

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/32009> holds various files of this Leiden University dissertation.

Author: Wilde, Jeroen Alexander de

Title: Does one size fit all? The case for ethnic specific standards to assess growth in South Asian children

Issue Date: 2015-02-18



CHAPTER 4

Trends in overweight and obesity prevalence in Dutch, Turkish, Moroccan and Surinamese South Asian children in the Netherlands

Jeroen A. de Wilde
Paula van Dommelen
Barend J.C. Middelkoop
Paul H. Verkerk

Archives of Disease in Childhood, 2009;95:795

ABSTRACT

Objective: To determine trends in the prevalence of overweight and obesity in children in the city of The Hague (the Netherlands) from 1999 through 2007.

Design: Population-based study of a series of cross-sectional assessments of height and weight from electronic health records.

Setting: Child Health Care of Municipal Health Service The Hague.

Participants: 50 961 children, aged 3-16 years, with Dutch (59%), Turkish (17%), Moroccan (13%) or Surinamese South Asian (11%) ethnicity, representative of the four major ethnic groups in The Hague, with 85 234 weight and height measurements recorded in the period 1999-2007.

Main outcome measures: (Trends in) prevalence of overweight (excluding obesity) and obesity as defined by the International Obesity Taskforce (IOTF) cut-off points, using logistic regression with year as independent variable.

Results: From 1999 through 2007 there was a decrease in the prevalence of overweight in Dutch girls from 12.6% to 10.9% (odds ratio [OR]=0.96; 95% Confidence Interval [CI]= 0.95-0.98) and an increase in Turkish boys from 14.6% to 21.4% (OR=1.08; 95%CI:1.04-1.11). Obesity prevalence rose significantly in Turkish boys from 7.9% to 13.1% (OR=1.04; 95%CI:1.01-1.06) and in Turkish girls from 8.0% to 10.7% (OR=1.04; 95%CI:1.01-1.08). Dutch boys, and Moroccan and Surinamese South Asian boys and girls showed no significant trends.

Conclusions: The declining prevalence of overweight in Dutch girls may indicate a turning point in the trend from past decades in the Netherlands. However, in Turkish children prevalence of overweight as well as obesity is high and increasing. Further public health actions remain necessary, especially for Turkish children.

What is already known on this topic

- Overweight and obesity prevalence in children in the Netherlands is still rising and at a faster rate than between 1980 and 1997.
- Overweight and obesity in the Netherlands are more prevalent in Turkish and Moroccan children.

What this study adds

- In Dutch girls overweight prevalence has declined since 1999.
- In Turkish children overweight and obesity prevalence has risen strongly since 1999.

INTRODUCTION

Worldwide, the prevalence of obesity in children has steadily increased since the 1980's.^{1,2} The fourth Dutch growth study of 1997 in the Netherlands also showed a two to fourfold increase in overweight and obesity prevalence in Dutch children compared to 1980 with a total overweight (including obesity) prevalence of 13%.³ In this study, for the first time, the second and third largest ethnic groups in the Netherlands, Turkish and Moroccan, were studied separately. These groups showed a two to four times higher prevalence of both overweight and obesity compared to Dutch children.⁴ The prevalence of overweight and obesity in Turkish children in the Netherlands is however comparable to that found in Germany.⁵ In Turkey itself, prevalence of overweight and obesity in children is lower and approximates the current level of overweight and obesity of Dutch children in the Netherlands.⁶⁻⁸

Compared to many other Western European countries, prevalence of overweight and obesity in Caucasian children in the Netherlands is relatively low. In 1997 around 12% of children aged 7-17 years were overweight or obese while in the United Kingdom rates in Caucasian children were almost twice as high as in the Netherlands.⁹ However, the prevalence of overweight and obesity in the Netherlands may be changing. A recent study showed a faster rate of increase of overweight and obesity in the Netherlands since 1997 than between 1980 and 1997.¹⁰

Since in that study no separate analyses of overweight and obesity in relation to ethnicity were performed, it is not known whether prevalence of overweight or obesity has increased in all ethnic groups at the same rate.

The aim of our study was to determine time trends in prevalence of overweight (excluding obesity) and obesity among children in the largest ethnic groups in the Netherlands between the ages of 3 and 16 years, using data routinely collected in the city of The Hague between 1999 and 2007.

