Autism and family health: stress, eating behavior, and health in young children with ASD and their parents

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Chapter 1

General Introduction

1.1 Background

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition which is characterized by persistent deficits in social communication and interaction and the presence of restricted and repetitive behavior (American Psychiatric Association, 2013). About one in 100 children are diagnosed with ASD worldwide (Zeidan et al., 2022). Research has shown that genetic factors play an important role in autism, with both common and rare genetic variants contributing to its development (Havdahl et al., 2021). A meta-analysis of twin studies reported heritability estimates between 64% and 93% (Tick et al., 2016). Beyond the core characteristics that are outlined in the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), individuals with ASD frequently experience comorbid mental and physical health conditions (Lai et al., 2019). In addition, about one third of the individuals with ASD have co-occurring intellectual disability (Zeidan et al., 2022). While many individuals who meet the classification criteria for autism have comorbid mental and physical health problems, research into mechanisms and factors that may contribute to these additional developmental challenges in individuals with ASD is relatively sparse.

The challenges experienced by children with ASD and their parents, can significantly shape family dynamics. Difficulties in social communication, problems in interpreting social cues, and difficulty in regulating emotions, may challenge parenting and the parent-child relationship. These difficulties may coincide with high stress levels in parents, that may influence parenting behavior and may interfere with responsiveness to a child's needs (Ward & Lee, 2020). This may in turn increase stress in the child, as responsiveness and sensitivity are important in adjusting to a child's needs (Garnett et al., 2020; Ward & Lee 2020). Not only in comparison to parents of neurotypical children, but also in comparison to parents of children with chronic conditions such as cerebral palsy or Down syndrome, parents of children with ASD report higher levels of stress (Davis & Carter, 2008; Hayes & Watson, 2013). Except influencing the parent-child interaction, these high levels of stress may have negative consequences for the mental and physical health of parents of children with ASD (Dijkstra-de Neijs et al., 2020). Indeed, many studies report mental and physical health problems in parents of

children with ASD (Schnabel et al., 2020; Warreman et al., 2023a). Notably, based on an Australian population study by Fairthorne and colleagues (2014), mothers of children with ASD are found to have mortality ratios that are twice as high and have a 54% higher likelihood to die from cancer compared to mothers of typically developing children. This suggests that the parents of children with ASD may have a serious health risk. Research into health risks in mothers and fathers of children with ASD, however, is sparse.

A better understanding into the relation between stress and health of children with ASD and their parents, may not only reveal mechanisms of challenged stress regulation in families of children with ASD, but may also eventually improve clinical care for children with ASD and their parents. Therefore, the studies that are part of this dissertation focus on stress in young children with ASD and their parents and the association of stress with mental and physical health.

1.2 Stress in parents of young children with ASD

Parents of children with ASD often encounter daily stressors that are related to taking care of a child with ASD. Stress is an adaptive mechanism serving as a biological response to environmental challenges, which enables individuals to respond to demanding circumstances. Although a certain amount of stress is common for all caregivers, parenting stress may shift towards chronic stress if parenting stress is persistent. Chronic stress is associated with multiple medical conditions, including obesity and metabolic syndrome (Low, Salomon, & Matthews, 2009; Tomiyama, 2019). As parents of children with ASD experience higher stress levels, they may be at risk for developing adverse health conditions. One pathway through which stress may be associated with health, is through its relationship with eating preferences. Chronic stress is associated with overeating and unhealthy eating (Adam & Epel, 2007; Torres & Nowson, 2007). Specifically, a recent meta-analysis demonstrates that stress is associated with an increased consumption of unhealthy foods and a decreased consumption of healthy foods (Hill et al., 2022). Moreover, previous research demonstrated higher levels of perceived stress, greater reward-based eating, and worse

metabolic health in mothers of children with ASD compared to typically developing children (Radin et al., 2019). Based on previous research, it could be hypothesized that the high levels of mental and physical health problems in parents of children with ASD could, at least partly, be attributed to the high levels of chronic parenting stress that parents experience.

To date, most research regarding stress in parents of children with ASD is directed at mothers, while fathers are rarely included. The limited research that has been performed on fathers, suggests that fathers also experience high levels of parenting stress. For example, Davis and Carter (2008) demonstrated that 39% mothers and 28% of fathers of children with ASD scored above the 90th percentile for parenting stress. Given that both mothers and fathers play an important role in their child's life, it is important to include both parents in studies regarding parenting stress. Moreover, raising a child with ASD might affect mothers and fathers differently.

