CHAPTER 5

Declining and stabilising trends in prevalence of overweight and obesity in Dutch, Turkish, Moroccan and South Asian children 3-16 years of age between 1999 and 2011 in the Netherlands

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Archives of Disease in Childhood, 2014;99:46

ABSTRACT

Objective: In many developed countries overweight and obesity prevalence seems to stabilise. The aim of this study was to determine trends between 1999 and 2011 in overweight and obesity prevalence, and mean BMI z-score in Dutch, Turkish, Moroccan, and Surinamese South Asian children in the Netherlands.

Design: A cross-sectional population based study with 136 080 measurements of height and weight of 73 290 children aged 3-16 years. BMI class and BMI z-score were determined with the latest IOTF criteria, with overweight defined as an adult BMI-equivalent ≥25, and obesity ≥30. Time trends per year were analysed using logistic and linear regression analyses.

Results: The prevalence of overweight in Dutch children declined from 13% to 11% (Odds Ratio 0.960; 95% Confidence Interval 0.954 to 0.965), but increased in Turkish children from 25% to 32% (OR 1.028; 95% CI 1.020 to 1.036). In Moroccan and Surinamese South Asian children overweight rates were stable, but obesity prevalence decreased (OR 0.973; 95% CI 0.957 to 0.989, OR 0.964; 95% CI 0.943 to 0.985 respectively) as well as the mean BMI z-score (B=-0.010; 95% CI -0.014 to -0.006, B=-0.010; 95% CI -0.016 to -0.004). In Turkish children, trends limited to the period 2007-2011 showed no statistically significant relationship for all outcome measures.

Conclusion: The decrease in obesity prevalence in Dutch, Moroccan and Surinamese South Asian children suggests that overweight children became less adipose. The stabilising trend in overweight and obesity prevalence in Turkish children since 2007 may signify a levelling off for this ethnic group.

What is already known on this topic

- Overweight (excluding obesity) and obesity prevalence has been shown to stabilise in many developed countries.
- In Dutch, Moroccan, and Surinamese South Asian children in the Netherlands over weight (excluding obesity) and obesity prevalence was stable from 1999 throug 2007.
- In Turkish children overweight (excluding obesity) and obesity prevalence increased strongly from 1999 through 2007.

What this study adds

- Overweight (including obesity) prevalence declined in Dutch boys and girls from 13% in 1999 to 11% in 2011, obesity prevalence from 3.0% to 1.8%.
- Although in Moroccan and Surinamese South Asian children overweight (including obesity) prevalence was stable since 1999, obesity prevalence and mean BMI z-score declined significantly.
- In Turkish children a stabilising trend in overweight (including obesity) and obesity rates was found since 2007.

INTRODUCTION

In many developed countries overweight and obesity prevalence has been shown to level off since the late 1990's.[1,2] In a previous study we showed that between 1999 and 2007 in the city of The Hague (the Netherlands) overweight and obesity prevalence had stabilised in most ethnic groups, however, there were marked differences between the ethnic groups studied. Dutch children of Western European descent had in 2007 a prevalence of overweight (including obesity) of around 13-14% whereas children of Turkish descent had a much higher rate, of around 34%.[3] Also, time trends differed between the groups. While overweight prevalence in Dutch girls had decreased since 1999, in Turkish children both overweight and obesity had increased sharply. A recent nationwide Dutch study also found that in the four largest cities of the Netherlands (including the city of The Hague) the prevalence of overweight and obesity had levelled off in children of European descent, although at the national level overweight and obesity in this group had increased.[4] Until 1997 the prevalence of overweight and obesity in these cities was appreciably higher than in other parts of the country, leading to national and local governments deciding to provide extra funds for the development and implementation of prevention programs and interventions in these cities. While the extra provisions in the large cities might be responsible for the improvements in certain groups of children, a direct effect has not been measured.[4] Currently, trends in overweight and obesity prevalence in minority groups in the Netherlands are unknown.

The aim of this study is to firstly, estimate the current level of overweight and obesity in four of the major ethnic groups living in the Netherlands, including Dutch of European descent, Turkish, Moroccan, and Surinamese South Asian children, and secondly, to determine trends over time for the period 1999-2011 in prevalence of overweight and obesity, and in mean BMI z-score for each ethnic group.

