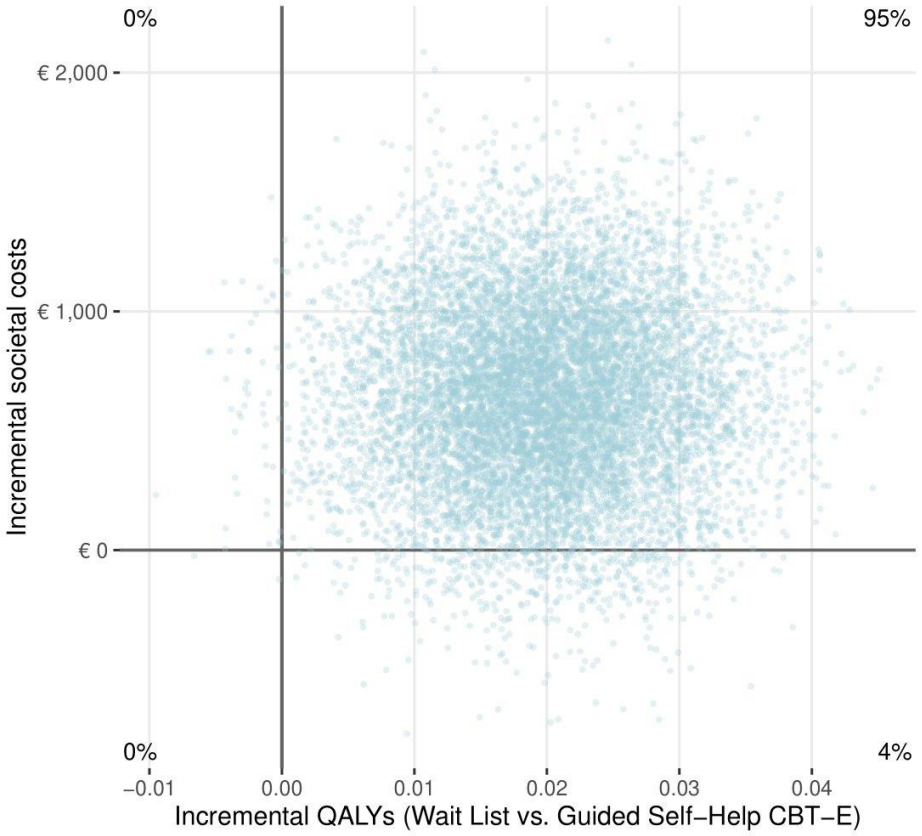
Note based on the imputed dataset
[1] Differences reported in Euro's

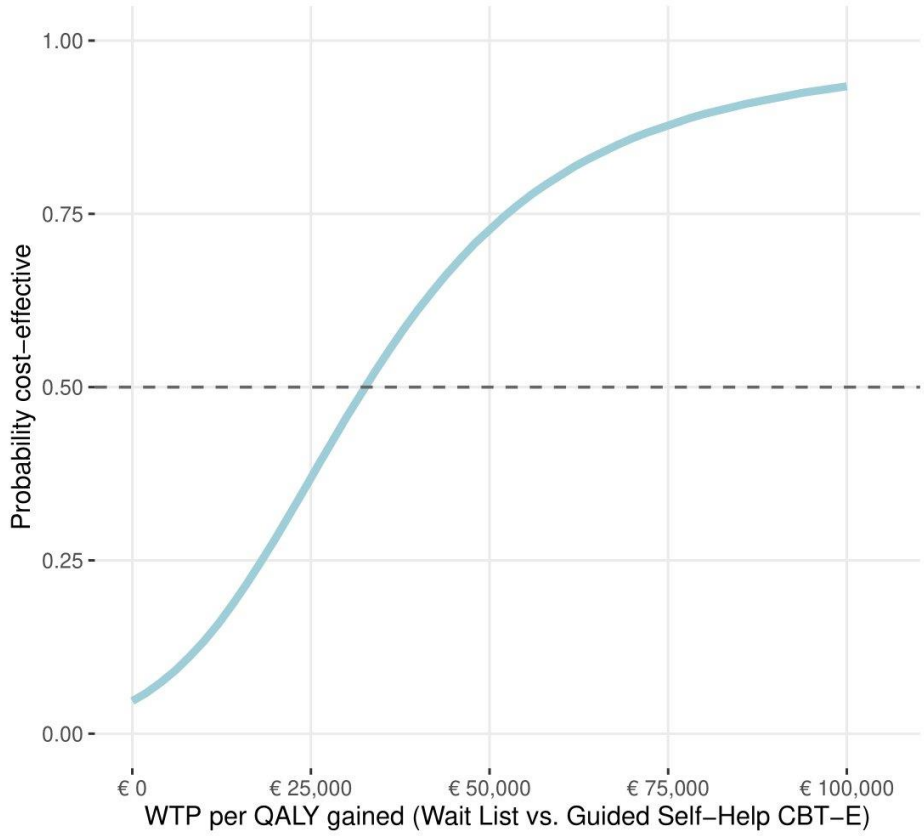
[2] QALYs were measured by the Dutch three-level variant of the five-dimensional EuroQol instrument [3] Incremental cost-effectiveness ratios were calculated as: ICER = (Costs Guided self-help CBT-E – Costs waiting-list) / (Effects Guided self-help CBT-E – Effects waiting-list)

ICER incremental cost-effectiveness ratio, *QALY* quality-adjusted life year

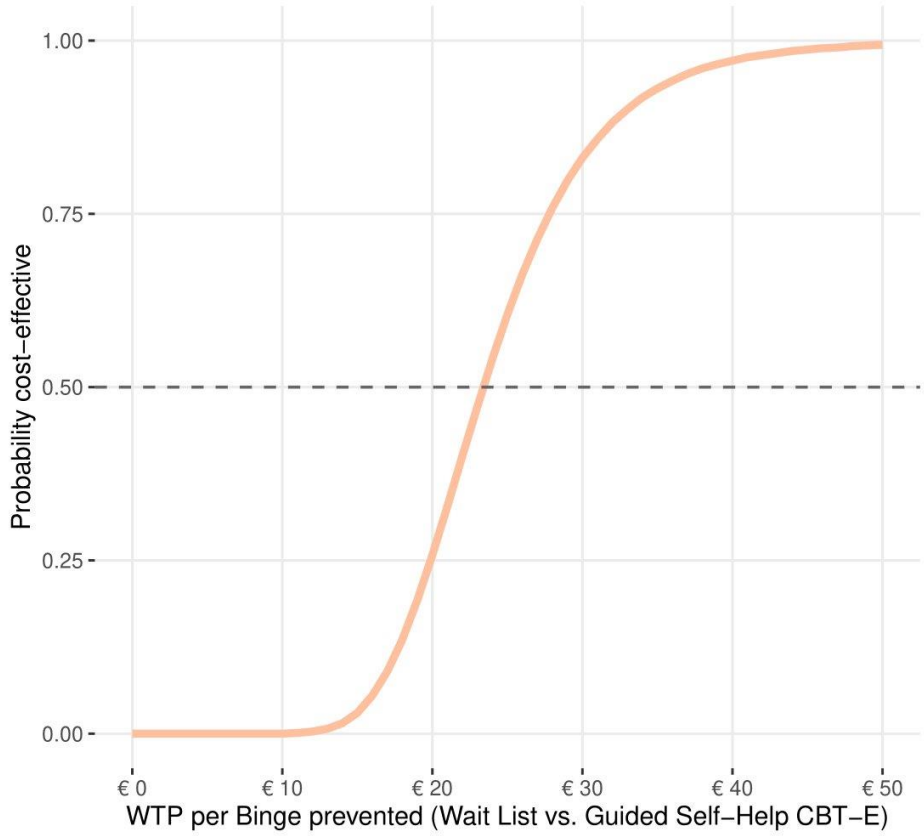
Figure 2 Cost-effectiveness and cost-utility planes and acceptability curves from a societal and health care perspective

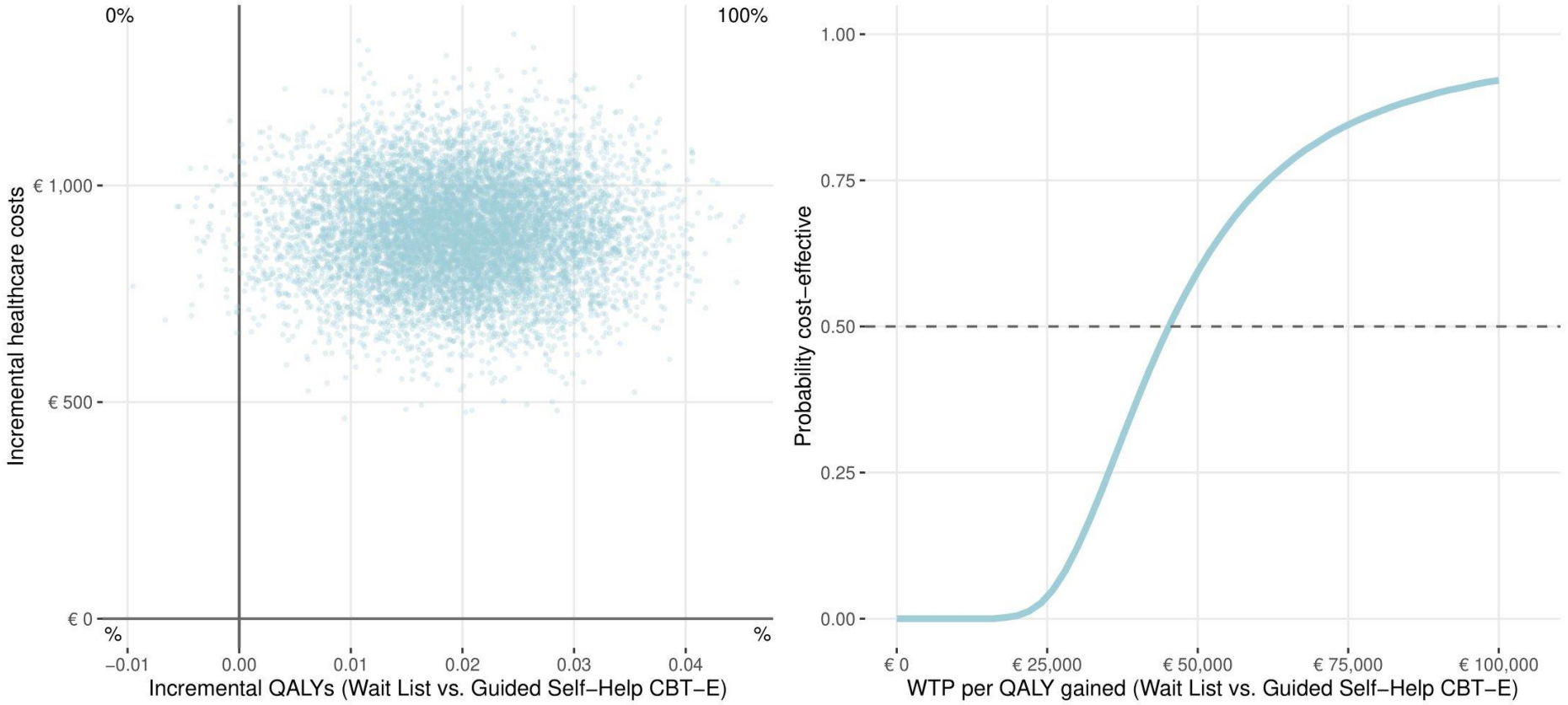



0%
95%
€ 2,000
€ 1,000
€ 0
0%
4%
Incremental societal costs
−0.01
0.00
0.01
0.02
0.03
0.04
Incremental QALYs (Wait List vs. Guided Self−Help CBT−E)


1.00
0.75
0.50
0.25
0.00
Probability cost−effective
€ 0
€ 25,000
€ 50,000
€ 75,000
€ 100,000
WTP per QALY gained (Wait List vs. Guided Self−Help CBT−E)


%
100%
€ 1,000
€ 500
€ 0
%
%
0
20
40
60
Incremental healthcare costs
Incremental Binges prevented (Wait List vs. Guided Self−Help CBT−E)


1.00
0.75
0.50
0.25
0.00
Probability cost−effective
€ 0
€ 10
€ 20
€ 30
€ 40
€ 50
WTP per Binge prevented (Wait List vs. Guided Self−Help CBT−E)



WTP willingness-to-pay

The four graphs on the left are cost-effectiveness planes. The horizontal axis indicated differences in binges prevented and QALY gains between guided self-help CBT-E and waiting for treatment over the three months course of treatment. The vertical axis represented the differences in costs. The chart area is divided into quadrants, each with a specific interpretation. All incremental cost-effectiveness ratios fell into the upper

right (“north-east”) quadrant. This indicated that guided self-help CBT-E generated a greater number of binges prevented and greater QALY gain at additional costs. The two plots on the right were cost-effectiveness acceptability curves. These curves show the probability that guided self-help CBT-E is cost-effective compared to waiting for treatment as a function of the willingness-to-pay for one additional unit of effect, represented as one additional binge prevented or one QALY gained. The probability 0.50 on the vertical axis indicated the point of indifference. Above the point of indifference point, guided self-help CBT-E has a greater likelihood to be preferred over waiting for treatment with regard to cost-effectiveness (with an equal likelihood to the probability on the vertical axis). As the exact willingness-to-pay per effect unit is generally unknown, willingness-to-pay is presented as a series of increments on the horizontal axis.

Discussion

Main findings

This study examined cost-effectiveness and cost-utility of guided self-help CBT-E versus a waiting-list for BED over a period of three months using data from the initial phase of an RCT. Key findings were that guided self-help CBT-E led to greater QALY gain, and a greater number of binge eating episodes were prevented compared to waiting for treatment. There was a >96% likelihood that guided self-help CBT-E led to more binges prevented, but at higher costs. Based on the NICE willingness-to-pay threshold of €35,000 per QALY (NICE, 2023), and the Dutch willingness-to-pay threshold of €80,000 for severe diseases (Zwaap et al., 2015), guided self-help CBT-E would be preferable by the Dutch society in terms of cost-effectiveness compared to a waiting-list during the first three months and can be seen as a reasonable investment for the Dutch health care system. In addition, willingness-to-pay per QALY gain was lower in current study than in another study which found a willingness-to-pay of €50,000 for guided self-help CBT for BED (König et al., 2018). There were no differences in costs between the two conditions, except for outpatient mental healthcare costs (associated with the intervention provided to the experimental group). The results remained stable in the sensitivity analyses, supporting the robustness of the findings.

Our study is among the first economic evaluations of guided self-help treatments for full-syndrome BED. Previously, two studies evaluated cost-effectiveness of guided self-help interventions for binge eating (König et al., 2018; Lynch et al., 2010) with smaller sample sizes ($N \leq 150$) than the present study. However, strength of these studies was that they represented a longer timeline than current study as guided self-help was compared to treatment-as-usual. One study analyzed cost-effectiveness of a guided self-help intervention based on the book *Overcoming binge eating* accompanied by eight in-person sessions among

patients with subsyndromal BED. This intervention was compared to treatment-as-usual, which consisted of advising patients on other treatment options. The intervention appeared cost-effective, however that study used a non-standardized measure to examine quality-of-life (Lynch et al., 2010). Another study compared CBT to guided self-help CBT among patients with BED and subsyndromal BED. The results of this study were inconclusive since guided self-help CBT led to greater QALY gain, whereas CBT led to greater reduction in binge eating at end-of-treatment (König et al., 2018). However, findings of current study are in line with the few studies available which indicated that guided self-help interventions for binge eating are cost-effective (König et al., 2018; Lynch et al., 2010).