Additionally, some challenges that parents of children with ASD experience, may also be specific to the age of their child. To illustrate, some studies suggest that the level of parenting stress decreases as the child becomes older (Neece et al., 2013). Certain challenges that are specific to early childhood, may be particularly stressful for parents. For example, at this developmental stage, children have to master different developmental challenges like motor milestones, language development and learning to socially interact and meet the challenge of participation in primary education. Moreover, with the mean age of children under the age 10 receiving their diagnosis being 43.2 months, parents are often searching for the most appropriate approach for their child during this period (Van 't Hof et al., 2021). It is important to evaluate the associations between stress, eating behavior and adverse health in parents during the early developmental stage of a child, as these early associations may lay the foundation for the development of health risk of parents later in life. For example, a longitudinal study in middle-aged men showed a relationship between components of the metabolic syndrome, such as obesity, and all-cause mortality 13.6 years after the baseline measurement (Ho et al., 2008). Since the majority of research is directed at parents of children in a broader age-range, focusing on stress dynamics in parents of young

children with ASD may deepen our understanding of early processes that may have lasting impact.

In summary, a gap in knowledge exists regarding stress, eating behavior and adverse health in mothers and fathers of young children with ASD.

1.3 Hair Cortisol as marker of biological Stress in parents of a child with ASD

The hypothalamic-pituitary-adrenal (HPA) axis plays an important role in the stress response by releasing cortisol during stressful situations to help to regulate stress and maintain homeostasis. On the short-term, this cortisol release can improve focus and increase alertness, providing benefits in response to environmental challenges. However, if stress becomes too strong or chronic and restoration after stress is insufficient, stress can lead to a dysregulation of the HPA-axis. The continuous high levels of cortisol may disrupt the balance of the HPA-axis, which could lead to negative health outcomes. Previous studies have related the dysregulation of the HPA-axis to adverse mental and physical health outcomes, including cardiovascular diseases, obesity, and depression (Lopez-Duran et al., 2009; van der Valk et al., 2021; van der Valk et al., 2024).

While stress is intensively investigated in parents of children with ASD, most research has focused on the self-reported stress and fewer studies have focused on (chronic) physiological stress that is associated with impact on health and wellbeing in parents of children with ASD. While self-report questionnaires are important to capture parental experiences, the use of physiological stress measures can provide a more objective understanding of the impact of parental stress in parents of children with ASD. This can be particularly useful in the understanding of the associations between stress and health in parents of children with ASD, as research in the general population associates physiological stress with various adverse health outcomes, such as abdominal obesity or cardiovascular disease (Staufenbiel et al., 2013).

The studies that compare HPA-axis activity of parents of children with ASD to parents of neurotypical children (reviewed by Padden and colleagues [2018]),

demonstrate blunted cortisol responses, lower cortisol levels and lower diurnal cortisol rhythms in parents of children with ASD, which suggests a dysregulation of the HPA-axis. This pattern of blunted cortisol responses and lower cortisol levels, likely results from chronic stress and prolonged activation of the stress systems in these parents. When researching HPA-axis activity, serum and salivary cortisol are the most frequently used indicators. However, these measures present some challenges. For example, these measures reflect cortisol levels over minutes to days and are subject to variability due to factors such as circadian rhythm and food intake and, by its nature, reflect daily variability of cortisol levels that not necessarily indicate chronic stress. Cortisol levels over time are captured in hair structures, by providing a cumulative measure of cortisol over weeks to months and is less influenced by short-term fluctuations. Hair cortisol analysis therefore offers a measure of chronic stress over longer time periods. This could provide further insight into stress responses associated with challenges that are faced by parents of children with ASD. Considering that taking care of a child with ASD is a continuous responsibility, the use of hair cortisol may deepen our understanding of the physiological impact of parenting stress. Hair cortisol concentrations may be important to obtain more insights into mental and physical health dynamics in parents of young children with ASD.

To date, only one study examined hair cortisol in parents of children with ASD. Based on this study lower hair cortisol concentrations (HCC) were reported in mothers of children with ASD in comparison to mothers of typically developing children (Radin et al., 2019). However, this study only focused on mothers and did not include fathers. Additionally, this study included mothers of children in a broad age range. As the physiological responsivity to stress may change due to exposure to stress factors and to varying challenges that are associated with the developmental stage of the child, it is of value to focus on parents of children in early childhood specifically. A gap in knowledge exists regarding associations between HCC and mental and physical health of mothers and fathers of young children with ASD.