METHODS

Population

The health of all children in the Netherlands is periodically assessed by physicians, nurses and physician assistants of Youth Health Care. In general, up until the age of four years around 15 health assessments are performed, and thereafter another three occur, usually at ages 5-6, 9-10 and 13-16 years.[5] The attendence rates to the assessments are generally high, ranging from 90-95% in children up until the age of four, and 80-90% in children older than four years of age.[3] The current study used all the height and weight data routinely collected between January 1st 1999 and December 31st 2011 during the standard health examinations at ages 3 through 16 years in the city of The Hague. Important personal and demographic variables such as family name, sex, date of birth, area code, country of birth of child and parents, and nationality were extracted from the digital health records according to the method described in our previous report.[3] Ethical consent for this study was not required as under Dutch law (Medical Research Involving Human Subjects Act) the use of routine medical information for scientific research is allowed

without the need for an evaluation by a medical ethical committee, provided that privacy is protected.[6] All personal data, such as names and dates of birth were removed from the database after some essential variables for the analyses were derived from these data, such as ethnic group and age at measurement. The anonymised dataset was used for the analyses.

As in our previous trend analysis,[3] only children belonging to the largest ethnic groups in the city of The Hague were included: Dutch (of European descent), Turkish, Moroccan and Surinamese South Asian. Because an increasing number of parents are second generation migrants in the Netherlands, i.e. born in the Netherlands themselves, ethnicity of all children measured in the years 2008 through 2011 was based on the country of birth of parents and the family name of the child. In the case of mixed origin of the parents, the country of birth of the mother determined ethnicity. However, if the mother was born in the Netherlands but the father in Turkey, Morocco or Suriname, and the child had respectively a typical Turkish, Moroccan or Surinamese South Asian family name, ethnicity was determined by father's country of birth and the child's family name.

BMI criteria

Body Mass Index [BMI=weight/(height)^2] is generally used as a proxy for body fat.[7] In adults a BMI-value of ≥25 kg/m^2 but <30 kg/m^2 is generally defined as overweight and a BMI-value of ≥30 kg/m^2 as obese. As body composition and proportions change during physical development of children these BMI criteria are unsuitable for children. Therefore, BMI cut-offs for age and sex were developed to correspond to adult BMI cut-offs of 25 and 30 kg/m^2 at 18-years[8]. This set of BMI criteria is often referred to as the IOTF (International Obesity Taskforce) cut-offs and can be applied universally, irrespective of ethnic group. Recently this set has been updated to accommodate the calculation of BMI z-scores.[9] For this study we used the new IOTF reference for all ethnic groups and we defined overweight (including obesity) as corresponding to an adult BMI-equivalent ≥25 kg/m^2 and obesity as a BMI ≥30 kg/m^2.

Area deprivation score

The socioeconomic status of a child is customarily determined by educational level of parents or the household income. As this information was unavailable for this study we used the deprivation score of the residential area of the child as a proxy for socioeconomic status of the child. These area deprivation scores are determined by the municipality of the city of The Hague and are based on the percentage of non-western migrants, the percentage of people unemployed for more than three years, the mean household income, the mean value of immovable properties (houses), and the percentage of people who relocated in the past three years. The score ranges from -25 to 25, whereby a higher score indicates a higher deprivation.

Statistical analyses

The differences in population characteristics between the years were determined using chi-square tests. To determine trends over time in the prevalence of overweight (including obesity) and obesity, logistic regression analyses were conducted with overweight (versus no overweight)

and obesity (versus no obesity) as the dependent variables, and year of measurement as the independent variable. Analyses per ethnic group were adjusted for age, deprivation score and sex; analyses per ethnicity and sex were adjusted for age and deprivation score.
Trends over time in mean BMI z-score per ethnic group were tested using a linear regression model with BMI z-score as the dependent variable and year of measurement, sex, age, and area deprivation score as the independent variables.
In all the analyses a p-value (two-sided) <0.05 was considered statistically significant.
IBM SPSS statistics software (Version 20) was used for all analyses.

RESULTS

A total of 73 290 children with 136 080 measurements of height and weight from 1999 through 2011 were included in the analyses. The population characteristics for the period 1999-2011 are shown in table 1. The ethnic group and age group distributions were significantly different between years. In the early years fewer adolescents (13-16 years) received a preventive health assessment. In later years the differences between the distributions were relatively small.