Limitations and strengths

The most significant limitation is the time horizon of three months. Since patients randomized to the waiting-list also received guided self-help CBT-E during follow-up, comparison of cost-effectiveness and cost-utility was not possible after three months. This precluded an evaluation of the long-term effectiveness as well as the costs of guided self-help CBT-E as compared to no treatment. A different study design, with a comparison to a treatment-as-usual control condition (e.g., in-person CBT-E), would have enabled an economic evaluation with a longer time horizon, which is recommended for future research. In addition, comparison to treatment-as-usual or another active comparator instead of a waiting-list would better reflect what normally would happen in the absence of guided self-help CBT-E (Richards, 2020). In addition, it should be noted that treatment expectation may play a role when comparing active treatment to a waitlist condition (Constantino, 2018).

Therapists' protocol adherence was only measured by self-report, whereas adherence assessment by an independent rater would yield more valid information (Lopez-Alcalde et al., 2022). An alternative could be the adherence checklist for CBT-E which has recently become available (Bailey-Straebler et al., 2022). Last, although patient's electronic files were used to

establish all mental health care costs of patients within Arkin foundation, other cost data were based on patients self-report over the last three months which may have been affected by recall bias. However, in order to reduce the potential impact of recall bias, health care utilization and number of binges were only measured over the month before the assessment and extrapolated over three months between the assessments. Furthermore, recall bias probably led to underestimation of the number of binges (Berg, Peterson, et al., 2012), therefore extrapolation might also have affected the measurement of binges.

This study has several strengths. This is the first study to perform an economic evaluation selectively including patients with full syndrome BED. Furthermore, the sample size was larger than in previously conducted studies, providing adequate statistical power to find differences between the two compared groups of patients. Study dropout of <10% was low and multiple imputation was performed to handle missing data. Patients were an accurate representation of patients with BED in the Netherlands. The EDE interview (Cooper & Fairburn, 1987; Jansen, 2000), is considered the gold-standard to measure binges, as especially patients with BED show a marked discrepancy between self-reported and investigator-based number of binges (Berg, Stiles-Shields, et al., 2012; Melisse et al., 2021).

Conclusions

Guided self-help is an internationally recommend treatment for BED, but was previously not available in the Netherlands. This study provides evidence for its efficacy and cost-effectiveness, which may contribute to future decision making in clinical practice (ANZAED, 2014; NICE, 2017). In addition, the current study findings may stimulate consideration into alternatives to the traditional mode of in-person delivery of CBT-E. Future studies should compare efficacy and cost-effectiveness of guided self-help CBT-E to in-person CBT-E. This will enable comparisons over a longer timeline and further enhance decision making on where the scarce resources should be allocated, and where they offer best

value for money (Konnopka et al., 2009; Stuhldreher et al., 2012). In conclusion, guided self-help CBT-E appeared the preferred treatment in terms of cost-effectiveness compared to a waiting-list for patients with BED. However, long-term data are necessary to establish the long-term efficiency and cost-effectiveness of this treatment mode.

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Chapter 10 General discussion

This dissertation aimed to investigate several gaps in the current state of knowledge about binge eating disorder (BED) in Saudi Arabia and in the Netherlands. Therefore, the several studies examined various aspects of eating disorders, mainly BED. BED is the most prevalent and most recently acknowledged eating disorder (APA, 2013; Kessler et al., 2013).

The objectives of part I and part II vary. Aim of **Part I** was two-fold: (1) to adapt and examine psychometric properties and to establish norms of the two most used assessment tools to examine body-shape dissatisfaction and eating disorder pathology: the Eating Disorder Examination- Questionnaire (EDE-Q) (chapter two) and the Body Shape Questionnaire (BSQ) (chapter three); (2) to investigate potential predisposing factors (chapter four and five) and correlates (chapter five) of eating disorder pathology. Main purpose of **Part II** was to examine the effectiveness and efficacy of two treatment modalities of CBT-E for BED. The first treatment modality, presented in chapter six, was in-person Cognitive Behavior Therapy- enhanced (CBT-E). The effectiveness of in-person CBT-E in clinical practice using ROM data was evaluated for patients with BED. Through a naturalistic design, outcome predictors of CBT-E were also examined. The second treatment modality, presented in chapter eight, was a newly developed eMental Health version of CBT-E offered with 12 brief guided telephone sessions (guided self-help CBT-E) among patients with BED. The efficacy of guided self-help CBT-E for BED was examined through a randomized controlled trial (RCT) and an economic evaluation was undertaken alongside the RCT (chapter nine).

Part I Assessment, etiology, and correlates of eating disorder pathology

Main findings

Chapter two and three examined the validity of the two most used self-report measures: the EDE-Q and BSQ. Psychometric characteristics of the Saudi version of the EDE-Q were satisfactory and the results supported the discriminant and convergent validity as compared to a golden standard, the eating disorder examination (EDE), a semi-structured diagnostic interview. The Receiver-operating-characteristic curve analysis showed that the EDE-Q could accurately discriminate between individuals at high and low risk for an eating disorder according to the EDE (area-under-the-curve value =.84). Severity level of eating disorder pathology was accurately determined by the EDE-Q global score. The optimal cut off of 2.93 on the global score yielded a sensitivity of .82 and specificity of .80 Furthermore, chapter two showed that the original four factor model of the EDE-Q was not supported.

Chapter three showed that the psychometric characteristics of the Saudi-Arabic BSQ were good. Both its full version (BSQ34) and the short version (BSQ8C) discriminated well between low and high levels of body-shape dissatisfaction (area-under-the-curve value =.93) according to the eating disorder examination- shape concern subscale. In addition, both Saudi-Arabic BSQs had high internal consistency and a unidimensional factor structure. When optimal specificity was called for, e.g., when screening for need of treatment, a cut-off of raw score > 123 (T> 59.1) would seem more appropriate. Sensitivity and specificity were balanced at .85 when a cut-off of raw score > 114 (T-score > 57.0) was applied. For the BSQ8C cut-off values for raw score > 28 and T-score > 56.4 were suggested. Cut-off values on the T score scale approximate quite well the generally recommend T = 55 to T = 60 for the transition from normal to clinical. The BSQ34 supplied more information on the type of concerns respondents had, which is worthwhile when the measure is used in clinical settings; the BSQ8C is recommended as a short screener.

In a systematic scoping review (chapter four), which included 81 studies and four websites that involved statistical data, such as GCC-stat, the number of Saudis who scored above a clinical cut-off on eating disorder measures were examined. In this review, 2- 55% scored above a clinical cut-off. Rates were higher among women (11.4- 54.8%) than among men (2- 47.3%) on eating disorder screening instruments. For chapter two of this dissertation, data regarding the prevalence of eating disorder pathology were collected in a Saudi community convenience sample. In this study (N = 2690), it was estimated that 28,8% (n = 775) of the sample screened positive on the EDE-Q. This was 28.5% (n = 598) for women and 29.7% (n = 177) for men, which was within the ranges of positive screens presented in chapter four. In chapter two, a subset (N = 98) was also subjected to the EDE interview. At first, participants with high scores on the EDE-Q were invited for an EDE interview. Later on, participants were randomly invited. On the EDE, 45% (n = 44) scored two standard deviations above average. The participants were consistent in presentation of the severity of their eating disorder pathology. However, they were not consistent in their symptom presentation between the EDE and EDE-Q. Therefore, data were insufficient to examine the exact prevalence of the various eating disorder symptoms. However, it was most likely that binge- eating was the most common eating disorder symptom. Around half of the Saudis included reported excess weight while BED was associated with high BMI. Furthermore, it is estimated that around 1/3 of individuals with excess weight suffered from BED (Van der Horst et al., 2019). The conclusion that BED was the most common eating disorder in Saudi Arabia was supported by the only study available that recently has been conducted: the Saudi National Health Survey among a large group of Saudis (N = 4004). That study reported a 12-months eating disorder prevalence of 3.2% and a life-time prevalence of 6.1%. BED was the most common eating disorder with a 12-months prevalence of 2.1% and a life-time prevalence of 2.6% (AlHadi et al., 2022). The review presented in chapter four established a gender difference, while our

data (reported on in chapter two and three) showed that there were no differences in eating disorder pathology between both genders, a finding in line with AlHadi., et al (2022).

This dissertation also investigated the prevalence of body-shape dissatisfaction in a Saudi convenience community sample, mainly existing of highly educated young women. On the Saudi-Arabic BSQ (see chapter three) it was found that among a total of $N = 867$ Saudis, 26.7% ($n = 231$) of them appeared at risk for body-shape dissatisfaction. However, the systematic review (chapter four) showed that on the Stunkard's body silhouettes test (Stunkard et al., 1983), around 66% of the Saudis displayed body-shape dissatisfaction (Madanat et al., 2011). The Stunkard's body silhouettes test was completed by a community sample of women who lived in urbanized areas. Chapter three did not find differences in body-shape dissatisfaction between women and men, while studies included in the review in chapter four found that women were more at risk for body-shape dissatisfaction than men (Al-Sendi et al., 2004; Ford et al., 1990). The substantial difference in body-shape dissatisfaction may be explained by the use of different measures. Another explanation could be that the Stunkard's body silhouettes test (Stunkard et al., 1983) is not valid for use in Arabic cultures (its validity has not been investigated). In addition, the studies included in the review did not use the culturally appropriate norms and the screeners used were not culturally adapted. This might have impacted the estimate rates and the gender differences that have been reported.

Lastly, chapter four and five of part I investigated potential predisposing factors for the development of eating disorder pathology. Both chapters confirmed that body shape-dissatisfaction was a correlate of eating disorder pathology. In addition, both studies concluded that higher BMI was associated with greater levels of body-shape dissatisfaction and eating disorder pathology. This is of great concern since currently Saudi Arabia has the highest prevalence of excess weight worldwide (Qamar Farshori et al., 2015; WHO, 2006). The review showed that Saudis with excess weight are known to be 2-3 times more likely to

develop eating disorder pathology than Saudis without excess weight, which was confirmed by the recently conducted Saudi national epidemiological survey (AlHadi et al., 2022). The high rates found of eating disorder pathology and body-shape dissatisfaction may be a reflection of the high rates of excess weight and maladaptive strategies for weight loss in Saudi Arabia. In addition, chapter five showed that high BMI is a covariate in the association between body-shape dissatisfaction and eating disorder pathology in Saudi Arabia.

The systematic review also examined other potential correlates of eating disorder pathology than BMI and body-shape dissatisfaction. It was found that eating disorder pathology in Saudi Arabia was associated with a western cultural orientation, high socioeconomic status and media use. In our cross-sectional study we found that unmarried Saudis reported more eating disorder pathology than married Saudis, which is in line with recent findings (AlHadi et al., 2022). In univariate analyses, it was found that socio-economic status was moderately associated with eating disorder pathology and a weak association was found between eating disorder pathology and media use. However, according to a multivariate regression analysis, only body-shape dissatisfaction and BMI were significantly associated with eating disorder pathology. Low self-esteem, western cultural orientation rather than Arab orientation, increased levels of stress, frequency of media use, and high socio-economic status were no longer associated with eating disorder pathology. Furthermore, the review suggested that cultural orientation was potentially associated with different types of symptomatology: western cultural orientation may be associated with bulimic symptoms and Arab cultural orientation may be associated with anorexic symptoms. This hypothesis was not confirmed in our cross-sectional study. Failure to reproduce the association between western cultural orientation and eating disorder pathology might be explained by the fact that only small associations were found in other studies (AlShebali et al., 2020; Thomas et al., 2018). Another explanation might be that eating disorder pathology was rather associated with

industrialization instead of westernization. Saudi Arabia also dealt with industrialization, while rapid industrialization is associated with increased risk for eating disorders (Ghubash et al., 2001; Nakai et al., 2018). The frequency of social media use was not associated with eating disorder pathology. Also other studies suggest that greater emotional investment, negative feedback seeking and social comparison were rather associated with eating disorder pathology instead of the frequency of media use (Fardouly et al., 2015; Holland & Tiggeman, 2016).

It can be concluded that eating disorder pathology is prevalent in Saudi Arabia, and BED appeared the most common eating disorder, a result also found for the western world. It can be concluded that young, highly educated women are at risk for the development of eating disorder pathology and body-shape dissatisfaction. Body-shape dissatisfaction and high BMI were associated with eating disorder pathology and the adapted EDE-Q and BSQ appeared reliable assessment tools.

Limitations and strengths

One of the major limitations that arose from the systematic review presented in chapter four was that many findings were based on non-validated assessment tools that were used in the included studies. For instance, several studies translated the EAT-40 or EAT-26 without adaptations, and used western norms (Eapen et al., 2006; Eladawi et al., 2018; Nasser, 1994). Use of non-validated assessment tools which were not adapted to the culture at hand is unfortunate, as it may lead to underestimation of symptom severity (Darcy et al., 2012), elevated rates of undiagnosed eating disorders, to a lack of knowledge and awareness about eating disorders (Griffiths et al., 2015) and may hamper timely proper treatment (Al Khadari 2016).

Another limitation of the systematic review was that several studies failed to provide essential information on the norms used, or how their statistical analysis was conducted (Musaiger & Al- Mannai, 2013). Furthermore, none of the studies on binge-eating behavior mentioned the frequency of binge-eating episodes, or whether the binges were of subjective or objective nature (Al Adawi et al., 2002; Latzer et al., 2009; Mousa, Al-Domi, et al., 2010; O'Hara et al., 2016). All the studies included in the systematic review relied on self-report measures, prone to socially desirable responding (Musaiger 2013). The resulting bias in self-report data may be even stronger present in the Saudi context, since the collectivistic culture of the Arab world made people hesitant to report individual desires (Raouf 2016). Consequently, the use of self-report measures made studies vulnerable to under- or overestimation of complaints (Mousa, Al-Domi, et al., 2010).

The studies presented in chapter two, three, and five also included several limitations: the samples were biased for age, gender and level of education. Therefore, all results should be interpreted with caution. A too large proportion of the samples consisted of highly educated young Saudi women. It is also likely that mainly more progressive men participated in the EDE interviews since Saudi Arabia dealt with strict gender separations in 2017 and 2018 and all the EDE interviews were conducted by women. This might have affected the study participation rate of men, as well as their willingness to confide in pathological eating behavior. At the same time, there were no effects of gender, age and level of education on eating disorder pathology and the EDE-Q and BSQ performed similarly among both genders and various age groups. In addition, chapter two describes our efforts to counteract the potential effect of selection bias. The percentile scores were separately presented for men and women and corrected for level of education by propensity weighting. Unmeasured factors also might have caused selection bias: participants might have had special interest in health care, mental health care or eating disorders, which motivated them to take part in the survey. In

addition, the psychometric properties of the Saudi EDE-Q and BSQ, and correlates of eating disorder pathology were investigated among community samples. Such studies among clinical samples were more reliable and show increased generalizability. Unfortunately, it appeared impossible to collect clinical data in order to examine the psychometric properties of the EDE-Q and BSQ and predisposing factors. There is a taboo on mental health and a stigma on psychotherapy (Latzer et al., 2009), therefore Saudis barely seek help and Saudi Arabia deals with a lack of specialists to treat body-shape dissatisfaction and eating disorders (Alkadari 2016).. In addition, the cross-sectional nature of the data described in chapters two, three and five also came with limitations. Only associations among eating disorder pathology and other variables could be investigated and it was not possible to address questions about causal relationships (e.g., "Is the rise of eating disorder pathology in Saudi Arabia due to body-shape dissatisfaction of is body-shape dissatisfaction a consequence of eating disorder pathology?") Of the psychometric properties, we did not assess test-retest reliability, nor investigated whether the EDE-Q and BSQ were sensitive to change.