1.4 Obesity in children with ASD

Population studies show approximately two times higher morbidity and mortality rates among individuals with autism compared to the general population (Catalá-López et al., 2022; Hirvikoski et al., 2016). These higher mortality rates concern various causes of death, associated with both mental and physical conditions. Many individuals with ASD experience physical and psychological comorbidities, such as obesity, gastrointestinal problems, and problems in metabolic health (Micai et al., 2023; Sammels et al., 2022; Warreman et al., 2023b; Warreman et al., 2023c).

One condition that has frequently been associated with morbidity and mortality in the general population is obesity. Studies in non-ASD populations have associated childhood obesity with higher lifetime risk for various chronic, serious conditions, including diabetes, multiple types of cancer, cardiovascular disease, and adult obesity (Faienza et al., 2020; Hannon et al., 2005; Weihe et al., 2020). Moreover, a population study from Sweden found that individuals with obesity during childhood had three times higher risk for mortality in early adulthood compared to same-aged individuals without obesity (Lindberg et al., 2020).

Based on a recent meta-analysis it is reported that obesity rates are higher among children and adolescents with ASD (ranging from 7.9% to 31.8%), compared to those without ASD (1.4 to 23.6%) (Sammels et al., 2022). There are several factors that could play a role in connecting ASD to the higher risk for obesity. First, as many individuals with ASD have difficulties in sensory processing, some may have challenges in recognizing or interpreting hunger and satiety signals. Previous research has associated ASD with specific food approach behavior, such as eating in the absence of hunger and emotional overeating (Wallace et al., 2021). Moreover, sensory sensitivities and rigid behaviors may lead to restricted food preferences and thereby limit the exposure to a healthy, diverse diet (Baraskewich et al., 2021). In addition, many individuals with ASD experience difficulties with self-regulation, which can make it harder to regulate their eating habits (Barnard-Brak et al., 2014). Furthermore, appetite-inducing medication may also play a role in overeating in ASD (van der Valk et al.,

2019). Lastly, parental stress may also play a role in obesity risk in children with ASD. As parents of individuals with ASD experience high levels of stress, it may be more difficult for them to create a healthy home environment, as they may focus primarily on managing the daily challenges that are related to having a child with ASD. Longitudinal studies in the general population demonstrated a link between parental stress and child weight, specifically in families with young children (Jang et al, 2019).

As obesity presents a significant health risk, it is important to examine obesity within the context of the health of children with ASD to understand and possibly prevent health problems in individuals with ASD. While overweight and obesity have been investigated before in individuals with ASD, the majority of studies have focused on children in a broad age range. As early development may impact the risk for obesity and other health problems in later childhood, it may be particularly relevant to study obesity during early childhood. Additionally, most studies on obesity in individuals with ASD have been conducted in the United States, where childhood obesity rates are higher compared to other Western countries (Sammels et al., 2022). Research into the obesity risk of young children with ASD in Europe is still sparse.

1.5 Stress in children with ASD

Children with ASD often struggle to adapt to changes and may perceive everyday stimuli as overwhelming, which may lead to intense and chronic stress and eventually to dysregulation of the HPA-axis. Studies in the general population demonstrate a link between stress exposure early in life and mental and physical health problems (e.g. obesity and depression) during adolescence (Danese & Tan, 2014; Hazel et al., 2008). As mentioned previously, individuals with ASD often experience additional mental and physical health issues apart from primary autism symptoms. Approximately 70% of the children with ASD are diagnosed with at least one co-morbid disorder, such as ADHD or anxiety (Mutluer et al., 2022; Simonoff et al., 2008). Additionally, studies show that compared to children from the general population, children and adults with ASD have higher rates of physical health problems, such as obesity and gastrointestinal problems (Sammels et al., 2022; Warreman et al., 2023b; Warreman et al., 2023c).

Possibly, dysregulation of the HPA-axis plays a role in the comorbid conditions that are often seen in individuals with ASD (Makris et al., 2022). For example, previous studies in non-ASD populations found an association between HPA-axis function and overweight in school-aged children and adolescents (Miller & Lumeng, 2018). As research indicates that early life stress can have an impact on the eating behavior and health of individuals, it is important to explore possible associations between stress and children's health early in life.