METHODS

Data collection

Child Health Care in the Netherlands records growth data as part of a routine health surveillance programme in all children. Height and weight are measured at specific ages: 3-4, 5-6, 7-10, and 13-16 year olds. In general all children in these age groups are invited for a standard preventive health examination by a school physician or school nurse. Examinations of 3-6 year olds are performed by a school physician and 7-10 year olds are examined by a school nurse. Until 2004 13-16 year olds were examined by school physicians, but numbers of examined adolescents were, because of understaffing, never optimal. From 2004 examinations of 13-16 year olds were prioritized and more school nurses were employed to perform the examinations instead of the school physicians. The year 2004 can be regarded as a transition year in which more 13-16 year olds and slightly less 7-10 year olds had a health assessment.

In the city of The Hague, with a population of around 470 000, all findings from preventive health assessments by Child Health Care have been documented in an electronic patient record

system since September 1998. For the current study we used all height and weight data that had been collected between January 1st 1999 and December 31st 2007. Only children with Dutch, Turkish, Moroccan or Surinamese South-Asian ethnicity were included in the study. Main personal data such as name, date of birth, sex, address, postal code, land of birth of both child and parents, and nationality were acquired from the Municipal Database (Personal Files) to keep the electronic patient record system up to date.

Anthropometric methods and definitions of overweight

Heights and weights were measured by trained public health care professionals (school physicians and school nurses). At ages 3 through 6 body weight was measured with a standard mechanical or electronic step scale in underclothes. From the age of 7 body weight was measured in light clothing without shoes. Height was measured with a stadiometer or microtoise and rounded to the nearest 0.1-0.5 cm and weight rounded to the nearest 0.1-0.5 kg, depending respectively on the type of stadiometer / microtoise or scale. Body Mass Index (BMI) was calculated with the formula $weight (in kg) / [height(in m)]^2$.

To determine weight status we used the internationally agreed standard for overweight (excluding obesity) and obesity of the International Obesity Taskforce (IOTF) using BMI cut-off points for age and sex that correspond to the adult cut-offs of 25 for overweight and 30 for obesity.¹¹ In this study we will define overweight as overweight but not obese, and total overweight as overweight including obesity.

Ethnicity and Socioeconomic status

Ethnic origin of children was first based on the mother's country of birth. If however the mother was born in the Netherlands and the father was born outside the Netherlands the father's birth country prevailed. If parental country of birth was not recorded in the municipal database, nationality was used as a proxy for ethnicity. Surinamese South Asian children could not be selected on parental birth country alone, because Surinam is a multi-ethnic society with people originating from China, Indonesia, India, the Netherlands and Africa. To select Surinamese South Asian children we matched the family names with a list of 2236 typical Surinamese South Asian family names.

As a proxy of socioeconomic status (SES) we used municipal area deprivation scores (ADS) that have been attributed to each residential district of The Hague since 1995. ADS is a continuous variable, that is based on unemployment rates, average income, housing subsidy rates in the particular area, and percentage immigrants. It ranges from -25 to 25. The ADS was added to each recorded height and weight based on the postal code during the time of measurement.

Method of analysis

Dutch, Turkish and Moroccan growth reference values from the fourth Dutch growth study^{3,4} were added to the individual records. As no growth reference for Surinamese South Asian children exist the Dutch reference was added to these records. Extreme values of height, weight,

BMI, height-SDS, weight-SDS and BMI-SDS were checked and either corrected where possible or excluded from the analyses. Time trends in prevalence rates of overweight and obesity over the nine year period (1999-2007) were calculated with logistic regression analyses with year of examination as a continuous independent variable for each sex, ethnic group and age group separately. In these analyses, all records of children in the database that did not belong to the analysed group were used as a reference group, i.e. all non-obese (including overweight) were analysed versus obese and all non-overweight (including obese) versus overweight. Age and SES, both measured on a continuous scale, were introduced into the model as adjusting variables. P-values (two-sided) less than 0.05 were considered statistically significant.

RESULTS

A total of 85 234 measurements of both weight and height in 50 961 children, measured between 1999 and 2007, were used in the analyses. Less than 0.1% of all measurements were excluded from the analyses. Table 1 shows the details of the studied population. Ethnic groups are represented equally over the years and together form a representative sample of the population of The Hague.