To evaluate the screening ability of the EDE-Q and BSQ we used a score above the community mean + 1 standard deviation on the EDE global score or the EDE shape concern subscale, respectively. The EDE is the gold standard to measure eating disorder pathology. It is yet not validated in Saudi Arabia. Moreover, some cultural adaptations were made to the EDE. Furthermore, due to the lack of a suitable alternative, the EDE appeared the best option due to it being assessor based and its detailed nature. In addition, the EDE measured pathology over the same period as the BSQ and EDE-Q and had the same rating scale and similar phrases and word use as the EDE-Q.

This thesis also includes several strengths. As Saudis are an understudied population, this dissertation was among one of the first studies examining eating disorder pathology in Saudi Arabia. In addition, it is the first study to examine eating disorder pathology with

validated and culturally adapted assessment tools. It is one of the few studies with large sample sizes, which provided ample statistical power to demonstrate significant associations. Sample sizes were large, despite all the challenges to collect data among Saudis, as they are perceived as a socially reclusive society. Compared to western societies, Saudis are quite sensitive to how they are perceived by others, and therefore, less inclined to participate in surveys where they are asked to express their personal values and believes (Al Darmaki 2003). Therefore, a lot of effort had to be put in data collection. In addition, Saudi Arabia dealt with stigma in relation to mental health problems, and a lack of knowledge about eating disorders (Alkhadari et al., 2016; Latzer et al., 2009). Therefore, study participation in this study was not self-evident for Saudis, as feelings of mistrust, lack of knowledge and awareness were barriers for study participation in other studies (Williams 2013, Schmotzer 2012, Honein-AbouHaidar 2016).

Other strengths were that chapter two and three were the first studies to be supplemented with interview data in order to understand the culture at hand (Gordon, 2001; AlHadi 2022). Though clinical samples were not available, analyses were repeated in a subsample at high risk for eating disorder pathology. Last, this dissertation evaluated the psychometric properties of the Saudi Arabic EDE-Q and BSQ and to provide preliminary normative data. In addition, this dissertation could be perceived as a first step to expanding knowledge regarding an understudied population investigating assessment, etiology and correlates of eating disorder pathology in Saudi Arabia.

Clinical implications

Results of the four studies included in part I indicated that eating disorder pathology and body-shape dissatisfaction are prevalent in Saudi Arabia. Since only body- shape dissatisfaction and a high BMI were found to be correlates of the severity of eating disorder

pathology it is recommended to offer preventative programs targeted to Saudis with excess weight and body- shape dissatisfaction. The proposed cut-offs of the EDE-Q and BSQ can be used to select Saudis for such programs aimed at avoiding the development of eating disorder pathology (Stice & Shaw, 2002). In addition, life style interventions counteracting the increase of the prevalence of excess weight in order to prevent associated health risks (Madanat et al., 2007), accompanied by psycho-education in order to prevent maladaptive weight-loss strategies, may be beneficial. In addition, Saudis with excess weight currently tend to seek bariatric surgery, without the recommended, screening for eating disorders taking place.

Screening for eating disorders and referral of Saudis at high risk for eating disorders might reduce delayed help seeking and prevent increased severity of eating disorder pathology. In addition, the Saudi-Arabic EDE-Q and BSQ could be used to measure reduction of eating disorder symptoms after eating disorder treatment. Furthermore, the availability of normalized standard scores (*T*-scores), will ease interpretation of test results and increase applicability of the BSQ (de Beurs et al., 2022). However, treatment is hampered by the lack of specialized therapists and treatment facilities (Qadan, 2009). More attention for eating disorder pathology is called for. Increased knowledge about eating disorders might decrease the current preference for self- or family help, and therefore counteract stigma associated with psychotherapy. Increased knowledge and awareness could be achieved by offering psycho-education at high-schools, including a parental program. Once college and high-school social workers are better educated in the recognition of eating disorders, they can refer their students to mental health care clinics. Furthermore, eating disorders should become a disorder of primary care in Saudi Arabia and therapists should be trained in treatment of eating disorders.

Future studies

This dissertation evaluated the psychometric properties and established norms for the Saudi-Arabic EDE-Q and BSQ. It is recommended to further examine the test- retest reliability of both measures in the Saudi context. Future studies should include data from clinical samples diagnosed with eating disorders. In order to increase generalizability such samples should be more balanced with regard to age, gender and level of education. Furthermore, the EDE, a detailed assessor-based interview, should be validated and become available in a Saudi- Arabic version to ease diagnosis of eating disorders. Concordance on eating disorder behaviors such as binge-eating and self-induced vomiting is only moderate at best (Berg 2012).

In order to investigate causal relationships between risk factors for eating disorder pathology, future studies should involve longitudinal designs. Such studies could potentially estimate whether high BMI and body-shape dissatisfaction caused eating disorder pathology or are a result of such pathology. In addition, the association between eating disorder pathology and social media use should focus on emotional involvement instead of solely establishing the frequency of social media use. When examining the association between westernization and eating disorder pathology a valid assessment tool should be used to measure eating disorder pathology. Moreover, it would be of interest to investigate the effect of recent transformations to modernize Saudi society, for example by releasing the obligation for women to wear an abaya, and whether this impacts body-shape dissatisfaction and eating disorder pathology. For instance, body-shape dissatisfaction could be compared between women who still wear an abaya and women who have decided not to wear the traditional abaya anymore. Last, since data from clinical samples are more reliable it is recommended to examine test- retest reliability of the EDE-Q and BSQ and associations or risk factors for eating disorder pathology among Saudis diagnosed with an eating disorder.

Part II Treatment

Main findings

Chapter six showed that in-person CBT-E is an effective treatment among adult patients diagnosed with BED outside the confines of a randomized controlled trial. At the end of treatment, 48% (42/113) showed abstinence from binges and 65% (74/113) had an EDE-Q score below clinical cut-off. Full recovery (abstinence from binges combined with an EDE-Q score below clinical cut-off) was achieved by 37% (54/113) and effect sizes of reduction in EDE-Q score were large. The results of this naturalistic study were comparable to other previously conducted naturalistic studies (Byrne et al., 2011; Dalle Grave et al., 2015; Knott et al., 2015; Wade et al., 2017). However, in chapter six larger effect sizes were found than in other studies that have been conducted. In addition, compared to trials conducted by Fairburn, chapter six found a somewhat lower effectiveness of in-person CBT-E (Fairburn et al., 2009; Fairburn et al., 2015). This diminished effectiveness of in-person CBT-E could not be explained by a low eating disorder severity at start, since severity at start was generally higher in the current thesis compared to other studies (Byrne et al., 2017; Poulsen et al., 2014; Wonderlich et al., 2014).

Consistent with the transdiagnostic nature of CBT-E, the naturalistic study displayed in chapter six showed that there were no differences in treatment outcomes among patients diagnosed with BED, BN, their respective OSFEDs and atypical AN. In addition, drop-out from treatment was only predicted by the diagnosis of BN. Furthermore, higher level of education predicted better treatment outcome at end of treatment and men had better treatment outcomes compared to women at 20 weeks follow-up. In line with several other studies which examined predictors of in-person CBT-E (Masheb & Grilo, 2008; Vall & Wade, 2015) or in-person CBT for BED (Lammers et al., 2015: Peterson et al., 2000), severity of the eating

disorder at start predicted a negative treatment outcome for all eating disorders at end of treatment and follow-up. However, the only exception was that eating disorder severity at start did not predict negative treatment outcomes at follow-up for BED patients. This indicated that 20 weeks after conclusion of in-person CBT-E, BED patients with a severe eating disorder did recover equally well as compared to patients with less severe eating disorders.

The naturalistic study conducted in chapter six also showed that there were no differences in treatment outcomes between the completers sample and the intention-to-treat sample. Therefore, patients might also recover with a less intense form of treatment (Berg et al., 2020; Moore et al., 2021; Waller et al., 2018), such as an online guided self-help. Therefore, in chapter eight a guided self-help version of CBT-E was compared in a randomized controlled trial (RCT) with a delayed treatment control design. Guided self-help CBT-E appeared superior to waiting for treatment. At end of treatment the experimental group showed greater rates of full recovery (as operationalized by an EDE score below clinical cut-off and abstinence from binges) than the delayed treatment control condition. In the guided self-help condition 40% (36/90) of the participants showed full recovery, abstinence from binge eating was reported by 48% (43/90) and eating disorder pathology score was below clinical cut-off for 63% (56/90) on interview data and 79% (71/90) on self-report data. Follow-up data revealed that there were no differences between groups after both conditions received treatment. The results based on self-report data were comparable to other studies who examined efficacy of in-person CBT-E (Dalle Grave et al., 2015; Fairburn et al., 2015; Poulsen et al., 2014; Wade et al., 2017) and guided self-help versions of CBT (Carter & Fairburn, 1998; Grilo et al., 2005; Hilbert et al., 2019). It should be noted that due to a lack of studies focusing specifically on BED populations, comparisons of present study results with in-person CBT-E are mostly made with transdiagnostic patient samples or BN patients.

However, chapter eight showed greater effect sizes compared to studies conducted by others. Comparisons with in-person CBT-E based on interview data were inconclusive: some studies showed that in-person CBT-E was superior to guided self-help CBT-E (Fairburn et al., 2015), some that in-person CBT-E was inferior (Wonderlich et al., 2014) and some showed equal outcomes (Poulsen et al., 2014; Thompson-Brenner et al., 2016).

Though chapter six and eight have different study designs, at Novarum center for eating disorders BED patients showed comparable rates of abstinence of binges after in-person CBT-E offered as treatment as usual and after online guided self-help CBT-E offered in an RCT. At end of treatment, 48% of the patients reported abstinence from binge eating. Furthermore, based on self-report data, around 80% of the BED patients who received guided self-help CBT-E reported scores under the clinical cut-off while this was 65% after conclusion of in-person CBT-E. Cautiously, guided self-help CBT-E seems as effective as in-person CBT-E.

The economic evaluation presented in chapter nine showed that guided self-help CBT-E led to a greater number of binges prevented, and greater QALY gain, but at higher costs, compared to waiting for treatment. Guided self-help CBT-E can be seen as a reasonable investment for the Dutch health care system as costs of one QALY gain are within the NICE willingness-to-pay threshold of €35,000 per QALY (NICE, 2023), and the Dutch willingness-to-pay threshold of €80,000 for severe diseases (Zwaap et al., 2015). In addition, costs per QALY gain were lower in the current study than in another study which found a willingness-to-pay of €50,000 for guided self-help CBT for BED (König et al., 2018). However, still, guided self-help CBT-E appeared an expensive treatment. This is most probably because the EQ-5D-3L was not specifically validated for BED. In addition, several questions have been raised whether the EQ-5D-3L should be used in economic evaluations of mental health care interventions. Due to a limited coverage of relevant domains of areas that are relevant to some

patients with mental health care problems (e.g. psychosis), the psychometric properties of the EQ-5D-3L showed mixed results (Brazier, 2014). However, the EQ-5D-3L appeared the most sufficient assessment tool, and therefore it is still likely that guided self-help CBT-E is cost-effective.

Chapter nine showed also that there were no differences in costs between the two conditions, except for outpatient mental healthcare costs. These outpatient mental health care costs were associated with the guided self-help CBT-E intervention provided to the experimental group. The results remained stable in the sensitivity analyses, supporting the robustness of the findings. Findings of current study are in line with the few studies available which indicated that guided self-help interventions for binge eating are cost-effective (König et al., 2018; Lynch et al., 2010).

Limitations and strengths

Part II has several limitations. A significant limitation of the effectiveness, efficacy and economic evaluation studies was the time horizon. Chapter eight and nine showed efficacy and cost-effectiveness over a three months time horizon. Since patients randomized to the waiting-list also received guided self-help CBT-E during follow-up, comparison of efficacy, cost-effectiveness and cost-utility was not possible after three months. This precluded evaluation of long-term effectiveness as well as the costs of guided self-help CBT-E as compared to no treatment. With regard to efficacy of guided self-help CBT-E only within group comparisons were meaningful during follow-up, though this was taken in consideration with the choice of statistical analyses. A different study design, with a comparison to a treatment-as-usual control condition (e.g., in-person CBT-E), would have enabled comparison of efficacy and an economic evaluation with a longer time horizon, which is recommended for

future research. In addition, effectiveness of in-person CBT-E in chapter six could only be examined until 20-weeks of follow-up. Longer term follow-up data were necessary in order to assess if long-term recovery was attained.

Another limitation of the designs was that chapter six was based on self-report data and the follow-up data of chapter eight and nine were only measured by self-report. Interview data are generally viewed as more reliable, especially when measuring binge eating behavior (Berg et al., 2012). Low concordance between interview and self-report data was also demonstrated in our data. In chapter eight, the frequency of objective binges at end of treatment showed a moderate relationship between interview and self-report data. This limits the comparison of the self-reported number of binges after conclusion of in-person CBT-E (chapter six) and number of binges as assessed by independent assessors after conclusion of guided self-help CBT-E (chapter eight). In both studies 48% of the BED patients showed abstinence from binges. However, around the globe there is high concordance of eating disorder severity as measured by self-report and interview data (Berg 2011, Berg 2012, (Melisse et al., 2021). Therefore, guided self-help CBT-E could be as effective as in-person CBT-E when outcomes are based on scores on the clinical cut-off of eating disorder measures. The use of self-report data was also a limitation of the economic evaluation. Though patient's electronic files were used to establish all mental health care costs of patients within Arkin foundation, other cost data were based on patients self-report which may have been affected by recall bias. However, in order to reduce the potential impact of recall bias, health care utilization and number of binges were only measured over the month before end of treatment and extrapolated over three months between the assessments.

The (absence of a) control group was also a limitation. Comparison of guided self-help CBT-E to waiting for treatment in chapter eight and nine had further limitations. Comparison to treatment-as-usual or another active comparator instead of a waiting-list would better

reflect what normally would happen in the absence of guided self-help CBT-E (Richards, 2020). In addition, it should be noted that treatment expectation may play a role when comparing active treatment to a waitlist condition (Constantino, 2018). Treatment expectation might affect symptomatology during the waiting period before treatment. However, the extend of this effect could not be established as treatment expectancy was not assessed. In addition, chapter six only measured eating disorder pathology at start and at end of CBT-E treatment. The lack of a control group in chapter six did not allow to compare effectiveness to waiting for treatment or another treatment.

Protocol adherence was not measured in chapter six. The studies reported on in Chapter eight and nine did included assessment of protocol adherence, but only by means of self-report of the therapists. Weekly supervision meetings were held to ensure protocol adherence, but the additional use of an adherence checklist, which recently became available for CBT-E (Bailey-Straebler et al., 2022), or adherence assessment by an independent rater would have yielded more valid information regarding treatment integrity (Lopez-Alcalde et al., 2022).

Last, all studies were biased for gender by an underrepresentation of men. Though 10% of the patients with AN or BN and around 35% of the patients with BED are men (Kessler et al., 2013), only 10% of the BED patients and less than 5% of the BN and atypical AN patients included in chapter 6-8 were men. However, no effect of gender was found on eating disorder pathology and the frequency of binges. The underrepresentation of males is common to most eating disorder studies and limits the generalizability of the findings (Shingleton et al., 2015).