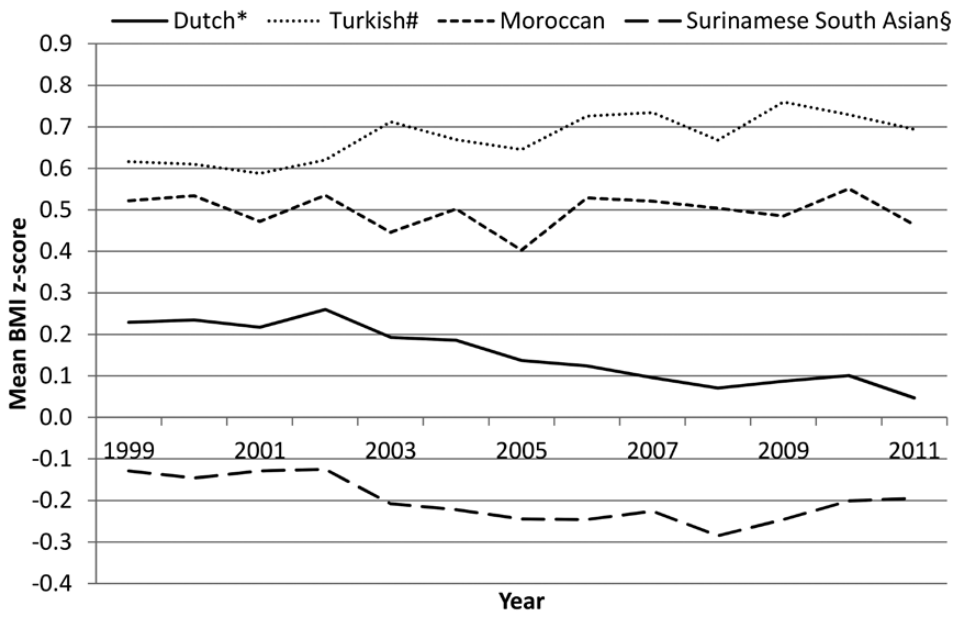
Table 1 *Study population characteristics, 1999-2011. As 1999 through 2007 were published previously, only 1999 and 2007 are shown*[3]

	Year						
	1999	2007	2008	2009	2010	2011	Total 1999-2011
N	8 749	10 308	13 429	11 946	13 574	11 897	136 080
Sex (%)							
Boys	50.8	51.0	50.3	50.5	50.2	50.0	50.7
Girls	49.2	49.0	49.7	49.5	49.8	50.0	49.3
Ethnicity (%)[a]							
Dutch	61.1	56.2	61.3	61.5	58.6	59.8	59.6
Turkish	14.4	18.3	15.6	15.8	17.6	16.7	16.5
Moroccan	12.1	14.4	12.8	12.8	13.9	13.5	13.0
Surinamese South Asian	12.3	11.1	10.3	9.9	9.9	10.0	10.9
Age group (%)[a]							
3-6 years	64.0	48.1	55.4	54.2	55.7	52.2	61.8
7-10 years	30.6	31.8	22.8	25.3	25.2	25.3	23.4
13-16 years	5.4	20.0	21.8	20.5	19.2	22.5	14.8

[a]significantly different from 1999 through 2011, P <0.001

Turkish children had the highest mean BMI z-score, followed by Moroccan, Dutch and Surinamese South Asian children (figure 1). In Surinamese South Asian children the mean BMI z-score in each year was below 0, indicating that on average Surinamese South Asian children had lower BMI's compared to the IOTF reference population. The mean BMI z-score declined statistically significantly in Dutch children between 1999 and 2011, but increased in Turkish and Surinamese South Asian children. However, in Surinamese South Asian children, after adjusting for sex, age and deprivation score, the mean BMI z-score declined significantly.

Figure 1 *Mean BMI z-score by ethnic group, adjusted for age, sex, and area deprivation score, 1999-2011.*



*significant decrease (B=-0.017; 95% CI -0.019 to -0.015), #significant increase (B=0.011; 95% CI 0.007 to -0.015), §significant decrease (B=-0.009; 95% CI -0.015 to -0.003)