Participation in the health surveillance programme was high (83.0%) after non-respondents were sent a second invitation to attend. Participation did not change markedly during the studied period and between ethnic groups the participation rate was similar (Dutch: 83.5%, Turkish 82.0%, Moroccan 81.6%, Surinamese South Asians 83.0%). Reasons for non-participation are not known.

Over the 9-year time period Turkish children had the highest mean prevalence of total overweight (including obesity) of 28%, followed respectively by Moroccan (23%), Surinamese South Asian (15%) and Dutch children (13%). In Turkish boys (Figure 1) and girls (Figure 2) total overweight prevalence has respectively increased from 22.4% to 34.5% ($P < 0.0001$) and from 27.4% to 33.8% ($P = 0.003$). Total overweight in Dutch girls has decreased significantly from 16.3% in 1999 to 14.2% in 2007 ($P < 0.0001$). Dutch boys, and Moroccan and Surinamese South-Asian boys and girls show no significant trend after adjustment for age and SES.

In Tables 2 and 3 prevalence of overweight and obesity is shown by ethnic group, sex and age group. The odds ratios are adjusted for SES (for the different age groups) or age and SES (total per sex). The analyses show a decline in the prevalence of overweight in Dutch 3-6 year old boys and girls, however, overweight prevalence in 7-10 year old Dutch boys showed a significant increase and therefore prevalence in the group of Dutch boys as a whole does seem to be stable.

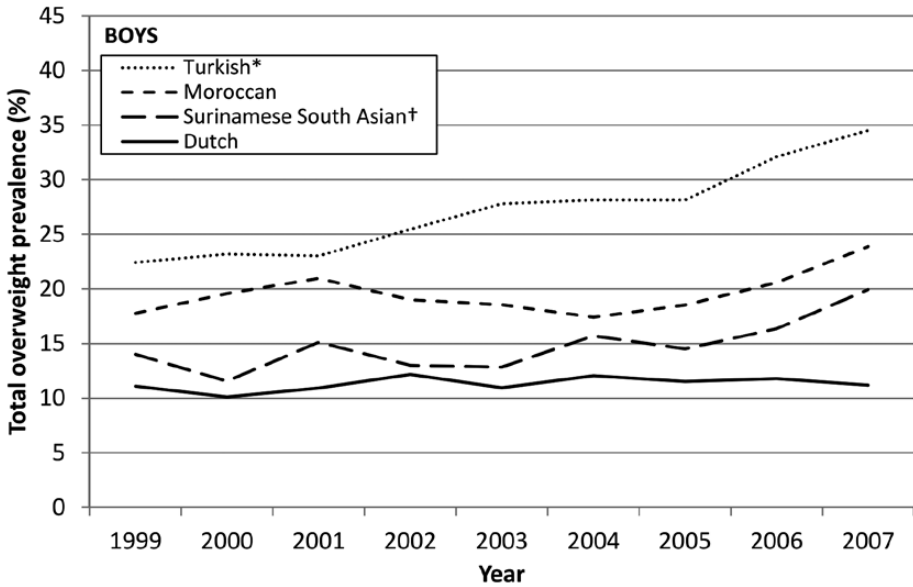
In Turkish boys overweight prevalence has increased from 14.5% in 1999 to 21.4% in 2007 ($P = 0.005$), which can be attributed to a significant increase in overweight in 7-10 year olds boys. Obesity prevalence has however increased in all age groups and the total prevalence rose from 7.9% to 13.1% in 2007 ($P < 0.0001$). In Turkish girls overweight increased significantly in 3-6 year olds and obesity in 7-10 year olds. Whilst at a group level no significant trends for overweight

and obesity could be found in Moroccan and Surinamese South Asian children, overweight prevalence has significantly increased in 7-10 year old Surinamese South Asian boys and 13-16 year old Moroccan boys. In Moroccan 13-16 year old boys also obesity rates have risen.