Strength of all studies was that they were conducted in a relevant clinical context. Results could potentially be generalized to eating disorder clinics in the Netherlands, since treatments were conducted in a specialized eating disorder treatment center. However, it

should be noted that Novarum is known for its evidence-based approach, highly structured treatment provision, and trained therapists. All therapists received weekly supervision to ensure protocol adherence. Furthermore, therapists that offered treatment in the RCT received an additional weekly supervision session. All studies were adequately powered, had larger sample sizes than most previously conducted studies (de Zwaan et al., 2017; König et al., 2018; Lynch et al., 2010) and used advanced statistical techniques, such as multiple imputations to handle missing data. Internationally used valid self-report instruments (Bohn et al., 2008; Fairburn & Beglin, 2008) were administered. Furthermore, efficacy of guided self-help CBT-E at end of treatment was examined by standardized interview data (Cooper & Fairburn, 1987; Jansen, 2000). Moreover, the studies reported on in chapter eight and nine had some additional strengths compared to the study of chapter six. Guided self-help CBT-E was a manualized treatment. In addition, compared to in-person CBT-E, patients who received guided self-help CBT-E came to a greater extent from all over the Netherlands. Therefore, the sample can be deemed representative for patients seeking specialized eating disorder treatment in the Netherlands. A special mention deserves the Covid-19 pandemic. Fortunately, due to the treatment delivery mode (eMental Health) of guided self-help CBT-E, the social distancing measures of the pandemic had limited impact on the study's execution. Nevertheless, COVID-19 might have affected the outcome of the treatments negatively, as many patients reported that it was a challenge to combine therapy, work and home-schooling kids at the same time. This would suggest that guided self-help CBT-E might potentially demonstrate even better outcomes under less adverse circumstances. Last, this was the first study to examine efficacy of guided self-help CBT-E and the first to perform an economic evaluation of a guided self-help intervention which only included full-syndrome BED patients.

Clinical implications

In concordance with the Dutch guidelines (Zorgstandaard, 2021) CBT-E is an effective treatment when offered in clinical real world setting to patients with BED, BN, their respective OSFEDs and atypical AN. With regard to personalized medicine, especially men, highly educated patients and patients with severe BED benefit well from in-person CBT-E. Therefore, in-person CBT-E should be the treatment of choice for men and highly educated patients with BN, and atypical AN. Since the diagnosis of BN predicts treatment dropout, the motivational phase of the CBT-E underweight (Fairburn, 2008; van den Berg & Schlochtermeier, 2017) could be considered when patients show low levels of motivation for treatment at start.

In concordance with the stepped care principle (Mitchell et al., 2011) and international guidelines (ANZAED, 2014; NICE, 2017) guided self-help CBT-E could be the first treatment of choice for patients with BED. When future studies confirm that guided self-help CBT-E appears non-inferior to in-person CBT-E, guided self-help CBT-E should be the first treatment of choice for patients diagnosed with BED. Preferably, the least resource-intensive treatment is delivered first (Mitchell et al., 2011). However, investigation of predictors of treatment outcomes of guided self-help CBT-E would enhance personalized medicine for BED (Kraemer, 2013) and enable information whether patients with severe BED should receive in-person CBT-E or guided self-help CBT-E. Furthermore, guided self-help treatment increased access to treatment (Abrahamsson et al., 2018; Mulkens Sandra, 2021). Moreover, guided self-help CBT-E could potentially enhance access to treatment over the globe when adapted to various socio-cultural contexts and offered among other cultures. Guided self-help CBT-E could be a resolution in Saudi Arabia to deal with the great distances, the lack of specialized treatment centers and therapists and long waiting periods. Before and during the Covid-19 pandemic several studies have shown that outcomes of remotely offered

psychotherapy either as treatment as usual or eMental Health, including CBT-E, are on par with in-person offered psychotherapy (Abrahamsson et al., 2018; Backhaus et al., 2012; de Beurs, 2022; Nelson & Duncan, 2015; Raykos et al., 2021; Trainor et al., 2020; Wang, 2022). In addition, remotely offered CBT-E is accepted by clinicians and patients (Jenkins-Guarnieri et al., 2015; Raykos et al., 2021; Rees & Stone, 2005), especially in sparsely populated areas and among patients living in the periphery (Simpson, 2009). Furthermore, even when remotely offered treatment was not accepted by patients, treatment outcomes were positive (Linardon, 2022). However, informing the patient about guided self-help CBT-E will help patients to understand and engage in the process (Waller, 2020). Moreover, another benefit from guided self-help CBT-E is that patients are more likely to attribute the results of treatment to their own efforts rather than the help of therapists. This in turn will help them enhance their sense of self-efficacy, confidence and motivation to complete treatment (Vallejo et al., 2015). This proved that guided self-help CBT-E can have a positive effect on eating disorders around the globe. However, it should be noted that in case emergency interventions appear necessary, such as in the situation of expressions of suicidal ideations during remote sessions, emergency services should be contacted while the patient is on the line (Waller, 2020). In addition, guided self-help CBT-E is not recommended when patients engage in aggressive behavior, or have serious emotional problems (Murphy et al., 2020).

Future studies

Guided self-help CBT-E holds the promise of being a cost-effective alternative to traditional treatment. However, the majority of data were collected during the Covid-19 pandemic. Therefore, future work in non-pandemic circumstances should replicate the positive outcomes of guided self-help CBT-E before further implementation (Gorrell Sasha, 2022). In addition, future studies are necessary to estimate if the results could be replicated in

other specialized eating disorder centers. Furthermore, it is of interest to examine predictors of guided self-help CBT-E. Furthermore, it is yet unclear whether guided self-help CBT-E is definitely non-inferior to in-person CBT-E, as the results of the various studies conducted who compared guided self-help CBT to in-person CBT were inconclusive (Bailer et al., 2004; de Zwaan et al., 2017; Zerwas et al., 2017). Subsequently, a logical next step for future research is to compare the effectiveness of guided self-help CBT-E with in-person CBT-E in an RCT. Such an RCT could potentially confirm if the stepped care principle should be followed and if patients can recover with a less intense form of CBT-E (Moore et al., 2021, Waller et al., 2018). When non-inferior, guided self-help CBT-E has the potential to reduce waiting times for specialized treatment (Carter 2012). In addition, when moderators of treatment are known, the Dutch guidelines should then recommend guided self-help for BED instead of in-person CBT-E as a first line of treatment.

Future studies are also recommended to assess recovery beyond 24 weeks after end of treatment. This will enable comparisons of efficacy and cost-effectiveness over a longer timeline and further enhance decision making since the scarce resources can be allocated where they offer best value for money (Konnopka et al., 2009; Stuhldreher et al., 2012). More importantly, it is also recommended to examine the efficacy of guided self-help CBT-E through video call instead of by telephone as patients can see their appearance and body on the screen during treatment. This potentially is an intervention on its own as it enhances body and weight acceptance and tolerance, and consequently changes the evaluation of body and weight to some extent (Murphy et al., 2020). Future studies should not solely rely on self-report but collect interview data as they are deemed more reliable (Berg et al., 2012). However, such valid interview assessments are currently not available in Saudi Arabia. Therefore the Saudi- Arabic EDE-Q and BSQ can be used to evaluate progression of treatment in Saudi Arabia.

Examination whether guided self-help CBT-E reduces general psychopathology is also of interest. Once guided self-help CBT-E shows long-term effectiveness including general psychopathology, investigating its effect among other eating disorder populations, such as patients suffering from non-purging BN is recommended. Several studies already showed that guided self-help interventions based on regular CBT showed positive outcomes for patients with BN (Carrard et al., 2011; Zerwas et al., 2017). Last, knowledge of guided self-help CBT-E predictors or moderators around the globe, enhances decision making by offering in-person or guided self-help CBT-E or a different type of treatment (Kraemer, 2016).

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Chapter 11 Summary

Eating disorders have a significant impact on the psychological, social and physical well-being and quality of life of affected patients (Agh et al., 2015; Hay et al., 2015; Rojo-Moreno et al., 2015). Of all eating disorders, Binge-Eating Disorder (BED) is the most recently acknowledged eating disorder and the most common eating disorders with an estimated life-time prevalence of 2%. Until 2013 BED was a provisional diagnosis and therefore not included in the Diagnostic and Statistical Manual of Mental Disorders. Still, BED remains underrecognized in comparison to anorexia nervosa and bulimia nervosa. This leads to undertreatment of BED in clinical practice. Furthermore, there is insufficient data about clinical characteristics and the clinical course of BED. Moreover, due to its recent acknowledgement, data regarding BED examining the etiology, prevalence, correlates, and response to treatment around the globe are scarce. Therefore, this dissertation focuses on various aspects of BED. Part I focuses on several knowledge gaps regarding assessment, prevalence, and correlates of BED, with a specific eye for Saudi Arabia. Focus of part II is treatment for BED: its effectiveness, efficacy, and cost-effectiveness. In short, two main subjects are addressed in this dissertation: assessment and correlates (part I), and treatment (part II).

Though data regarding efficacy and cost-effectiveness of treatments for BED are scarce in the western world, etiology, prevalence, and correlates are unknown for most Arab countries, such as Saudi Arabia. This may be because traditional Arab notions of beauty differ from the western ideal, with a curvy body being associated with fertility and wealth. However, since the oil boom a rise of the thin ideal occurred, and there are indications that eating disorders are prevalent in the Arab world. However, since eating disorders are not perceived as disorders of primary care, Saudi Arabia faces an absence of assessment tools and specialized treatment centers. In addition, research regarding eating disorders in Saudi Arabia is further

complicated by Saudi dealing with several taboos and stigma regarding mental health problems.

Assessment

Absence of assessment tools to measure body-shape dissatisfaction and eating disorder pathology may lead to overlooking or underdiagnosing BED and other eating disorders, which hampers timely proper treatment. Consequently, reliable and valid assessment tools adapted to the language and culture at hand facilitates detection of individuals at high risk of eating disorders and body-shape dissatisfaction. The Body Shape Questionnaire (BSQ; Cooper et al., 1987) is most often used to measure body-shape dissatisfaction and the Eating Disorder Examination- Questionnaire (EDE-Q; Fairburn & Beglin, 1994) is the most widely used self-report measure for eating disorder pathology. Both self-report measures are translated and adapted to various cultures. The BSQ and EDE-Q are currently not available in an Arabic version adapted for use in Saudi Arabia.. Due to cultural differences self-report instruments need adaptations, and norms for Western and Arabic populations may differ. Therefore, the present thesis aims to adapt the BSQ and EDE-Q to the Saudi language and culture and evaluate its psychometric properties.

Correlates

The Saudi culture is currently undergoing rapid changes. Previous research shows that countries dealing with such rapid changes are impacted by an increase in eating disorder prevalence (Gordon, 2001; Pavlova et al., 2010). Various explanations have been put forth. Sociocultural changes come along with a more sedentary lifestyle, and a dietary shift towards western types of foods, instrumental in the rise of excess weight. Excess weight appears to be

associated with body-shape dissatisfaction, which increases the risk for unhealthy dietary habits, which in turn increases the risk of developing eating disorder pathology. Westernization, another consequence of the sociocultural changes in Saudi Arabia, is associated with eating disorder pathology as well, as it led to a rise in the popularity of the "thin ideal". Consequently, levels of dieting, body-shape dissatisfaction and eating disorder pathology increased. Identification of correlates of eating disorder pathology, and the co-variating role of high BMI may facilitate the identification of individuals at risk for developing an eating disorder. These individuals at risk may benefit from participation in prevention programs (Stice et al., 2010).

Treatment

Enhanced Cognitive Behavioral Therapy (CBT-E; Fairburn, 2008) is an effective treatment among transdiagnostic samples and for adult patients suffering from bulimia nervosa and atypical anorexia nervosa. However, data are scarce on how adult patients diagnosed with BED respond to CBT-E. In addition, efficacy of CBT-E is mostly examined in randomized controlled trials, while effectiveness studies involve a naturalistic design and measure the degree of beneficial effect in real world, clinical settings. Therefore, the effectiveness of CBT-E among patients suffering from BED is investigated in this thesis and compared to other eating disorders. Furthermore, determination of factors predicting CBT-E treatment outcome provide prognostic information about for whom CBT-E is likely to be beneficial and for whom less so. Treatment outcomes can potentially be maximized by understanding its predictors as more targeted treatments can be offered and potentially add-ons can be developed, thus improving clinical decision making (Kraemer, 2013).

CBT-E is effective, but provided in the traditional face-to-face manner it is a time consuming treatment, requesting intense therapist involvement. In order to offer more

efficient treatments, an eMental Health intervention of CBT-E accompanied by 12 brief telephone sessions (guided self-help CBT-E) might be a solution, as this potentially covers the present gap between treatment needs and provision. Guided self-help CBT-E has also several additional advantages for the patient. As a first step to evaluate this treatment modality for BED, its efficacy is examined in a randomized controlled trial (RCT) by comparing outcomes of an experimental treatment group to a delayed treatment control group.

Guided self-help CBT-E is briefer than in-person CBT-E, requires less therapist involvement, and therefore potentially associated with lower costs of providing treatment. Furthermore, guided self-help CBT-E potentially decreases societal burdens (Weissman, 2017), since BED is associated with non communicable diseases such as hypertension and diabetes mellitus and decreased work place productivity. Therefore, an economic evaluation is undertaken from a societal perspective, alongside the RCT.

Part I Assessment, etiology, and correlates of eating disorder pathology

Main findings

Assessment

Psychometric characteristics of the Saudi version of the EDE-Q (chapter **two**) were satisfactory and the results supported the discriminant and convergent validity as compared to a golden standard, the eating disorder examination (EDE), a semi-structured diagnostic interview. The receiver-operating-characteristic curve analysis showed that the EDE-Q could accurately discriminate between individuals at high and low risk for an eating disorder according to the EDE. The original four factor model of the EDE-Q was not supported, but severity level of eating disorder pathology was accurately determined by the EDE-Q global score. The proposed cut off was 2.93.

The full version of the BSQ (BSQ34) and the short version (BSQ8C) discriminated well between clinical and non-clinical levels of body-shape dissatisfaction according to the eating disorder examination- shape concern subscale (chapter **three**). Both Saudi-Arabic BSQs had high internal consistency and a unidimensional factor structure. Suggested optimal cut-off for the BSQ34 was 114. The Saudi- Arabic EDE-Q and BSQ can be used to identify Saudis at risk for eating disorders in order to offer preventative programs.

Etiology

The review presented in **chapter four** showed that rates of eating disorder pathology were higher among women (11.4- 54.8%) than men (2- 47.3%) on eating disorder screening instruments. From our own findings presented in **chapter two**, it was estimated that according to the Saudi-Arabic EDE-Q, 28,8% (*n* = 775) of the sample was at high risk for an eating disorder. Since participants in this study were not consistent in their symptom presentation between the EDE and EDE-Q, data were insufficient to examine the exact prevalence of the various eating disorder symptoms. However it was most likely that binge- eating was the most common eating disorder symptom. The majority of the Saudi participants reported excess weight and BED was associated with high BMI. The conclusion that BED was the most common eating disorder in Saudi Arabia was supported by the recently conducted Saudi National Health Survey (AlHadi et al., 2022). This study reported a 12-months eating disorder prevalence of 3.2% and a life-time prevalence of 6.1%. BED was the most common eating disorder with a 12-months prevalence of 2.1% and a life-time prevalence of 2.6% (AlHadi et al., 2022). The review presented in chapter **four** established a gender difference, while our data (reported on in chapter **two** and **three**) showed that there were no differences in eating disorder pathology between both genders, a finding in line with AlHadi., et al (2022).

Chapter **three** investigated the prevalence of body-shape dissatisfaction in a Saudi convenience community sample, mainly existing of highly educated young women. According to the Saudi- Arabic BSQ 26.7% (*n* = 231) of them appeared at risk for body-shape dissatisfaction. However, the systematic review (chapter **four**) showed that on the Stunkard's body silhouettes test (Stunkard et al., 1983), around 66% of the Saudis displayed body-shape dissatisfaction. Chapter three did not find differences in body-shape dissatisfaction between women and men, while studies included in the review in chapter four found that women were more at risk for body-shape dissatisfaction than men. The substantial difference in body-shape dissatisfaction may be explained by the use of different measures. In addition, the studies included in the review did not use the culturally appropriate norms and the screeners used were not culturally adapted. This might have impacted the reported estimate rates and gender differences.