We found considerable differences between ethnic groups in overweight (including obesity) and obesity prevalence in 2011 (table 2 and 3). Turkish children had the highest rates, followed by Moroccan, Surinamese South Asian, and Dutch children. Overweight and obesity prevalence declined significantly in Dutch children between 1999 and 2011. In Moroccan and Surinamese South Asian children overweight (including obesity) rates remained stable during the 13-year period, whereas obesity prevalence decreased in both ethnic groups. In Turkish children overweight (including obesity) and obesity increased. However, as the data in table 2 suggest that the prevalence may have levelled off in Turkish children since 2007, we also calculated the trends between 2007 and 2011 (data not shown). These analyses confirmed that in Turkish children there was no statistically significant trend in overweight (including obesity) prevalence (OR 0.997; 95% CI 0.968 to 1.027), nor after adjustment for sex, age and area deprivation score (OR 1.003; 95% CI 0.974 to 1.034). For obesity, a similar trend was found (OR 0.975; 95% CI 0.933 to 1.019; after adjusting for confounding factors OR 0.977; 95% CI 0.934 to 1.021). To test if in Turkish children the trends between the periods 1999-2007 and 2007-2011 were different (increase versus flattening), we performed a logistic regression analysis for the three calendar years 1999 (coded as 1) , 2007 (=9), and 2011 (=13), with the quadratic term [calendar year]^2 added as independent factor (data not shown). This analysis confirmed that the trends were different between the two periods as the quadratic term was statistically significantly associated to the

dependent factor *overweight (including obesity)* (P=0.032) and *obesity* (P=0.003) while adjusting for sex, age, and area deprivation score.

The trends between 1999 and 2011 in the mean BMI z-score in overweight (including obese) children showed a statistically significant decline in Dutch, Moroccan, and Surinamese South Asian children (figure 2). This suggests that overweight children of these ethnic groups became less adipose. In overweight (including obese) Turkish children we found no significant trend in mean BMI z-score.

Table 2 *Overweight (including obesity) rates by sex and ethnic group in 1999, 2007, 2011 (other years not shown), and time trends from 1999 through 2011 per calendar year.*

	Overweight (incl. obesity)			Time trends 1999-2011, per calendar year	
	1999	2007	2011	OR (95% CI), unadjusted	OR (95% CI), adjusted
Dutch					
Boys	11.3	11.3	10.6	0.995 (0.987 to 1.003)	0.966 (0.958 to 0.975)[c]
Girls	16.0	14.3	12.3	0.974 (0.967 to 0.982)[c]	0.954 (0.947 to 0.962)[c]
Total	13.6	12.8	11.4	0.984 (0,979 to 0.989)[c]	0.960 (0.954 to 0.965)[c]
Turkish					
Boys	22.7	34.8	32.3	1.049 (1.038 to 1.061)[c]	1.033 (1.021 to 1.045)[c]
Girls	27.1	33.8	32.6	1.034 (1.022 to 1.045)[c]	1.023 (1.011 to 1.035)[c]
Total	24.8	34.4	32.4	1.042 (1.034 to 1.050)[c]	1.028 (1.020 to 1.036)[c]
Moroccan					
Boys	18.1	23.9	23.2	1.020 (1.006 to 1.035)[b]	1.014 (1.000 to 1.028)
Girls	26.1	27.5	22.5	1.003 (0.990 to 1.016)	0.994 (0.981 to 1.007)
Total	22.1	25.7	22.8	1.011 (1.001 to 1.020)[a]	1.003 (0.994 to 1.013)
Surinamese South Asian					
Boys	14.2	19.9	17.4	1.036 (1.019 to 1.053)[c]	1.000 (0.982 to 1.017)
Girls	13.5	17.1	17.3	1.013 (0.996 to 1.030)	0.987 (0.970 to 1.005)
Total	13.8	18.6	17.3	1.024 (1.012 to 1.037)[c]	0.994 (0.981 to 1.006)