Table 1 Study population characteristics (numerator between brackets)

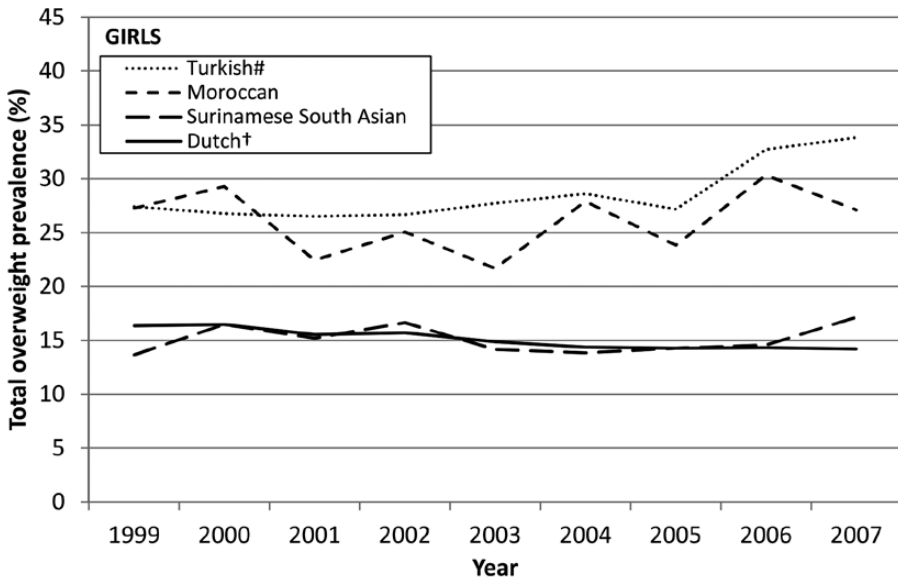
	Year											Total
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
N	8749	8112	9541	8574	8524	9407	9919	12100	10308		85234	
Sex (%)												
Boy	50.8 (4444)	51.0 (4140)	51.3 (4891)	50.6 (4337)	51.1 (4358)	50.8 (4776)	50.4 (5003)	51.2 (6193)	50.7 (5224)	50.9 (43366)		
Girl	49.2 (4305)	49.0 (3972)	48.7 (4650)	49.4 (4237)	48.9 (4166)	49.2 (4631)	49.6 (4916)	48.8 (5907)	49.3 (5084)	49.1 (41868)		
Ethnicity (%)												
Dutch	61.1 (5349)	57.1 (4636)	57.2 (5458)	60.0 (5147)	60.3 (5141)	57.7 (5424)	61.4 (6086)	60.8 (7359)	56.2 (5793)	59.1 (50393)		
Turkish	14.4 (1260)	17.5 (1416)	17.5 (1672)	16.5 (1413)	16.1 (1372)	16.8 (1583)	16.0 (1591)	16.3 (1975)	18.3 (1889)	16.6 (14171)		
Moroccan	12.1 (1063)	13.4 (1086)	13.9 (1322)	12.0 (1032)	12.4 (1054)	13.8 (1298)	12.0 (1193)	12.1 (1469)	14.4 (1480)	12.9 (10997)		
Surinamese	12.3 (1077)	12.0 (974)	11.4 (1089)	11.5 (982)	11.2 (957)	11.7 (1102)	10.6 (1049)	10.7 (1297)	11.1 (1146)	11.3 (9673)		
South Asian												
Age Group (%)												
3-6 year	64.0 (5596)	68.9 (5586)	66.8 (6374)	70.6 (6055)	79.6 (6784)	77.1 (7252)	69.2 (6865)	57.6 (6965)	48.1 (4959)	64.0 (5596)		
7-10 years	30.6 (2681)	24.4 (1982)	27.0 (2576)	25.9 (2218)	17.3 (1474)	9.1 (858)	16.5 (1639)	21.9 (2646)	31.8 (3283)	22.7 (19357)		
13-16 years	5.4 (472)	6.7 (544)	6.2 (591)	3.5 (301)	3.1 (266)	13.8 (1297)	14.3 (1415)	20.6 (2489)	20.0 (2066)	11.1 (9441)		
Response (%)	82.3	78.7	84.8	84.5	83.2	83.2	84.5	85.6	79.9	83.0		

Figure 1 Total overweight (including obesity) prevalence in boys per ethnic group from 1999 through 2007



*Significant increase, also after adjustment for age and SES (OR=1.061; 95%CI =1.039-1.083), †significant increase, but not after adjustment for age and SES.

Figure 2 Total overweight (including obesity) prevalence in girls per ethnic group from 1999 through 2007



*Significant increase, also after adjustment for age and SES (OR=1.032; 95%CI =1.010-1.053), †Significant decrease, also after adjustment for age and SES (OR=0.964; 95%CI=0.951-0.978).