However, investigating stress in children with ASD can be complex. For example, some children with ASD are non-verbal, making it challenging to assess their stress levels through self-report measures. Therefore, more objective measures, such as the measurement of cortisol over a longer period of time in children with ASD can increase our understanding of stress in children with ASD. Studies comparing HCC of children with ASD to children from the general population have produced mixed findings (Lin et al., 2024; Ogawa et al., 2017). This can probably be explained by the small sample sizes that were used or by the broad age-ranges (2 to 17 years). Research regarding the associations between stress of children with autism and their parents and the health of individuals with ASD, specifically during early childhood is sparse. This is particularly important as the behavioral and emotional patterns that are formed during early childhood can have lasting effects throughout the individual's life. Therefore, a gap in knowledge exists regarding the associations between HPA-axis activity and the health of young children with ASD.

Box 1.

To illustrate the challenges that are faced by children with ASD and their parents, consider the case of Tom, a four-year-old boy diagnosed with ASD and of Emma, a five-year-old girl diagnosed with ASD. These cases demonstrate the emotional and physical stress that is experienced by parents as they try to deal with daily challenges, affecting both their child's health and the overall well-being of the family. These clinical case examples have been adapted to maintain privacy of the children.

Example 1:

Tom is a four-year-old boy who is diagnosed with ASD, which manifests in social deficits, specific habits, and routines. He often fixates on specific things and shows a strong preference for the things he is familiar with, such as his favorite toys (cars) and his favorite food. Tom also follows specific rituals throughout the day, for instance, he insists that his cars should be arranged in a precise order. If his parents touch or move his cars while tidying the living room, he dysregulates. His parents notice that Tom insists on having certain foods, crisps specifically. If Tom gets upset, he demands for crips or walks to the kitchen to take the crisps out by himself. Despite the best intentions of his parents to provide Tom with healthy food, they find it hard to, as denying his requests or taking away his food results in temper tantrums. His parents state that they do not have the energy to put up a fight so many times a day and that, while they know that complying with this eating behavior contributes to the weight gain of Tom, they view it as a temporary solution to keep Tom calm.

The parents of Tom feel overwhelmed by the constant demands that are placed on them. They experience concerns regarding the future development of Tom, particularly regarding his social ability. Due to Tom's behavior, parents avoid going to social gatherings, such as parties, as they fear that he will have temper tantrums. Parents rarely have time for themselves, and their social circle has decreased in the last few years, as they prioritize Tom's care.

Example 2:

Emma is a five-year-old girl with ASD. As she is non-verbal, she struggles to communicate her needs. Due to these communication difficulties, she often gets frustrated and ends up crying or screaming. Her parents are stressed, as they are often unsure of what Emma wants or needs. One of Emma's most notable obsessions is water: if she sees water, she gets fixated on it and tries to touch it. This requires parents to constantly supervise her, especially when outside, as she frequently attempts to approach any sources of water, such as canals or fountains. As a result, parents find it safer to stay at home, where they
are better able to control her environment. This has led to social isolation for the family.

Both of Emma's parents have demanding schedules, due to the combination of their jobs and demands in taking care of Emma. As a result, they often don't have the time or energy to cook and often order food. This has led to less healthy eating habits for the whole family. Emma also faces difficulties with eating. She does not seem to recognize when she is full and therefore, she will continue eating if food is available.

1.6 Scope and outline of this dissertation

In this dissertation we evaluate the health of young children with ASD and their parents and evaluate whether their health and eating behavior is associated with chronic stress.

In Chapter 2, results of a study are reported that addresses the questions if there are differences between mothers and fathers of children with ASD and adults from the general population regarding parenting stress, eating behavior and physical health. It is also studied whether parenting stress is associated with eating behavior and physical health in mothers and fathers of young children with ASD.

In Chapter 3, we address the question if there is an association between chronic stress (HCC) in children with ASD and chronic stress of their parents? It is also explored if chronic stress of parents is related to the mental and physical health of mothers and fathers of a child with ASD.

In Chapter 4, we report the obesity rates in a group of Dutch preschool children with ASD compared to children from the general Dutch population. Additionally, it is explored which child factors (BMI, child eating behavior and ASD severity) and which parental factors (BMI, eating behavior, parenting stress and highest completed educational level) are associated with obesity in these children.

In Chapter 5, we focus on biological stress levels of young children with ASD. The following questions are addressed: (1) Is there a difference in biological stress between children with ASD and their peers? (2) Is child biological stress associated with child mental and weight-related health? (3) Is (self-reported and biological) stress of parents associated with child mental and weight-related health?

In Chapter 6, a summary of results and a general discussion of our main findings is provided.

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