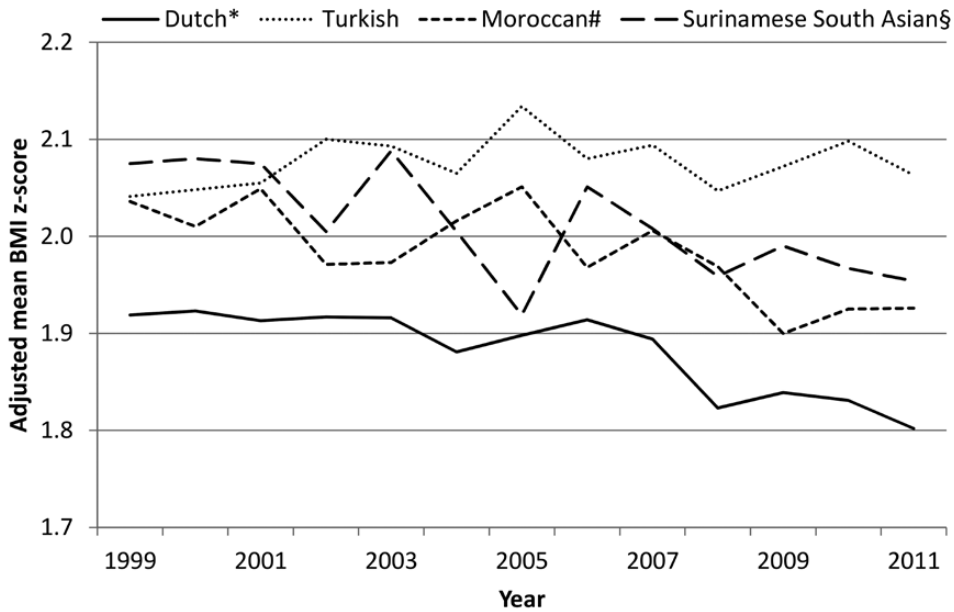
[a]P<0.05; [b]P<0.01; [c]P<0.001; OR=Odds Ratio; CI=Confidence Interval

Table 3 *Obesity rates by sex and ethnic group in 1999, 2007, 2011 (other years not shown), and time trends from 1999 through 2011 per calendar year.*

	Obesity			Time trends 1999-2011, per calendar year	
	1999	2007	2011	OR (95% CI), unadjusted	OR (95% CI), adjusted
Dutch					
Boys	2.2	2.3	1.6	0.976 (0.959 to 0.994)[b]	0.943 (0.925 to 0.961)[c]
Girls	3.9	3.4	1.9	0.951 (0.936 to 0.965)[c]	0.932 (0.917 to 0.947)[c]
Total	3.0	2.8	1.8	0.962 (0.951 to 0.973)[c]	0.937 (0.925 to 0.949)[c]
Turkish					
Boys	8.0	13.1	11.0	1.035 (1.018 to 1.053)[c]	1.030 (1.013 to 1.048)[c]
Girls	8.0	11.5	8.9	1.028 (1.011 to 1.047)[b]	1.025 (1.007 to 1.044)[b]
Total	8.0	12.3	10.0	1.032 (1.020 to 1.044)[c]	1.028 (1.016 to 1.041)[c]
Moroccan					
Boys	6.0	7.1	5.3	0.981 (0.958 to 1.005)	0.973 (0.949 to 0.997)[a]
Girls	7.6	7.2	5.5	0.975 (0.954 to 0.996)[a]	0.972 (0.951 to 0.995)[a]
Total	6.8	7.2	5.4	0.977 (0.962 to 0.993)[b]	0.973 (0.957 to 0.989)[b]
Surinamese South Asian					
Boys	5.1	5.4	5.2	0.987 (0.961 to 1.015)	0.959 (0.932 to 0.987)[b]
Girls	4.6	4.7	3.0	0.989 (0.957 to 1.021)	0.969 (0.937 to 1.002)
Total	4.8	5.1	4.1	0.988 (0.967 to 1.009)	0.964 (0.943 to 0.985)[b]

[a]P<0.05; [b]P<0.01; [c]P<0.001; OR=Odds Ratio; CI=Confidence Interval

Figure 2 *Mean BMI z-score, adjusted for sex, age and area deprivation score, in the subgroup of overweight (including obese) children by ethnic group, 1999-2011.*



*significant decrease (B=-0.010; 95% CI -0.014 to -0.006); #significant decrease (B=-0.010; 95% CI -0.014 to -0.006); §significant decrease (B=-0.010; 95% CI -0.016 to -0.004)

DISCUSSION

In this study for the period 1999-2011 we found more pronounced trends than in our previous report for the period 1999-2007.[3] Obesity declined significantly in Dutch, Moroccan, and Surinamese South Asian children between 1999 and 2011, whereas overweight (including obesity) only declined in Dutch children. While in Moroccan and Surinamese South Asian children overweight rates were stable during the 13-year period, the declining trend in obesity prevalence suggests that Moroccan and Surinamese South Asian overweight children became less adipose. This was also confirmed by a significant decrease in the mean BMI z-score in overweight children of these ethnic groups. In Turkish children overweight and obesity increased significantly between 1999 and 2011, but as there was no trend in the mean BMI z-score in overweight Turkish children over time, this group did not become more adipose. Also, from 2007, overweight (including obesity) and obesity prevalence remained stable in Turkish children, which may indicate that levels have plateaued.