Table 2 Overweight (excluding obesity) rates (%) per ethnic group, sex and age group in 1999 and 2007 and for the whole period 1999-2007; Unadjusted and adjusted odds ratio (OR) and 95% Confidence Interval (CI) for 1999 through 2007 with year of examination as independent variable, adjusted for SES (age group) or SES and age (totals per sex per ethnic group)

			1999	2007	1999 - 2007			
			% (n)	% (n)	% (n)	OR; 95%CI, unadjusted	OR; 95%CI, adjusted	
Dutch	Boys	3-6 years	7.6 (1683)	5.2 (1474)	7.2 (1241)	0.972; 0.949-0.995*	0.975; 0.952-0.998*	
		7-10 years	10.8 (916)	13.1 (793)	11.9 (675)	1.031; 1.002-1.060*	1.040; 1.011-1.070**	
		13-16 years	11.5 (113)	12.2 (637)	14.4 (374)	0.849; 0.757-0.952**	0.981; 0.933-1.031	
		Total	8.8 (2712)	8.9 (2904)	8.9 (229)	1.010; 0.994-1.027	0.983; 0.967-1.000	
	Girls	3-6 years	10.8 (1689)	8.4 (1447)	9.9 (1643)	0.970; 0.950-0.990**	0.971; 0.951-0.991**	
		7-10 years	16.2 (819)	14.1 (834)	15.7 (872)	0.976; 0.951-1.001	0.984; 0.959-1.010	
		13-16 years	13.2 (129)	12.7 (608)	14.7 (382)	0.888; 0.791-0.996*	0.972; 0.927-1.018	
		Total	12.6 (2637)	10.9 (2889)	11.7 (2897)	0.979; 0.965-0.994**	0.963; 0.948-0.978***	
	Turkish	Boys	3-6 years	12.0 (459)	15.9 (441)	13.9 (657)	1.027; 0.994-1.062	1.028; 0.994-1.063
			7-10 years	21.3 (150)	28.1 (392)	24.0 (428)	1.074; 1.033-1.117***	1.076; 1.035-1.119***
13-16 years			18.4 (38)	20.6 (175)	25.4 (210)	0.858; 0.762-1.016	1.047; 0.983-1.116	
Total			14.5 (647)	21.4 (1008)	17.6 (1295)	1.035; 1.011-1.060**	1.037; 1.012-1.062**	
Girls		3-6 years	17.0 (406)	18.7 (406)	17.3 (776)	1.035; 1.003-1.068*	1.035; 1.003-1.069*	
		7-10 years	28.0 (161)	28.3 (339)	26.7 (419)	1.002; 0.963-1.042	1.003; 0.964-1.044	
		13-16 years	10.9 (46)	23.5 (136)	23.2 (179)	0.949; 0.785-1.147	1.056; 0.987-1.129	
		Total	19.4 (613)	23.2 (881)	20.1 (1374)	1.019; 0.995-1.043	1.020; 0.996-1.044	
Moroccan		Boys	3-6 years	12.8 (374)	11.8 (357)	11.9 (432)	0.984; 0.945-1.024	0.984; 0.945-1.024
			7-10 years	10.7 (140)	20.8 (231)	17.5 (214)	1.050; 0.997-1.106	1.050; 0.996-1.106
	13-16 years		9.5 (21)	22.7 (132)	16.2 (99)	1.202; 0.962-1.502	1.118; 1.014-1.233*	
	Total		12.1 (535)	16.7 (720)	13.7 (745)	1.023; 0.993-1.054	1.011; 0.981-1.042	
	Girls	3-6 years	20.3 (325)	18.0 (333)	17.4 (616)	1.024; 0.989-1.061	1.023; 0.988-1.060	
		7-10 years	20.3 (138)	24.8 (286)	22.0 (283)	1.032; 0.986-1.080	1.032; 0.986-1.080	
		13-16 years	18.5 (65)	17.7 (141)	23.5 (167)	0.916; 0.758-1.107	0.986; 0.925-1.052	
		Total	20.1 (528)	20.5 (760)	19.2 (1066)	1.026; 1.000-1.053	1.015; 0.989-1.042	
	Surinamese South Asian	Boys	3-6 years	6.7 (343)	7.3 (261)	5.6 (179)	1.032; 0.971-1.096	1.030; 0.969-1.095
			7-10 years	12.3 (179)	22.7 (220)	16.6 (192)	1.107; 1.048-1.169***	1.108; 1.049-1.170***
13-16 years			14.3 (28)	15.3 (111)	16.8 (108)	0.880; 0.707-1.096	0.995; 0.912-1.086	
Total			8.9 (550)	14.5 (592)	9.6 (479)	1.083; 1.044-1.124***	1.034; 0.996-1.074	
Girls		3-6 years	5.0 (317)	6.7 (240)	7.5 (216)	0.967; 0.917-1.024	0.976; 0.923-1.032	
		7-10 years	15.7 (178)	20.7 (188)	19.2 (220)	1.044; 0.991-1.100	1.048; 0.994-1.104	
		13-16 years	15.6 (32)	11.9 (126)	13.8 (95)	0.863; 0.682-1.091	0.987; 0.904-1.078	
		Total	9.3 (527)	12.6 (554)	11.3 (531)	1.009; 0.975-1.044	0.984; 0.950-1.020	