Correlates

Last, chapter **four** and **five** investigated correlates of eating disorder pathology. Body shape-dissatisfaction and high BMI were correlates of eating disorder pathology. A higher BMI was also associated with greater levels of body-shape dissatisfaction. Currently Saudi Arabia has the highest prevalence of excess weight worldwide (WHO, 2006), which makes this a relevant finding. High BMI appeared a covariate in the association between body-shape dissatisfaction and eating disorder pathology among Saudis. The high rates of eating disorder pathology and body-shape dissatisfaction may be a reflection of the high rates of excess weight and the attempts to lose weight among the Saudi society. **Chapter five** also showed that unmarried Saudis reported more eating disorder pathology than married Saudis which is in line with (AlHadi et al., 2022). In univariate analyses eating disorder pathology and media use

were weakly associated and socio-economic status was moderately associated with eating disorder pathology. Next, a multivariate regression analysis was performed. Low self-esteem, western cultural orientation rather than Arab orientation, increased levels of stress, frequency of media use, and high socio-economic status were no longer associated with eating disorder pathology.

Limitations and strengths of the studies

The most significant limitation was that the findings in chapter four were based on measures that were not validated for use in Arabic countries. This might have impacted the prevalence rates and estimated symptom severity. In addition, the samples in chapter two, three and five were biased. The Saudi convenience community samples included mainly young, highly educated women. Other factors also might have caused selection bias: participants might have had special interest in health care, mental health care or eating disorders, which motivated them to take part in the survey. The self-report data might also have been biased. The collectivistic culture of the Arab world made people hesitant to report individual desires, which might have impacted the reported eating disorder pathology. However, gender, age and level of education did not affect eating disorder pathology and the EDE-Q and BSQ performed similarly among both genders and various age groups. In addition, chapter two describes the efforts to counteract the potential effect of selection bias by propensity weighting. Due to the cross-sectional nature of part I it was impossible to examine causal relationships. The psychometric properties of the EDE-Q and BSQ were not assessed in a clinical sample and test-retest reliability nor sensitivity to change were assessed.

Strengths were the large sample sizes, data were collected in a society with a taboo on mental health care and a lack of popular knowledge regarding eating disorders. The studies were sufficiently powered. This was the first study to examine eating disorder pathology by

the use of validated assessment tools and some studies were supplemented by interview data. The studies included could be perceived as a first step to expanding knowledge regarding the understudied Saudi population examining assessment, etiology and correlates of eating disorder pathology.

Clinical implications

The proposed cut-offs of the EDE-Q and BSQ can be used to select Saudis for programs aiming to avoid development of eating disorder pathology and to measure reduction of eating disorder symptoms after eating disorder treatment, and therefore to assess efficacy and effectiveness of the various eating disorder treatments across the globe. In addition, life style interventions counteracting the elevated prevalence of excess weight in order to prevent associated health risks, accompanied by psycho-education in order to prevent maladaptive weight-loss strategies, may be beneficial. Treatment is hampered by the lack of specialized therapists and treatment facilities, as well as the lack of popular knowledge about eating disorders which has lead to stigmatization, and delayed help seeking. It is necessary to increase awareness on eating disorders in the Saudi community. This could be achieved by offering psycho-education at high-schools, including a parental program. Furthermore, eating disorders should become a disorder of primary care in Saudi Arabia and therapists should be trained in treatment of eating disorders.

Future studies

It is recommended for future studies to examine test-retest reliability and sensitivity to change of the Saudi-Arabic EDE-Q and BSQ in a clinical sample. In order to increase generalizability such samples should be more balanced with regard to age, gender and level of education. In addition, in order to draw causal relationships between risk factors for eating

disorder pathology future studies should involve longitudinal data. Such studies could potentially estimate whether high BMI and body-shape dissatisfaction caused eating disorder pathology or are a result of such pathology.

Part II Treatment

Main findings

Chapter **six** showed that in-person CBT-E is an effective treatment among adult patients diagnosed with BED outside the confines of an RCT. At the end of treatment, 48% showed abstinence from binges, and 65% had an EDE-Q score below clinical cut-off. Full recovery (abstinence from binges combined with an EDE-Q score below clinical cut-off) was achieved by 37%. Effect sizes of reduction in EDE-Q score were large. Furthermore, and consistent with the transdiagnostic nature of CBT-E, the naturalistic study showed that treatment outcomes among patients diagnosed with BED, bulimia nervosa, their respective OSFEDs and atypical anorexia nervosa were similar. Furthermore, chapter **six** added to the scarce body of knowledge on treatment outcome predictors of in-person CBT-E, and predictors of early treatment termination (drop-out). Drop-out from treatment was only predicted by the diagnosis of bulimia nervosa (a higher drop out among these patients). Higher level of education predicted better treatment outcome at the end of treatment and men had better treatment outcomes compared to women at follow-up. In line with several other studies which examined predictors of in-person CBT-E (Masheb & Grilo, 2008; Vall & Wade, 2015) or in-person CBT for BED (Lammers et al., 2015: Peterson et al., 2000), severity of the eating disorder at start predicted a higher level of pathology for all eating disorders at the end of treatment and follow-up. An exception was that for BED patients eating disorder severity at the start did not predict severity at follow-up. This indicated that 20

weeks after conclusion of in-person CBT-E BED patients with a severe eating disorder had greater reduction of eating disorder pathology than patients with less severe eating disorders.

Next, a treatment variant which requires less therapist time: online guided self-help CBT-E was evaluated. Such a less intense form of CBT-E treatment might bring about several other potential benefits for patients and therapists, such as bridging the present gap between treatment needs and treatment provision, the removal of geographical barriers, reduced travel costs and travel time. In chapter **seven** and **eight** the efficacy of this guided self-help version of CBT-E was evaluated by comparing it in an RCT with a delayed treatment control group. Guided self-help CBT-E appeared superior to waiting for treatment at end of treatment. In the guided self-help condition 40% of the participants showed full recovery, abstinence from binge eating was reported by 48% and eating disorder pathology score was below clinical cut-off for 63% on interview data and 79% on self-report data. In the waitlist group 10% showed abstinence from binges and 12% an EDE score below clinical cut-off. Follow-up data revealed that there were no longer differences in number of binges and severity of eating disorders pathology between groups after both conditions had received treatment.

Chapter **nine** examined whether guided self-help CBT-E was a reasonable investment for the Dutch health care system. An economic evaluation of guided self-help CBT-E compared to waiting for treatment over a period of three months, the initial phase of the RCT was performed. The economic evaluation showed that guided self-help CBT-E led greater QALY gain. The difference in societal costs between both conditions was approximately €641 [CI -86-1,393]. Costs of one QALY gained were €32,515 [CI -4619-151,393], and approximately €17 [CI -2-40] per incremental binge prevented. Guided self-help CBT-E can be seen as a reasonable investment for the Dutch health care system as costs of one QALY gain are within the NICE willingness-to-pay threshold of €35,000 per QALY (NICE, 2023). There were no differences in costs between the two conditions, except for outpatient mental

healthcare costs, associated with the guided self-help CBT-E intervention provided to the experimental group. The results remained stable in the sensitivity analyses, supporting the robustness of the findings. Findings of current study are in line with the few other studies reported on in the literature, which indicated that guided self-help interventions for binge eating are cost-effective (König et al., 2018; Lynch et al., 2010).

Limitations and strengths of the studies

A limitation of the studies included in part II was the time horizon. Longer follow-up data than 20-weeks could also assess if long-term recovery was achieved after in-person CBT-E as presented in chapter six. Chapter eight and nine showed efficacy and cost-effectiveness over a three months time horizon. Patients in the control condition received guided self-help CBT-E during follow-up. Therefore, comparison of efficacy, cost-effectiveness and cost-utility was not possible after three months. This precluded evaluation of long-term effectiveness as well as the costs of guided self-help CBT-E as compared to no treatment. The use of a waiting list control group was also a limitation. The use of an active comparator would have enabled examination of efficacy and an economic evaluation of guided self-help CBT-E with a longer time horizon. Part II also partly relied on self-report, while EDE interview data are generally more reliable, especially when measuring binges. The use of self-report data might also have affected recall bias. This effect was counterbalanced by extrapolation of last month's data over three months. Next, the use of a CBT-E adherence checklist, or adherence assessment by an independent rater would have yielded more valid information regarding treatment integrity. Last, all studies were biased for gender. Though 10-35% of the patients with eating disorders are men, only 5-10% of the included patients in chapters 6-8 were men.

Strength of all studies was that all therapists received at least weekly supervision sessions. All studies were adequately powered. Multiple imputations were performed to handle missing data. Internationally used valid self-report and interview instruments were administered. The Covid-19 pandemic had limited impact on the study's execution, due to the treatment delivery mode (eMental Health) of guided self-help CBT-E. Last, this dissertation was the first to examine efficacy and cost-effectiveness of guided self-help CBT-E only including full-syndrome BED patients.

Clinical implications

The Dutch guidelines recommend CBT-E. With regard to personalized medicine, especially men, highly educated patients and patients with severe BED benefit well from in-person CBT-E. Therefore, in-person CBT-E should be the treatment of choice for men and highly educated patients with bulimia nervosa, and atypical anorexia nervosa. Since the diagnosis of bulimia nervosa predicts treatment dropout, the motivational phase of the CBT-E underweight could be considered when patients show low levels of motivation for treatment at the start. In addition, in concordance with the stepped care principle and international guidelines guided self-help CBT-E could be the first treatment of choice for patients with BED. Moreover, guided self-help CBT-E will enhance access to treatment over the globe when adapted to various socio-cultural contexts and offered among other cultures. Thus, guided self-help CBT-E could be a resolution in Saudi Arabia to deal with the great distances, the lack of specialized treatment centers and therapists. Several studies have shown that outcomes of remotely offered psychotherapy, including CBT-E, are on par with in-person offered psychotherapy, either at end-of-treatment or at follow-up. Even when remotely offered treatment was not accepted by patients, treatment outcomes were positive (Linardon, 2022). Another advantage from guided self-help CBT-E over traditional in-person therapy is

that patients are more likely to attribute the results of treatment to their own efforts rather than the help of therapists. This in turn will enhance their sense of self-efficacy, confidence and motivation to complete treatment. These examples show that guided self-help CBT-E can have a positive effect on eating disorders around the globe.

Future studies

A logical next step is to compare the effectiveness and cost-effectiveness of guided self-help CBT-E with in-person CBT-E in an RCT. Furthermore, future studies are recommended to assess recovery beyond 24 weeks after the end of treatment. This will enable evaluation of efficacy and cost-effectiveness over a longer timeline and further enhance decision making as scarce resources can be allocated where they offer best value for money (Konnopka et al., 2009; Stuhldreher et al., 2012). More importantly, it is also recommended to examine the efficacy of guided self-help CBT-E through video conferencing instead of by telephone as patients can see their appearance and body on the screen during treatment. This potentially is an intervention on its own as it enhances body and weight acceptance and tolerance, and consequently changes the evaluation of body and weight to some extent (Murphy et al., 2020).

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Chapter 12 Nederlandse samenvatting

Eetstoornissen zijn aandoeningen die gepaard gaan met beperkingen op psychologisch en sociaal vlak en voor een verminderde kwaliteit van leven zorgen (Agh et al., 2015; Hay et al., 2015; Rojo-Moreno et al., 2015). *Binge- eating disorder* (BED), in het Nederlands ook wel de eetbuistoornis genoemd, heeft een geschatte levensprevalentie van 2% en is daarmee de meest voorkomende eetstoornis. BED is pas sinds 2013 opgenomen in de *Diagnostic and Statistical Manual of Mental Disorders* en daarmee de meest recent erkende eetstoornis. Ondanks de recente erkenning van BED, wordt BED in vergelijking met anorexia nervosa en boulimia nervosa nog onvoldoende (h)erkend. Deze gebrekkige herkenning zorgt ervoor dat een groot deel van de mensen met BED onbehandeld blijft. Hierdoor blijft het gebrek aan kennis over eigenschappen en behandeleffecten van BED cliënten in stand. Het aantal onderzoeken naar de etiologie, prevalentie, tegelijk voorkomende variabelen en behandeluitkomsten is schaars. Daarom richt dit proefschrift zich op verschillende aspecten van BED. Deel I richt zich op verschillende kennishiaten met betrekking tot diagnostiek, en prevalentie van BED, alsmede op variabelen geassocieerd met BED, met een specifiek oog voor Saoedi- Arabië. Deel II richt zich op de hiaten kennis over de behandeling van BED: de effectiviteit, werkzaamheid en kosteneffectiviteit. Er komen zo in dit proefschrift twee hoofdonderwerpen aan de orde: diagnostiek en variabelen geassocieerd met BED (deel I) en behandeling (deel II).

Hoewel in de westerse wereld gegevens over de werkzaamheid en kosteneffectiviteit van behandelingen voor BED schaars zijn, zijn etiologie, prevalentie en variabelen die geassocieerd worden met BED in Arabische landen, zoals Saoedi-Arabië bijna geheel onbekend. Een verklaring voor het gebrek aan kennis over BED in Arabische landen is mogelijk dat de traditionele Arabische opvattingen over schoonheid aanzienlijk verschillen van het westerse ideaal. In de traditionele Arabische wereld wordt een lichaam met rondingen

geassocieerd met vruchtbaarheid en rijkdom. Sinds de opkomst van de olie wordt echter een slank lichaam steeds meer als het schoonheidsideaal gezien en zijn er aanwijzingen dat eetstoornissen wel voorkomen in de Arabische wereld. Saoedi-Arabië kampt echter met een gebrek aan diagnostische instrumenten en gespecialiseerde behandelcentra. Bovendien wordt onderzoek naar eetstoornissen verder bemoeilijkt doordat Saoedi-Arabië te maken heeft met meerdere taboes en stigma's met betrekking tot psychische stoornissen.

Diagnostiek

Door het gebrek aan diagnostische instrumenten die lichaamsontevredenheid en eetstoornisklachten meten, worden BED en andere eetstoornissen te vaak over het hoofd gezien. Doordat eetstoornissen onvoldoende gediagnosticeerd worden krijgen te weinig mensen met een eetstoornis een passende behandeling. Beschikbaarheid van gevalideerde en cultureel aangepaste diagnostische instrumenten draagt bij aan herkenning van mensen met een verhoogd risico op lichaamsontevredenheid en/of een eetstoornis. De *Body Shape Questionnaire* (BSQ) (Cooper et al., 1987) en de *Eating Disorder Examination-Questionnaire* (EDE-Q) (Fairburn & Beglin, 2008) worden wereldwijd het meest gebruikt om lichaamsontevredenheid, dan wel eetstoornispathologie te meten. Beide vragenlijsten zijn momenteel beschikbaar in verscheidene talen en inzetbaar voor diverse culturen. Van de BSQ en EDE-Q zijn echter momenteel geen Arabische versies die zijn aangepast voor gebruik in Saoedi-Arabië. Vanwege de culturele verschillen wordt geadviseerd zelfrapportagelijsten aan te passen aan de desbetreffende cultuur. Daarnaast kunnen normen voor westerse en Arabische bevolkingsgroepen verschillen. Een van de doelen van het huidige proefschrift was de BSQ en EDE-Q aan te passen aan de Saoedische taal en cultuur en de psychometrische eigenschappen te onderzoeken.