The large representative sample, including four of the major ethnic groups in the Netherlands, and the adjustment for age and area deprivation score in the analyses are unique in our study. Previous studies were of smaller size and compared just two periods, whereas our study included data per calendar year. In addition, height and weight were measured (instead of self-reported) and plotted on digital growth charts that were shown to parents and children during the routine health assessment. This practice allows for the detection of erroneous measurements and the consecutive correction, leading to more precise and reliable data.
A limitation of our study is that our results may not be representative of Dutch children (of European descent) in the Netherlands in general, as overweight (including obesity) prevalence in the Dutch population of our study (11%) was somewhat lower than the estimates of a recent national prevalence study (14%).[4] The reasons for this discrepancy are currently unclear. For the minority groups studied, the results from our study are expected to be representative of the whole of the Netherlands, as most Turkish, Moroccan and Surinamese South Asian children reside in larger cities, and our previously determined prevalence rates in Turkish and Moroccan children in 1999 were similar to results from the national study of 1997.[10]

Despite the improvements detected in our study, considerable differences in childhood overweight and obesity prevalence remain between ethnic groups in the Netherlands with overweight (including obesity) in Turkish children (32%) being three times more prevalent than in Dutch children (11%). The differences have even become more pronounced as, contrary to the other ethnic groups, in Dutch children both overweight (including obesity) and obesity have declined. Also, while the prevalence of overweight (including obesity) and obesity in 1999 were still similar for Turkish and Moroccan children, in 2011 the prevalence of overweight (including obesity) in Turkish children was almost 10 percent points higher.

In our previous study, we showed that differences between the ethnic groups in overweight and obesity prevalence were already present in the youngest age groups.[3] Another Dutch study also found considerably higher overweight (including obesity) rates in Turkish and Moroccan children at 2 years of age compared with other ethnic groups,[11] which was attributed to the mother's pre-pregnancy BMI and a more rapid weight gain in the first 6 months. The reason that Turkish and Moroccan children gain more weight during infancy is unknown. Even though infant feeding practices differed between the ethnic groups studied, this was not directly associated with the excess weight gain.[12] Such single factors may not sufficiently explain the ethnic disparities in childhood overweight and obesity. More likely, the found differences are the result of a combination of biological, cultural, socio-economic, and environmental factors, and the interactions between them.[13]

Among the minority groups Surinamese South Asian children are different from Turkish and Moroccan children. In the current study, the mean BMI z-score of Surinamese South Asian children was even the lowest of all ethnic groups, and overweight (including obesity) prevalence was at 17% only slightly higher than in Dutch children. Nonetheless, the prevalence rates in Surinamese South Asian children may not represent the true prevalence in this group, as we recently showed that current universal cut-offs to determine overweight and obesity are likely to be too high for South Asian children.[14] Consequently, the current overweight and obesity rates in South Asian children expectedly underestimate the true prevalence in this group. Therefore, similarly to South Asian adults[15], BMI cut-offs to determine overweight and obesity may have to be lowered for South Asian children.

Although we cannot relate our data to the effectiveness of preventive programs, the declining prevalence of obesity in most ethnic groups of our study, and the stabilisation in the prevalence of overweight (including obesity) and obesity in Turkish children since 2007, might be a result of such programs in the city of The Hague. While studies of individual preventive interventions for overweight have either not shown an effect, or at most a small effect on BMI,[16] the combination of interventions and health promotional activities at different levels (policy, environmental, individual, school, and community) for a prolonged period of time may have had a synergetic effect to lower the overweight and obesity prevalence in several ethnic groups in the city of The Hague. Nevertheless, despite the evidence of a plateau in the prevalence of overweight and obesity in Turkish children, the differences between Dutch children and children from other ethnic groups have increased. This may be due to health promotional messages and lifestyle interventions insufficiently targeted to adequately reach migrant groups, but information on the varying effectiveness of strategies on different ethnic groups is not available. In conclusion, more research is necessary to investigate why the observed trends differ between the migrant groups studied, and why overweight (including obesity) and obesity rates remain considerably higher in Turkish children than in other ethnic groups.

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