* P <0.05; ** P<0.01; *** P<0.001

DISCUSSION

The main finding of this study is that in recent years overweight and obesity prevalence in children in the city of The Hague (the Netherlands) has been rising, and in particular in Turkish children. Prevalence of total overweight in Turkish boys rose from 22.4% in 1999 to 34.5% in 2007, which is an increase of 54% since 1999. In Turkish girls a 23% increase in total overweight since 1999 was found, from 27.4% to 33.8%. We also found an unexpected decline in prevalence of overweight (excluding obesity) in Dutch girls from 12.6% in 1999 to 10.9% in 2007,

Table 3 Obesity rates (%) per ethnic group, sex and age group in 1999 and 2007 and for the whole period 1999-2007; Unadjusted and adjusted odds ratio (OR) and 95% confidence interval (CI) for 1999 through 2007 with year of examination as independent variable, adjusted for SES (age group) or SES and age (totals per sex per ethnic group)

			1999	2007	1999 - 2007			
			% (n)	% (n)	% (n)	OR; 95%CI, unadjusted	OR; 95%CI, adjusted	
Dutch	Boys	3-6 years	1.8 (1683)	1.2 (1474)	1.8 (17343)	0.975; 0.933-1.020	0.992; 0.949-1.038	
		7-10 years	3.3 (916)	4.2 (793)	3.6 (5652)	1.016; 0.967-1.067	1.045; 0.994-1.099	
		13-16 years	0.9 (113)	2.5 (637)	3.7 (2593)	0.792; 0.645-0.972*	1.039; 0.940-1.148	
		Total	2.2 (2712)	2.3 (2904)	2.4 (25588)	1.010; 0.979-1.041	0.997; 0.965-1.029	
	Girls	3-6 years	3.4 (1689)	3.5 (1447)	3.0 (16666)	0.992; 0.958-1.029	1.005; 0.970-1.042	
		7-10 years	4.5 (819)	3.6 (834)	4.3 (5541)	0.946; 0.903-0.991*	0.972; 0.927-1.019	
		13-16 years	3.1 (129)	2.3 (608)	3.7 (2598)	0.803; 0.643-1.003	0.940; 0.864-1.023	
		Total	3.7 (2637)	3.3 (2889)	3.4 (24805)	0.973; 0.947-0.999*	0.978; 0.951-1.005	
	Turkish	Boys	3-6 years	8.3 (459)	11.1 (441)	9.5 (4741)	1.071; 1.030-1.114**	1.071; 1.029-1.114**
			7-10 years	8.7 (150)	14.0 (392)	11.6 (1782)	1.054; 1.000-1.100	1.056; 1.004-1.113*
13-16 year			0 (38)	16.0 (175)	9.3 (827)	1.182; 0.922-1.515	1.100; 1.037-1.167**	
Total			7.9 (647)	13.1 (1008)	10.0 (7350)	1.075; 1.043-1.107***	1.188; 1.063-1.329**	
Girls		3-6 years	7.6 (406)	8.4 (406)	8.1 (4478)	1.020; 0.977-1.066	1.022; 0.978-1.068	
		7-10 years	7.5 (161)	14.2 (339)	10.8 (1572)	1.082; 1.021-1.146**	1.085; 1.025-1.150**	
		13-16 years	13.0 (46)	8.8 (136)	8.3 (771)	1.181; 0.872-1.600	1.022; 0.924-1.131	
		Total*	8.0 (613)	10.7 (881)	8.8 (6821)	1.042; 1.008-1.076*	1.041; 1.007-1.077*	
Moroccan		Boys	3-6 years	5.1 (374)	5.9 (357)	5.5 (3619)	0.988; 0.934-1.046	0.968; 0.931-1.044
			7-10 years	7.9 (140)	8.7 (231)	7.3 (1222)	1.025; 0.950-1.107	1.025; 0.950-1.107
	13-16 years		0 (21)	8.3 (132)	6.9 (611)	1.065; 0.783-1.448	1.164; 1.002-1.353*	
	Total		5.6 (535)	7.2 (720)	6.1 (5452)	1.019; 0.976-1.064	1.011; 0.968-1.056	
	Girls	3-6 years	7.7 (325)	6.3 (333)	6.6 (3546)	0.968; 0.918-1.022	0.968; 0.918-1.022	
		7-10 years	5.8 (138)	6.6 (286)	8.6 (1287)	0.961; 0.898-1.028	0.960; 0.897-1.027	
		13-16 years	7.7 (65)	7.1 (141)	6.3 (712)	1.240; 0.877-1.754	1.040; 0.926-1.168	