Variabelen geassocieerd met BED

Saoedi-Arabië heeft momenteel te kampen met snelle culturele veranderingen. Uit eerdere onderzoeken blijkt dat de prevalentie van eetstoornissen toeneemt in landen die met zulke snelle veranderingen te maken hebben (Gordon, 2001; Pavlova et al., 2010). Hiervoor zijn verscheidene verklaringen. Zo gaan sociaal-culturele veranderingen bijvoorbeeld gepaard met een toename van overgewicht, wat veroorzaakt wordt door de meer sedentaire levensstijl en een verschuiving in het voedingspatroon naar meer westerse soorten voedsel. De toename in overgewicht lijkt verband te houden met de toename in lichaamsontevredenheid. Ontevredenheid met het lichaam verhoogt het risico op ongezonde dieetgewoonten en daarmee ook het risico op het ontwikkelen van eetstoornispathologie. De sociaal-culturele veranderingen in Saoedi-Arabië leiden ook tot verwestering. Met de verwestering wint het 'slanke schoonheidsideaal' aan terrein en daarmee ook de prevalentie eetstoornis pathologie. Door het veranderende schoonheidsideaal neemt de lichaamsontevredenheid toe en gaan Saoedi's meer diëten en. Het in kaart brengen van factoren die tegelijk voorkomen met eetstoornispathologie, alsmede het in kaart brengen van de co-variërende rol van een hoog BMI, kan het herkennen van individuen vergemakkelijken die risico lopen een eetstoornis te ontwikkelen. Deze individuen met een verhoogd risico kunnen baat hebben bij deelname aan preventieprogramma's (Stice et al., 2010).

Behandeling

Enhanced Cognitive Behavioral Therapy (CBT-E) (Fairburn, 2008) blijkt een effectieve behandeling bij transdiagnostische groepen en voor volwassen met boulimia nervosa en atypische anorexia nervosa. Er zijn echter weinig gegevens over hoe volwassenen

met de diagnose BED reageren op CBT-E. Bovendien wordt de werkzaamheid van CBT-E meestal onderzocht in gerandomiseerde gecontroleerde experimenten, terwijl effectiviteitsonderzoeken van naturalistische aard zijn en zo de effectiviteit van behandelingen in de dagelijkse klinische praktijk kan worden bepaald. Daarom wordt in dit proefschrift de effectiviteit van CBT-E bij cliënten met BED zoals toegediend in de alledaagse praktijk onderzocht en vergeleken met de effectiviteit van CBT-E bij andere eetstoornissen. Bovendien maakt onderzoek naar voorspellers van de effectiviteit van CBT-E duidelijk voor wie CBT-E waarschijnlijk een gunstig resultaat zal hebben en voor wie een minder gunstig resultaat. De effectiviteit van CBT-E kan hierdoor potentieel worden gemaximaliseerd, aangezien met deze kennis een meer op kenmerken van de persoon toegespitste behandeling aangeboden kan worden, waardoor de klinische besluitvorming wordt verbeterd (Kraemer, 2016).

CBT-E is een effectieve, maar een tijdrovende behandeling wanneer op de traditionele *face-to-face* wijze aangeboden. CBT-E vereist intensieve betrokkenheid van de therapeut. Een *eMental Health* -interventie van CBT-E vergezeld van 12 korte telefonische sessies (begeleide zelfhulp CBT-E) is potentieel een efficiëntere manier van behandelen en verkleint mogelijk het tekort aan behandelaanbod. Daarnaast heeft begeleide zelfhulp CBT-E ook een aantal andere bijkomende voordelen voor de cliënt. De eerste stap om deze vorm van behandeling voor BED te evalueren is de werkzaamheid te onderzoeken in een gerandomiseerd gecontroleerd experiment. De resultaten van een groep die begeleide zelfhulp CBT-E krijgt worden vergeleken met een controlegroep op een wachtlijst.

Begeleide zelfhulp CBT-E duurt korter dan *face-to-face* CBT-E en vereist minder betrokkenheid van de therapeut. Hierdoor gaat begeleide zelfhulp CBT-E naar verwachting gepaard met lagere kosten van de behandeling. Bovendien heeft begeleide zelfhulp CBT-E mogelijk een gunstig effect op de maatschappelijke lasten die BED met zich meebrengt

(Striegel Weissman & Rosselli, 2017). BED wordt namelijk geassocieerd met verscheidene somatische ziekten zoals hypertensie en diabetes mellitus en verminderde productiviteit op de werkplek. Daarom wordt naast het experimentele onderzoek ook een economische evaluatie uitgevoerd vanuit het maatschappelijk perspectief.

Deel I Diagnostiek, etiologie en variabelen geassocieerd met eetstoornispathologie

Belangrijkste bevindingen

Diagnostiek

De psychometrische eigenschappen van de Saoedische versie van de EDE-Q (hoofdstuk twee) bleken voldoende in vergelijking met de *Eating Disorder Examination* (EDE): de discriminerende en convergente validiteit bleken voldoende. *De receiver-operating-characteristic curve*- analyse toonde aan dat de EDE-Q op basis van de EDE onderscheid kon maken tussen individuen met en zonder eetstoornis. De ernst van de eetstoornispathologie kon accuraat worden vastgesteld aan de hand van de EDE-Q totaal score en de klinische afkapwaarde was 2.93. Het oorspronkelijke vier-factor model voor de EDE-Q werd echter niet teruggevonden in de Saoedi- Arabische EDE-Q.

De BSQ (BSQ34) en de verkorte versie van de BSQ (BSQ8C) konden op basis van de EDE subschaal ‘piekeren over figuur’, onderscheid gemaakt worden tussen klinische en niet-klinische niveaus van lichaamsontevredenheid. Beide Saoedi- Arabische BSQ' s hadden een hoge interne consistentie en een eendimensionale factorstructuur. De voorgestelde afkapwaarde op de BSQ voor klinische lichaamsontevredenheid was 114. De Saoedi-Arabische EDE-Q en BSQ kunnen worden gebruikt om Saoedi’s met een verhoogd risico op het ontwikkelen van een eetstoornis te identificeren alvorens een preventieprogramma aan te bieden.

Etiologie

Het literatuuroverzicht in hoofdstuk vier toonde aan de hand van zelfrapportage lijsten aan, dat het risico op het ontwikkelen van een eetstoornis groter was bij vrouwen (11,4-54,8%) dan bij mannen (2-47,3%). Op basis van onze eigen bevindingen, gepresenteerd in hoofdstuk twee, kwam echter naar voren dat aan de hand van de Saoedi-Arabische EDE-Q geschat werd dat 28,8% (*n* = 775) van de steekproef een verhoogd risico had op het ontwikkelden van een eetstoornis. Het was echter niet mogelijk om de exacte prevalentie van de verschillende eetstoornissen symptomen te onderzoeken. Dit had te maken met het feit dat de proefpersonen onvoldoende consistentie lieten zien tussen de EDE en EDE-Q in de presentatie van hun symptomen. We vermoeden echter dat BED de meest voorkomende eetstoornis is in Saoedi- Arabië, aangezien BED geassocieerd wordt met overgewicht en meer dan de helft van de Saoediërs overgewicht heeft. De conclusie dat BED de meest voorkomende eetstoornis was in Saoedi- Arabië, werd ondersteund door recente uitkomsten van een onderzoek met de *Saudi National Health Survey* (AlHadi et al., 2022). In deze studie werden een 12-maanden eetstoornisprevalentie van 3,2% en een levensprevalentie van 6,1% gevonden. BED was de meest voorkomende eetstoornis met een 12-maandenprevalentie van 2,1% en een levensprevalentie van 2,6%. Uit het literatuuroverzicht gepresenteerd in hoofdstuk vier kwam een sekseverschil naar voren, terwijl onze gegevens (waarover gerapporteerd wordt in hoofdstuk twee en drie) en de studie van AlHadi., et al (2022) geen verschillen in eetstoornispathologie tussen mannen en vrouwen lieten zien.

Hoofdstuk drie onderzocht de prevalentie van lichaamsontevredenheid bij een groep Saoediërs die online een set vragenlijsten invulden. Deze steekproef bestond voornamelijk uit hoogopgeleide jonge vrouwen. Volgens de Saoedi-Arabische BSQ bleek 26,7% *(n* = 231) van hen een verhoogd risico te hebben op lichaamsontevredenheid. Uit de systematische review

(hoofdstuk vier) bleek echter dat aan de hand van de Stunkard's body silhouettes test (Stunkard et al., 1983), dat ongeveer 66% van de Saoedi's een verhoogde score had. De verscheidene studies uit het literatuuroverzicht lieten zien dat vrouwen een groter risico hadden op lichaamsontevredenheid dan mannen. In het literatuuroverzicht van hoofdstuk drie werden echter geen verschillen in lichaamsontevredenheid tussen vrouwen en mannen gevonden. De grote verschillen in lichaamsontevredenheid kunnen verklaard worden door het gebruik van verschillende diagnostische instrumenten. Daarnaast werden in meerdere studies in het literatuuroverzicht diagnostische instrumenten gebruikt die niet cultureel aangepast waren en waar geen passende normen beschikbaar voor waren. Dit kan van invloed zijn geweest op de geschatte prevalenties en de gevonden verschillen tussen mannen en vrouwen.

Variabelen geassocieerd met eetstoornispathologie

Hoofdstuk vier en vijf onderzochten welke variabelen geassocieerd waren met eetstoornispathologie. Lichaamsontevredenheid en een hoog BMI bleken geassocieerd met eetstoornispathologie. Een hoger BMI werd ook in verband gebracht met meer lichaamsontevredenheid. Dit was vooral een relevante bevinding omdat in Saoedi- Arabië de hoogste prevalentie van overgewicht wereldwijd is aangetoond (WHO, 2006). Een hoog BMI bleek bij Saoedi's ook een co-variabele te zijn in het verband tussen lichaamsontevredenheid en eetstoornispathologie. Mogelijk zijn de hoge percentages eetstoornispathologie en lichaamsontevredenheid in de Saoedische samenleving een weerspiegeling van de grote prevalentie overgewicht en de daaruit voortvloeiende pogingen tot gewichtsreductie. Daarnaast bleek uit hoofdstuk vijf en uit het onderzoek van AlHadi et al., (2022) dat ongehuwde Saoedi's meer eetstoornispathologie rapporteerden dan gehuwde Saoedi's. In de univariate analyses werd een zwakke associatie gevonden tussen eetstoornispathologie en sociale mediagebruik. Sociaal-economische status bleek matig geassocieerd met

eetstoornispathologie. Uit de multivariate regressieanalyse bleek echter dat een laag zelfbeeld, verwestering, stress, frequentie van sociale mediagebruik en een hoge sociaal- economische status niet geassocieerd waren met eetstoornispathologie.

Beperkingen en sterke punten van de onderzoeken

De belangrijkste beperking was dat een deel van de bevindingen gebaseerd waren op gebruik van diagnostische instrumenten die niet gevalideerd waren voor gebruik in Arabische landen (hoofdstuk vier). Dit kan zowel van invloed zijn geweest op de prevalentiecijfers, alsmede de geschatte ernst van de symptomen. Bovendien was er sprake van vertekening in de steekproeven in hoofdstuk twee, drie en vijf. De groep Saoediërs die online een set vragenlijsten invulden bestond voornamelijk uit jonge, hoogopgeleide vrouwen. Andere factoren kunnen ook selectie vertekening hebben veroorzaakt: deelnemers deden mogelijk mee aan het onderzoek omdat zij mogelijkerwijs verhoogde interesse hadden in gezondheidszorg, geestelijke gezondheidszorg of eetstoornissen. De resultaten kunnen ook vertekend zijn geweest door het gebruik van zelf-rapportage vragenlijsten. De collectivistische culturele aard kan eraan bijgedragen hebben dat deelnemers het moeilijker vonden om hun specifieke zorgen te uiten. Geslacht, leeftijd en opleidingsniveau bleken echter geen invloed te hebben op de eetstoornispathologie en de EDE-Q en BSQ presteerden vergelijkbaar bij vrouwen en mannen, alsmede bij de jongere en oudere Saoedi's. In hoofdstuk twee is het effect van selectievertekening tegengegaan, onder andere door *propensity*-weging toe te passen. Vanwege het cross-sectionele karakter van deel I was het onmogelijk om oorzakelijke verbanden te onderzoeken. De psychometrische eigenschappen van de EDE-Q en BSQ werden niet bepaald aan de hand van een klinische steekproef. Daarnaast werden test-hertest betrouwbaarheid noch gevoeligheid voor verandering beoordeeld.

Klinische implicaties

Om Saoedi's te selecteren die in aanmerking komen voor preventieprogramma's kunnen de voorgestelde afkapwaarden van de EDE-Q en BSQ worden aangehouden. Daarnaast kunnen de Saoedische BSQ en EDE-Q ook ingezet worden om de vermindering van eetstoornispathologie te meten aan het eind van behandeling. Op deze manier kan de werkzaamheid en effectiviteit van verscheidene beschikbare eetstoornis behandelingen wereldwijd onderzocht worden. Wellicht kunnen de verhoogde prevalentie van overgewicht en daarmee gepaarde gezondheidsrisico's tegengaan worden aan de hand van leefstijlinterventies. Deze leefstijlinterventies bevatten idealiter ook psycho-educatie om het aantal ongezonde pogingen tot gewichtsverlies te beperken. Door het gebrek aan kennis over eetstoornissen en het gebrek aan gespecialiseerde behandelaren en behandelcentra worden momenteel onvoldoende individuen met een eetstoornis behandeld. Daarnaast houdt het gebrek aan kennis over eetstoornissen het stigma en taboe op hulp zoeken in stand. Het is noodzakelijk in de Saoedische gemeenschap het bewustzijn met betrekking tot eetstoornissen te vergroten. Dit zou bijvoorbeeld kunnen worden bereikt door op middelbare scholen zowel leerlingen als ouders psycho-educatie te geven. Bovendien zouden eetstoornissen in Saoedi-Arabië behandeld moeten kunnen worden in zowel de basis-ggz alsmede de specialistische ggz. Het is daarin essentieel dat behandelaren geschoold worden in het behandelen van eetstoornissen.

Toekomstig onderzoek

Voor vervolgonderzoek naar de Saoedi- Arabische EDE-Q en BSQ wordt aanbevolen om de test-hertest betrouwbaarheid, alsmede de gevoeligheid voor verandering te onderzoeken bij een klinische steekproef. De generaliseerbaarheid van dergelijke

onderzoeken wordt groter naarmate de steekproeven evenwichtiger zijn met betrekking tot leeftijd, geslacht en opleidingsniveau. Bovendien kunnen causale verbanden gelegd worden tussen risicofactoren voor het ontwikkelen van eetstoornispathologie bepaald worden wanneer er gebruik gemaakt wordt van longitudinale data. Op deze manier kan de causale relatie, alsmede de richting, bepaald worden tussen lichaamsontevredenheid, een hoog BMI en eetstoornispathologie.

Deel II Behandeling

Belangrijkste bevindingen

Uit hoofdstuk zes bleek dat *face-to-face* CBT-E ook een effectieve behandeling is voor BED cliënten wanneer de behandeling niet binnen een gerandomiseerd experiment aangeboden wordt. Bij afronden van de behandeling had 48% van de BED cliënten geen eetbuien meer en 65% had een EDE-Q-score onder de klinische afkapwaarde. Ongeveer 37% was volledig hersteld (abstinentie van eetbuien gecombineerd met een EDE-Q-score onder de klinische afkapwaarde). De reductie in EDE-Q-score gaf een groot effect aan. Bovendien, werd de transdiagnostische effectiviteit van CBT-E in de naturalistische studie in hoofdstuk zes bevestigd: het effect van de behandeling was vergelijkbaar bij cliënten met de diagnose BED, boulimia nervosa hun respectievelijke ander gespecificeerde eetstoornissen en atypische anorexia nervosa. Bovendien bracht hoofdstuk zes voorspellers van de behandeleffectiviteit van *face-to-face* CBT-E in kaart. Cliënten met de diagnose boulimia nervosa stopten significant vaker vroegtijdig met de behandeling. Bij het afronden van de behandeling bleken hoogopgeleide cliënten meer geprofiteerd te hebben van de behandeling dan cliënten met een lager opleidingsniveau en 20 weken na afronding van behandeling bleken mannen meer geprofiteerd te hebben van behandeling dan vrouwen. In overeenstemming met andere studies die voorspellers van de behandeling onderzochten, bleek een ernstigere eetstoornis bij de start

een voorspeller te zijn voor iets minder goed herstel bij zowel afronden, alsmede 20 weken na de behandeling. BED cliënten vormden hierop echter de enige uitzondering: ernst van de eetstoornis bij aanvang van de behandeling bleek geen voorspeller voor de ernst van de eetstoornispathologie 20 weken na de behandeling. Dit betekent dat 20 weken na afronden van *face-to-face* CBT-E bij BED cliënten met een ernstigere eetstoornis de eetstoornispathologie meer verminderde dan bij cliënten met een minder ernstige eetstoornis, beide groepen hadden na 20 weken vergelijkbare ernstscores.