		Total	7.2 (528)	6.6 (760)	7.0 (5545)	0.973; 0.936-1.012	0.970; 0.933-1.010	
	Surinamese South Asian	Boys	3-6 years	2.3 (343)	3.4 (261)	3.3 (3177)	0.975; 0.901-1.054	0.980; 0.906-1.060
			7-10 years	10.1 (179)	7.7 (220)	9.4 (1157)	0.997; 0.931-1.067	0.997; 0.931-1.067
13-16 years			7.1 (28)	5.4 (111)	7.9 (642)	0.924; 0.675-1.266	0.965; 0.860-1.084	
Total			5.1 (550)	5.4 (592)	5.3 (4976)	0.994; 0.948-1.042	0.962; 0.916-1.010	
Girls		3-6 years	2.8 (317)	2.9 (240)	2.5 (2866)	1.014; 0.924-1.113	1.017; 0.926-1.117	
		7-10 years	7.3 (178)	6.9 (188)	6.3 (1144)	0.985; 0.906-1.072	0.994; 0.913-1.083	
		13-16 years	3.1 (32)	4.0 (126)	4.9 (687)	0.992; 0.670-1.470	0.965; 0.842-1.105	
		Total	4.4 (527)	4.5 (554)	3.8 (4697)	0.995; 0.940-1.053	0.975; 0.919-1.034	

* P <0.05; ** P<0.01; *** P<0.001

a 14% decrease since 1999. These findings differ from a previous study that showed an increase in overweight and obesity prevalence among children in the general Dutch population.¹⁰ However, in that study ethnic differences were not investigated. Thus, ethnic specific figures in that study may have been similar to those in our study. Alternatively, differences between the studies may be a result of the population of children in The Hague perhaps differing from other regions in the Netherlands or public health campaigns potentially having been more successful in The Hague. More national growth studies are needed to confirm if our findings are representative of the whole of the Netherlands.

The use of growth data from standard health assessments is ideal for monitoring overweight, and the increasing use of electronic patient records systems makes it much easier to acquire growth data for analyses. A strength of this study is the large study population, high response rate and availability of measured (rather than reported) data on weight and height. Furthermore, the reliability of the collected data is high. The electronic patient record system in which the growth data are recorded also plots growth charts which are shown to parents and children during the health examination. Errors in registration are therefore easily recognized and will be corrected by the examiner. Another strong point of our study is that data on SES (based on area deprivation scores) were available. A limitation of using area deprivation scores as a proxy for SES is that they are partly based on percentage immigrants in the particular area. When used as an adjusting factor it could lead to overcompensation for ethnicity. In the present study SES was only used as adjusting variable in analyses within the different ethnic groups and therefore did not affect the outcome.

Although response rates were generally high, for 13-16 year olds the whole target population was not invited every year for a health assessment, due to understaffing until 2003. This would only have affected the results if a specific group had been invited to attend the health assessments. Since this had not been the case, the examined children were most likely a random sample of the target population.