Vervolgens werd de werkzaamheid van online begeleide zelfhulp CBT-E onderzocht. Begeleide zelfhulp CBT-E is een behandeling die minder inzet van therapeuten vraagt. Een dergelijke minder therapeut-intensieve vorm van CBT-E kan voor zowel cliënten als behandelaren verschillende andere voordelen opleveren. Begeleide zelfhulp CBT-E kan bijvoorbeeld de kloof tussen vraag en aanbod naar gespecialiseerde behandeling verkleinen: behandeling kan vrijwel overal aangeboden worden en begeleide zelfhulp CBT-E zorgt voor een vermindering in reiskosten en reistijd.

In hoofdstuk zeven en acht werd de werkzaamheid van deze begeleide zelfhulpversie van CBT-E geëvalueerd in een gerandomiseerde gecontroleerde studie (RCT). Begeleide zelfhulp CBT-E werd vergeleken met een controlegroep die na een wachtperiode van gelijke duur als de interventie (12 weken) behandeling aangeboden kreeg. Na een periode van 12 weken bleek begeleide zelfhulp CBT-E superieur aan wachten op behandeling. In de groep die direct startte met begeleide zelfhulpconditie was 40% van de deelnemers volledig hersteld, 48% had geen eetbuien meer. Volgens de EDE was 63% hersteld (een score onder de klinische afkapwaarde) en 79% scoorde onder de klinische afkapwaarde van de EDE-Q. In de groep die 12 weken had gewacht op behandeling rapporteerde 10% geen eetbuien meer en 12% had een EDE score onder de klinische afkapwaarde. Tijdens de follow-up metingen

hadden beide groepen behandeling gekregen en waren er geen verschillen meer tussen de groepen met betrekking tot het aantal eetbuien en ernst van de eetstoornis pathologie.

In hoofdstuk negen werd onderzocht of begeleide zelfhulp CBT-E een redelijke investering was voor het Nederlandse gezondheidszorgsysteem. Een economische evaluatie werd uitgevoerd tijdens de drie maanden durende eerste fase van de RCT, waarin begeleide zelfhulp CBT-E werd vergeleken met wachten op behandeling. Uit de economische evaluatie bleek, dat na begeleide zelfhulp CBT-E kwaliteit van leven beter was dan bij de groep die wachtte voor behandeling. Het verschil in maatschappelijke kosten tussen beide condities was ongeveer €641 [BI -86-1.393]. De kosten voor toename van één QALY (een jaar leven in perfecte gezondheid) waren minimaal €32.515 [BI -4619-151.393] en ongeveer €17 [BI -2-40] per voorkomen eetbui. Op basis van deze resultaten kan begeleide zelfhulp CBT-E gezien worden als een redelijke investering voor de Nederlandse gezondheidszorg: de kosten voor toename van één QALY zijn namelijk binnen de NICE richtlijnen van een betalingsbereidheid van € 35.000 per QALY (NICE, 2023). Tussen beide groepen waren, behalve de kosten van de begeleide zelfhulp CBT-E interventie aan de experimentele groep, geen verschillen in maatschappelijke kosten De robuustheid van de bevindingen werd ondersteund door de resultaten van de gevoeligheidsanalyses. De bevindingen van dit onderzoek kwamen overeen met de paar andere onderzoeken die concludeerden dat begeleide zelfhulpinterventies voor eetbuien kosteneffectief zijn (König et al., 2018; Lynch et al., 2010).

Beperkingen en sterke punten van de onderzoeken

De tijdsduur van gegevensverzameling na afsluiting van de behandeling was een van de beperkingen van de therapie-effect studies. Wanneer de follow-up periode in hoofdstuk zes langer zou zijn dan 20 weken, had beoordeeld kunnen worden of cliënten na *face-to-face* CBT-E langdurig herstellen. Hoofdstuk acht en negen onderzochten de werkzaamheid en

kosteneffectiviteit van begeleide zelfhulp CBT-E over een periode van drie maanden. Doordat cliënten in de controleconditie begeleide zelfhulp CBT-E tijdens de follow-up periode kregen konden de werkzaamheid, kosteneffectiviteit en kostenutiliteit na de periode van drie maanden niet meer met elkaar vergeleken worden. Hierdoor konden zowel de kosten alsmede de effectiviteit van wel of geen behandeling op de lange termijn niet onderzocht worden. Wanneer begeleide zelfhulp CBT-E met een andere actieve behandeling vergeleken zou worden was het wel mogelijk geweest om de kosten-effectiviteit en de werkzaamheid op de langere termijn te vergelijken. Een andere beperking van de therapie-effect studies was dat de werkzaamheid, danwel effectiviteit onderzocht waren aan de hand van de EDE-Q, terwijl de EDE betrouwbaarder is om het aantal eetbuien vast te stellen. Daarnaast kan er ook vertekening in de data ontstaan zijn omdat het voor sommige cliënten lastig was om zich hun klachten en kosten te herinneren van de afgelopen periode. Er is gepoogd herinneringsvertekening zo veel mogelijk tegen te gaan door in hoofdstuk negen de kosten en klachten alleen over de laatste maand te meten en deze vervolgens te extrapoleren over een periode van drie maanden. De behandelaren beoordeelden zelf in welke mate zij de behandeling getrouw aan het protocol uitvoerden. Het is echter betrouwbaarder om dit door een onafhankelijke beoordelaar te laten doen of aan de hand van een gestandaardiseerde checklist. Tot slot bleken de mannen ondervertegenwoordigd te zijn in de onderzochte cliënt-groepen. Hoewel 10-35% van de cliënten met een eetstoornis man is, was slechts 5-10% van de geïncludeerde cliënten in hoofdstuk 6-8 man.

Sterk punt van alle studies was dat alle behandelaren minimaal een keer per week supervisie kregen. Alle onderzoeken hadden voldoende power. Om met ontbrekende gegevens om te gaan zijn de datasets geïmputeerd. De zelf-rapportage vragenlijsten en de interviews die bij de cliënten zijn afgenomen worden wereldwijd gebruikt in onderzoek naar eetstoornissen en kosten effectiviteit. Door het *eMental Health* karakter van begeleide

zelfhulp CBT-E had de Covid-19-pandemie een beperkte impact op de studie uitvoering. Tot slot is dit proefschrift het eerste waarin de werkzaamheid en kosteneffectiviteit van begeleide zelfhulp CBT-E werd onderzocht met cliënten die voldeden aan de BED criteria en niet bij cliënten met een subklinische BED.

Klinische implicaties

Volgens de Nederlandse zorgstandaard is CBT-E de aanbevolen behandeling voor eetstoornissen. Wanneer een persoonlijk behandelaanbod gedaan wordt hebben met name mannen, hoogopgeleide cliënten en cliënten met ernstige BED veel baat bij *face-to-face* CBT-E. Op basis van de resultaten dient *face-to-face* CBT-E dus met name voor mannen en hoogopgeleide cliënten met boulimia nervosa en atypische anorexia nervosa de voorkeursbehandeling te zijn. Cliënten met boulimia nervosa stopten vaker vroegtijdig met de behandeling, daarom zou wanneer bij aanvang blijkt dat zij verminderd gemotiveerd zijn voor behandeling, overwogen kunnen worden om aan hen de motivatie fase van het CBT-E-ondergewicht protocol aan te bieden. Bovendien zou, in overeenstemming met het *stepped care*-principe en internationale richtlijnen, begeleide zelfhulp CBT-E de voorkeursbehandeling kunnen zijn voor cliënten met BED. Bovendien zou begeleide zelfhulp CBT-E wereldwijd de toegang tot behandeling kunnen verbeteren. Het is dan echter wel essentieel dat begeleide zelfhulp CBT-E wordt aangepast aan de betreffende sociaal-culturele context. Begeleide zelfhulp CBT-E zou dus een oplossing kunnen zijn in Saoedi- Arabië om de grote afstanden, het gebrek aan gespecialiseerde behandelcentra en het gebrek aan behandelaren te overbruggen. Verscheidene onderzoeken hebben aangetoond dat de resultaten van online aangeboden psychotherapie, waaronder CBT-E, vergelijkbaar zijn met *face-to-face* psychotherapie, bij zowel afronden van de behandeling, alsmede bij de follow-up. Zelfs wanneer cliënten *face-to-face* behandeling prefereerden waren de behandelresultaten positief

(Linardon, 2022). Een ander voordeel van begeleide zelfhulp CBT-E ten opzichte van traditionele *face-to-face* therapie is dat cliënten geneigd waren hun herstel toe te schrijven aan hun eigen inspanningen in plaats van aan die van de behandelaar. Dit zal de gevoelens van zelfredzaamheid, zelfvertrouwen en de motivatie om de behandeling af te ronden vergroten. Deze voorbeelden laten zien dat begeleide zelfhulp CBT-E wereldwijd een positief effect kan hebben op eetstoornis herstel.

Toekomstig onderzoek

Een logische vervolgstap is om de werkzaamheid en kosteneffectiviteit van begeleide zelfhulp CBT-E te vergelijken met reguliere CBT-E in een RCT. Bovendien is het aanbevolen om ook de werkzaamheid van begeleide zelfhulp CBT-E over een langere follow-up periode van 24 weken te onderzoeken. Op deze manier kunnen de werkzaamheid en kosteneffectiviteit over een langere tijdlijn onderzocht worden en aan de hand daarvan kunnen de richtlijnen voor behandeling verbeterd worden, aangezien dan de schaarste in het behandelaanbod zo efficiënt mogelijk ingezet kan worden (Konnopka et al., 2009; Stuhldreher et al., 2012). Het is ook aanbevolen om de werkzaamheid van begeleide zelfhulp CBT-E aangeboden middels videobellen in plaats van via de telefoon te onderzoeken. Wanneer cliënten tijdens de behandeling zichzelf op het scherm kunnen zien, is dit mogelijk een al op zichzelf staande interventie, omdat het de acceptatie en tolerantie van lichaam en gewicht verbetert (Murphy et al., 2020).

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Short biography

Bernou Melisse was born November 14, 1984 in Heiloo, the Netherlands. She went to Montessori Lyceum high school in Amsterdam. Between 2005- 2012 she completed her Master's degree in child and adolescent psychology at the VU after finalizing her internship at the eating disorder department of PsyQ in la Haye. After conducting some clinical experience in the Netherlands she moved to Riyad, Saudi Arabia in 2014. In Riyad she took part in the development of the clinical psychology program at Princess Noura University and used to lecture various psychology courses. As part of this dissertation conducted at Leiden University, she started to investigate eating disorders in Saudi Arabia during her free time. In 2018 she moved back to the Netherlands to complete the second part of this thesis. She started a position as a project leader for the online binge eating disorder treatment at Novarum center for eating disorders. She coordinates BED treatments, supervises therapists, offers psychotherapy, and examines the effectiveness and efficacy of eating disorder treatments. She also works part-time at Utrecht University where she supervises thesis students. In addition, she lectures about eating disorders at various Dutch universities and at other institutions such as the Dutch Academy of eating disorders and the Dutch association of CBT. She spoke about eating disorders at various conferences, in several newspapers, podcasts and at TV items. She is a committee member of the European Council on Eating Disorders conference and presented as a board member of the eating disorder section of the Dutch association of CBT.

Abbreviations

AN: Anorexia Nervosa

ARMSA II: Acculturation Scale for Mexican Americans II

BED: Binge Eating Disorder

BES: Binge Eating Scale

BMI: Body Mass Index

BN: Bulimia Nervosa

BSQ: Body Shape Questionnaire

CBT: Cognitive Behavioral Therapy

CBT-Enhanced: Cognitive Behavioral Therapy- Enhanced

CIA: Clinical Impairment Assessment

CHEERS: Consolidated Health Economic Evaluation Reporting Standards

CONSORT: Consolidated Standards of Reporting Trials

EAT: Eating Attitudes Test

ED: Eating Disorder

EDE: Eating Disorder Examination

EDE-Q: Eating Disorder Examination-Questionnaire

EDI 2 DT: Eating Disorders Inventory 2 Drive for Thinness Scale

EQ-5D-3L: EuroQol five-dimensional three-level GSH CBT-E: Guided Self-Help Cognitive Behavioral Therapy- Enhanced

FRS: Figure Rating Scale

GAD-7: General Anxiety Disorder questionnaire

GSH: Guided Self- Help

NICE: National Institute for Health and Care Excellence

OCI-R: Obsessive Compulsive Inventory

OSFED: Other Specified Feeding or Eating Disorder

PNU: Princess Noura bint Abdulrahman University

PRISMA: Preferred Reporting Items for Systematic reviews and Meta-Analyses

PSS: Perceived Stress Scale

RCT: Randomized Controlled Trial

SCID-5: Structured Clinical Interview for DSM-5

SCOFF: Sick, Control, One, Stone, Fat, Food

SES: Socioeconomic Status

UAE: United Arab Emirates

WAI: Working Alliance Inventory

WHO: World Health Organization

List of publications

1. **Melisse, B**., Berg, E. v. d., Jonge, M. d., Blankers, M., Furth, E. v., Dekker, J., & Beurs, E. d. (2023). Efficacy of Online Guided Self-Help Cognitive Behavioral Therapy- Enhanced for Binge Eating Disorder: a Randomized Controlled Trial. *Journal of medical Internet research*. https://doi.org/10.2196/40472

2. **Melisse, B**., Van Furth, E., & De Beurs, E. (2022). The Saudi-Arabic adaptation of the Body Shape Questionnaire (BSQ34): Psychometrics and Norms of the full version and the short version (BSQ8C*). Frontiers in Psychology, 7162*. https://doi.org/10.3389/fpsyg.2022.1046075

3. **Melisse, B.,** Blankers, M., de Beurs, E., & van Furth, E. F. (2022). Correlates of eating disorder pathology in Saudi Arabia: BMI and body dissatisfaction. *Journal of Eating disorders, 10*(1). doi:10.1186/s40337-022-00652-4

4. Geerts, M., **Melisse, B.,** van Leeuwen, M. (2022). Diagnostiek van vermijdende/ restrictieve voedselinnamestoornis en eetbuistoornis. *PsyExpert, 3*

5. **Melisse, B.,** Dekker, J., Berg, E. v. d., Jonge, M. d., Peen, J., & Beurs, E. d. (2022). Comparing the effectiveness and predictors of cognitive behavioural therapy-enhanced between patients with various eating disorder diagnoses: a naturalistic study. *The Cognitive Behaviour Therapist, 15*. doi: https://doi.org/10.1017/S1754470X22000174

6. **Melisse, B**., van Furth, E., & de Beurs, E. (2021). The Eating Disorder Examination-Questionnaire: Norms and Validity for Saudi Nationals. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity.* doi:10.1007/s40519-021-01150-3

7. **Melisse, B**., de Beurs, E., & Van Furth, E. (2020). Eating disorders in the Arab world: a literature review. *Journal of Eating disorders*. doi: 10.1186/s40337-020-00336-x