The decrease in the proportion of overweight (excluding obese) Dutch girls and no overall increase in overweight and obesity prevalence in Dutch boys may suggest that in Dutch children a plateau in overweight and obesity prevalence has been reached. Similarly, in Sweden a decrease of overweight in 10 year old girls¹², and in France a stabilization of overweight (including obesity) in 4 to 15 year old children has recently been found.¹³

It is unclear why in our study the prevalence of overweight and obesity is increasing in Turkish children and overweight has decreased in Dutch 3-6 year old boys and girls. Perhaps public health campaigns of the past decade have been better directed to and adopted by Dutch parents and children than by Turkish. A low parental educational level, a known risk factor for childhood overweight and obesity³, may be an important influential factor since Turkish people in the Netherlands belong to the lowest educated ethnic groups¹⁴.

Many social and behavioural factors such as parenting skills, self-regulation of food intake and the parents' own eating behaviour influence the development of overweight and obesity.¹⁵ The decrease of overweight (excluding obesity) in the youngest age group of Dutch children could mean that parents of young children are becoming more aware of the importance of physical activity and healthy nutrition, and have changed some of these behaviours. However, the concurrent rise in overweight prevalence in 7-10 year old Dutch boys shows that explaining these trends may be more complex with many factors influencing the weight status of a population. In conclusion, prevalence of overweight and obesity in the Netherlands may have reached a plateau in most ethnic groups. However, in Turkish children overweight as well as obesity is still increasing at an alarming rate. In addition, since prevalence in all ethnic groups is continuing to be much higher than in 1980, public health interventions are still needed, especially interventions tailored to Turkish children and their parents.

REFERENCES

1. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. *Lancet* 2002; 360(9331):473-482.
2. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes* 2006; 1(1):11-25.
3. Fredriks AM, van Buuren S, Wit JM, Verloove-Vanhorick SP. Body index measurements in 1996-7 compared with 1980. *Arch Dis Child* 2000; 82(2):107-112.
4. Fredriks AM, van Buuren S, Sing RA, Wit JM, Verloove-Vanhorick SP. Alarming prevalences of overweight and obesity for children of Turkish, Moroccan and Dutch origin in The Netherlands according to international standards. *Acta Paediatr* 2005; 94(4):496-498.
5. Kuepper-Nybelen J, Lamerz A, Bruning N, Hebebrand J, Herpertz-Dahlmann B, Brenner H. Major differences in prevalence of overweight according to nationality in preschool children living in Germany: determinants and public health implications. *Arch Dis Child* 2005; 90(4):359-363.
6. Bundak R, Furman A, Gunoz H, Darendeliler F, Bas F, Neyzi O. Body mass index references for Turkish children. *Acta Paediatr* 2006; 95(2):194-198.
7. Oner N, Vatanserver U, Sari A *et al.* Prevalence of underweight, overweight and obesity in Turkish adolescents. *Swiss Med Wkly* 2004; 134(35-36):529-533.
8. Simsek E, Akpınar S, Bahcebasi T, Senses DA, Kocabay K. The prevalence of overweight and obese children aged 6-17 years in the West Black Sea region of Turkey. *Int J Clin Pract* 2007; 4(4):195-200.
9. Lobstein T, Frelut ML. Prevalence of overweight among children in Europe. *Obes Rev* 2003; 4(4):195-200.
10. van den Hurk K., van Dommelen P., Van Buuren S., Verkerk PH, Hirasing RA. Prevalence of overweight and obesity in the Netherlands in 2003 compared to 1980 and 1997. *Arch Dis Child* 2007; 92(11):992-995.
11. Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ* 2007; 335(7612):194.
12. Sjöberg A, Lissner L, Bertsson-Wikland K, Marild S. Recent anthropometric trends among Swedish school children: evidence for decreasing prevalence of overweight in girls. *Acta Paediatr* 2008; 97(1):118-123.
13. Peneau S, Salanave B, Maillard-Teyssier L *et al.* Prevalence of overweight in 6- to 15-year-old children in central/western France from 1996 to 2006: trends toward stabilization. *Int J Obes (Lond)* 2009; 33(4):401-407.
14. Merens, A., Hermans, B. Emancipatiemonitor 2008. Den Haag: Sociaal Cultureel Planbureau, 2009.
15. Birch LL, Davison KK. Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatr Clin North Am* 2001; 48(4):893-907.