8. van den Berg, E., **Melisse, B**., Koenders, J. et al. (2020). Online cognitive behavioral therapy enhanced for binge eating disorder: study protocol for a randomized controlled trial. *BMC Psychiatry* 20, 190. doi.org/10.1186/s12888-020-02604-1

Saudi- Arabic Eating Disorder Examination- Questionnaire

استبيان الأكل

ميليس برنو من العربية النسخة

bernoumelisse@outlook.com

على مدى ٢٨ يوما الماضية	ولا يوم	١-٥ يوم	١٢- ٦ يوم	١٣- ١٥ يوم	١٦- ٢٢ يوم	٢٣- ٢٧ يوم	كل يوم
١- هل حاولت عمدا تحديد كمية من الطعام الذي تتناوله للتأثير على شكلك أو وزنك (سواء نجحت في ذلك أو لا)؟	٠	١	٢	٣	٤	٥	٦
٢- هل بقيت لفترات طويلة من الوقت (كالاستيقاظ لثمان ساعات أو أكثر) بدون تناول أي شيء على الإطلاق من أجل التأثير على شكلك أو وزنك؟	٠	١	٢	٣	٤	٥	٦
٣- هل حاولت أن تستبعد الطعام الذي تحبه من حميتك من أجل التأثير على شكلك أو وزنك (سواء نجحت في ذلك أو لا)؟	٠	١	٢	٣	٤	٥	٦
٤-هل حاولت أن تتبع قواعد محددة فيما يتعلق بتناول طعامك (على سبيل المثال، الحد من السعرات الحرارية) من أجل التأثير على شكلك أو وزنك؟	٠	١	٢	٣	٤	٥	٦
٥- هل كان لديك رغبة واضحة بأن تكون معدتك فارغة كهدف للتأثير على شكلك أو وزنك؟	٠	١	٢	٣	٤	٥	٦
٦-هل كانت لديك رغبة واضحة بأن تكون معدتك مسطحة/ منبسطة تماما؟	٠	١	٢	٣	٤	٥	٦
٧- هل التفكير بالطعام والأكل والسعرات الحرارية يجعل التركيز على الأمور التي تهتم بها صعب جدا مثل العمل ومتابعة الحديث أو القراءة؟	٠	١	٢	٣	٤	٥	٦
٨ - هل التفكير بالشكل والوزن يجعل التركيز على الأمور التي تهتم بها صعب جدا مثل العمل ومتابعة الحديث أو القراءة؟	٠	١	٢	٣	٤	٥	٦
٩-هل لديك مخاوف واضحة من فقدان سيطرتك على الأكل؟	٠	١	٢	٣	٤	٥	٦
١٠- هل لديك مخاوف واضحة من اكتساب الوزن الزائد؟	٠	١	٢	٣	٤	٥	٦
١١- هل شعرت بالبدانة؟	٠	١	٢	٣	٤	٥	٦
١٢- هل كانت لديك رغبة قوية لفقدان وزنك؟	٠	١	٢	٣	٤	٥	٦

***الأسئلة الموجودة هنا متعلقة بالأسابيع الأربعة الماضية، أقرأ الأسئلة الآتية بشكل جيد ثم أجب عليها : شكرا جزيلا.**

الأسئلة من ١-١٢: فضلا ضع دائرة على الإجابة المناسبة، تذكر بأن الإجابات ستكون متعلقة بالأسابيع الأربعة الماضية (٢٨ يوما).

*** الأسئلة من ١٣-١٨: يرجى ملء العدد المناسب على اليسار. تذكر أن الأسئلة تشير فقط إلى الأسابيع الأربعة الماضية (٢٨ يوما).**

على مدى الأسابيع الأربعة الماضية (٢٨ يوما) .....

١٣- خلال ٢٨ يوم الماضية، كم عدد المرات التي اكلت فيها كمية طعام يعدها الأشخاص الآخرون كميات أكثر من المعتاد؟ (وضح الظروف)؟

.....

١٤- كم عدد المرات التي شعرت فيها بفقدانك للسيطرة عند تناولك للطعام (بينما كنت تأكل)؟

.....

١٥- خلال ٢٨ يوما الماضية، كم **يوما** حدثت لك حالة من الإفراط في تناول الطعام (أي أنك قد تأكل كمية كبيرة غير اعتيادية من الأكل وشعرت بفقدان السيطرة في ذلك الوقت)؟

.....

١٦- خلال ٢٨ يوما الماضية، كم عدد المرات التي قمت بإمراض نفسك (التقيؤ عمداً) كوسيلة للسيطرة على شكلك أو وزنك؟

.....

١٧- خلال ٢٨ يوما الماضية، كم عدد المرات التي تناولت "المسهلات" كوسيلة للسيطرة على شكلك أو وزنك؟

.....

١٨- خلال ٢٨ يوما الماضية، كم عدد المرات التي مارست فيها الرياضة بطريقة "إلزامية" أو كوسيلة للسيطرة على وزنك وشكلك أو كمية الدهون، أو لحرق السعرات الحرارية؟

.....

*** الأسئلة من ١٩-٢١: فضلا ضع دائرة على الإجابة المناسبة، تتضمن هذه الأسئلة الآتية مصطلح يسمى شراهة الأكل و هو الأكل بكميات قد يعتقد الأغلبية من الناس على أنها كبيرة جدا في وقت قصير , مع الإحساس بفقدان السيطرة عند الأكل.**

١٩- خلال ٢٨ يوما الماضية، كم يوما أكلت في السر (أي خلسة)؟ ..... لا تقم بحساب نوبات الشراهة في الأكل	ولا يوم ٠	١-٥ يوم ١	٦-١٢ يوم ٢	١٣- ١٥ يوم ٣	١٦- ٢٢ يوم ٤	٢٣- ٢٧ يوم ٥	كل يوم ٦
٢٠-كم مرة شعرت بالذنب عندما أكلت (شعرت أنك فعلت شي خاطئ) بسبب تأثيره على شكلك أو وزنك؟ ..... لا تقم بحساب نوبات الشراهة في الأكل	ولا يوم ٠	بعض الأوقات ١	اقل من النصف ٢	نصف الوقت ٣	أكثر من النصف ٤	أكثر من النصف ٥	كل وقت ٦
٢١-خلال ٢٨ يوما الماضية، كم مره شعرت بالقلق عند رؤية الناس لك عندما تأكل؟ لا تقم بحساب نوبات الشراهة في الأكل	ولا يوم ٠	بعض الأوقات ١	اقل من النصف ٢	نصف الوقت ٣	أكثر من النصف ٤	أكثر من النصف ٥	كل وقت ٦

***الأسئلة من ٢٢-٢٨: فضلا ضع دائرة على الإجابة المناسبة, تذكر بأن الإجابات ستكون متعلقة بالأربعة أسابيع الماضية (٢٨يوما)**

على مدى ٢٨ يوما الماضية	على الأطلاق		قليلا		باعتدال		ملحوظ	
٢٢- هل أثر وزنك على طريقة تفكيرك بنفسك وحكمك على ذاتك؟	٠	١	٢	٣	٤	٥	٦	
٢٣- هل شكلك أثّر على طريقة تفكيرك كشخص؟	٠	١	٢	٣	٤	٥	٦	
٢٤- لأي درجه تشعر بالانزعاج إذا طلب منك أن تزن نفسك مرة واحدة في الأسبوع (على الاكثر) خلال الأربع أسابيع المقبلة؟	٠	١	٢	٣	٤	٥	٦	

٢٥- ما هي درجة استيائك من وزنك؟	٠	١	٢	٣	٤	٥	٦
٢٦- ما هي درجة استيائك من شكل جسمك؟	٠	١	٢	٣	٤	٥	٦
٢٧ - لأي درجة تشعر بعدم الارتياح عند النظر إلى جسمك (مثلا: عند النظر إلى شكل جسمك في المرآة، أو عند انعكاسه عاريا أوعند الاستحمام)؟ في نافذة المتجر أو حين تكون	٠	١	٢	٣	٤	٥	٦
٢٨-لأي درجة تشعر بعدم الراحة عند رؤية الآخرين لشكل جسمك (مثلا: في غرف أخذ القياسات المشتركة، أو عند السباحة، أوعند ارتداء ملابس ضيقة)؟	٠	١	٢	٣	٤	٥	٦

- ما هو وزنك الحالي؟ (الرجاء إعطاء أفضل تقدير) .....

- ما هو طولك؟ (الرجاء إعطاء أفضل تقدير) .....

.

*إذا كنت أنثى:

- خلال الأشهر الثلاثة أو الأربعة الماضية هل انقطعت عنك الدورة الشهرية؟ .....

- إذا كانت الإجابة بنعم.. كم عدد الدورات الشهرية المنقطعة؟ .....

- هل تأخذين حبوب منع الحمل؟ .....

شكراً

Saudi- Arabic Body Shape Questionnaire

سؤال كل قراءة الرجاء .الماضية أسابيع الأربعة خلال شكلك حيال تشعرين كنتِ كيف نعرف أن نود

.اليسار جهة على الموجود الرقم حول دائرة وضع و

.الأسئلة جميع على الإجابة الرجاء

:خلال الأربعة أسابيع الماضية	أبدًا	نادرًا	أحيانًا	غالبًا	عادةً	دائمًا
١. هل شعورك بالملل جعلك تطيلين التفكير بشكلك؟	١	٢	٣	٤	٥	٦
٢. هل كنتِ قلقة حيال شكلك مما جعلك تشعرين أنه عليك أن تتبعِ حمية؟	١	٢	٣	٤	٥	٦
٣. هل فكرتِ أن فخذيك، وركيكِ أو ردفيك كبيرة جداً بالنسبة لباقي جسمكِ؟	١	٢	٣	٤	٥	٦
٤. هل خفتِ من أن تصبحي سمينة (أو أسمن)؟	١	٢	٣	٤	٥	٦
٥. هل قلقتِ من أن لا يكون لحمكِ مكتنزاً كفاية؟	١	٢	٣	٤	٥	٦
٦. هل الشعور بالشبع جعلكِ تشعرين بالسمنة (مثال: بعد تناولك وجبة كبيرة) ؟	١	٢	٣	٤	٥	٦
٧. هل شعرت بشعورٍ سيء حيال جسمك مما جعلكِ تبكين؟	١	٢	٣	٤	٥	٦
هل تجنبتِ الجري بسبب أن جسدك قد يتهد ل ٨ . ؟	١	٢	٣	٤	٥	٦
٩. هل وجودك مع امرأة/فتاة نحيلة جعلك تشعرين بوعي شخصي حيال شكلك؟	١	٢	٣	٤	٥	٦
١٠. هل قلقت حيال فخذيكِ من أن ينبسطا للخارج عندما تجلسين؟	١	٢	٣	٤	٥	٦
١١. هل مجرد تناول كمية صغيرة من الطعام جعلك تشعرين بالسُمنة؟	١	٢	٣	٤	٥	٦
١٢. هل شعرتِ عند ملاحظة شكل نساء/فتيات أخريات بعدم تفضيلٍ لشكلك بالمقارنة بهنّ ؟	١	٢	٣	٤	٥	٦
١٣. هل التفكير حيال شكلك تدخلَ بقدرتكِ على التركيز(مثال: أثناء مشاهدتك للتلفاز، القراءة، الاستماع لحوار)؟	١	٢	٣	٤	٥	٦

١٤. هل كونك عارية (كما في حال استحمامك) جعلك تشعرين بالسُمنة؟	١	٢	٣	٤	٥	٦	

	أبدًا	نادرًا	أحيانًا	غالبًا	عادةً	دائمًا
١٥. هل تجنبتِ ارتداء الملابس خصوصاً التي تجعلك مُدركة لشكل جسمكِ؟	١	٢	٣	٤	٥	٦
١٦. هل تخيلتِ قطع مناطق لحمية من جسمكِ؟	١	٢	٣	٤	٥	٦
١٧. هل تناولكِ للحلويات، والكعك أو أطعمة أخرى ذات سعرات حرارية عالية، جعلك تشعرين بالسُمنة؟	١	٢	٣	٤	٥	٦
١٨. ألم تذهبِ لمناسبات اجتماعية (كالحفلات) بسبب مشاعر سيئة لديك حيال شكلك؟	١	٢	٣	٤	٥	٦
١٩. هل شعرتِ بأنك ضخمة جد أً؟	١	٢	٣	٤	٥	٦
٢٠. هل شعرتِ بالخجل من جسمك؟	١	٢	٣	٤	٥	٦
٢١. هل شعوركِ بالقلق حيال شكلك جعلكِ تتبعين حمية؟	١	٢	٣	٤	٥	٦
٢٢. هل شعرتِ بسعادةٍ أكبر حول شكلك عندما تكون معدتكِ فارغة (مثال: في الصباح)؟	١	٢	٣	٤	٥	٦
٢٣. هل فكرتِ بأن شكلك الذي أنتِ عليه هو بسبب افتقاركِ للسيطرة على نفسك؟	١	٢	٣	٤	٥	٦
٢٤. هل قلقتِ حيال رؤية أناس آخرين لتكوراتٍ من لحمك حول وسطك أو معدتك؟	١	٢	٣	٤	٥	٦
٢٥. هل شعرتِ بأنه ليس من العدل أن تكون النساء/الفتيات الأخريات أنحف منك؟	١	٢	٣	٤	٥	٦
٢٦. هل تقيأتِ من أجل الشعور بالنحافة؟	١	٢	٣	٤	٥	٦
٢٧. عندما تكونين في رفقة/مع مجموعة، هل تقلقين من أن تأخذي حيزاً كبيراً (كالجلوس على الكنبة أو مقعد السيارة)؟	١	٢	٣	٤	٥	٦

٢٨. هل قلقتِ من أن يكون جسمكِ متهدلا ؟	١	٢	٣	٤	٥	٦
٢٩. هل رؤية صورتكِ (في المرآة مثلاً أو على زجاج المحلات) جعلكِ تشعرين بالضيق من شكلكِ؟	١	٢	٣	٤	٥	٦

	أبدًا	نادرًا	أحيانًا	غالبًا	عادةً	دائمًا
٣٠. هل قرصتِ مناطق من جسمك لتري كم من الدهن يوجد فيها؟	١	٢	٣	٤	٥	٦
٣١. هل تجنبتِ مواقف أو مناسبات حيث يمكن للناس رؤية جسمك (كحفلات الزفاف أو في النادي الرياضي)؟	١	٢	٣	٤	٥	٦
٣٢. هل أخذتِ مسهلات من أجل الشعور بالنحافة؟	١	٢	٣	٤	٥	٦
٣٣. هل كان لديكِ وعي ذاتي خاص حيال شكلكِ عندما تكوني بصحبة الآخرين؟	١	٢	٣	٤	٥	٦
٣٤. هل قلقكِ حيال شكلكِ جعلكِ تشعرين بأنه يجب عليكِ ممارسة التمارين الرياضية؟	١	٢	٣	٤	٥	٦

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Binge- eating disorder in the Arabic world and the Netherlands, assessment, etiology, efficacy, effectiveness and economic evaluation of psychological interventions

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ter verkrijging van de graad Doctor aan Universiteit Leiden, op gezag van de rectrix magnifica Prof. Dr. H. Bijl, in het openbaar te verdedigen ten overstaan van de promotiecommissie van de Faculteit sociale wetenschappen op xx 2023 om xx uur in een bijeenkomst van de universiteit, Rapenburg 70, 2311 EZ Leiden

door

Bernou Melisse

geboren te Heiloo

promotoren:	Prof. Dr. E. de Beurs
	Prof. Dr. E. van Furth
promotiecommissie:	Prof. Dr. Andrea Evers
	Prof. Dr. Philip van Spinhoven
	Prof. Dr. Glenn Waller
	Prof. Dr. Anneke Goudriaan
	Dr. Nadia Garnefski

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