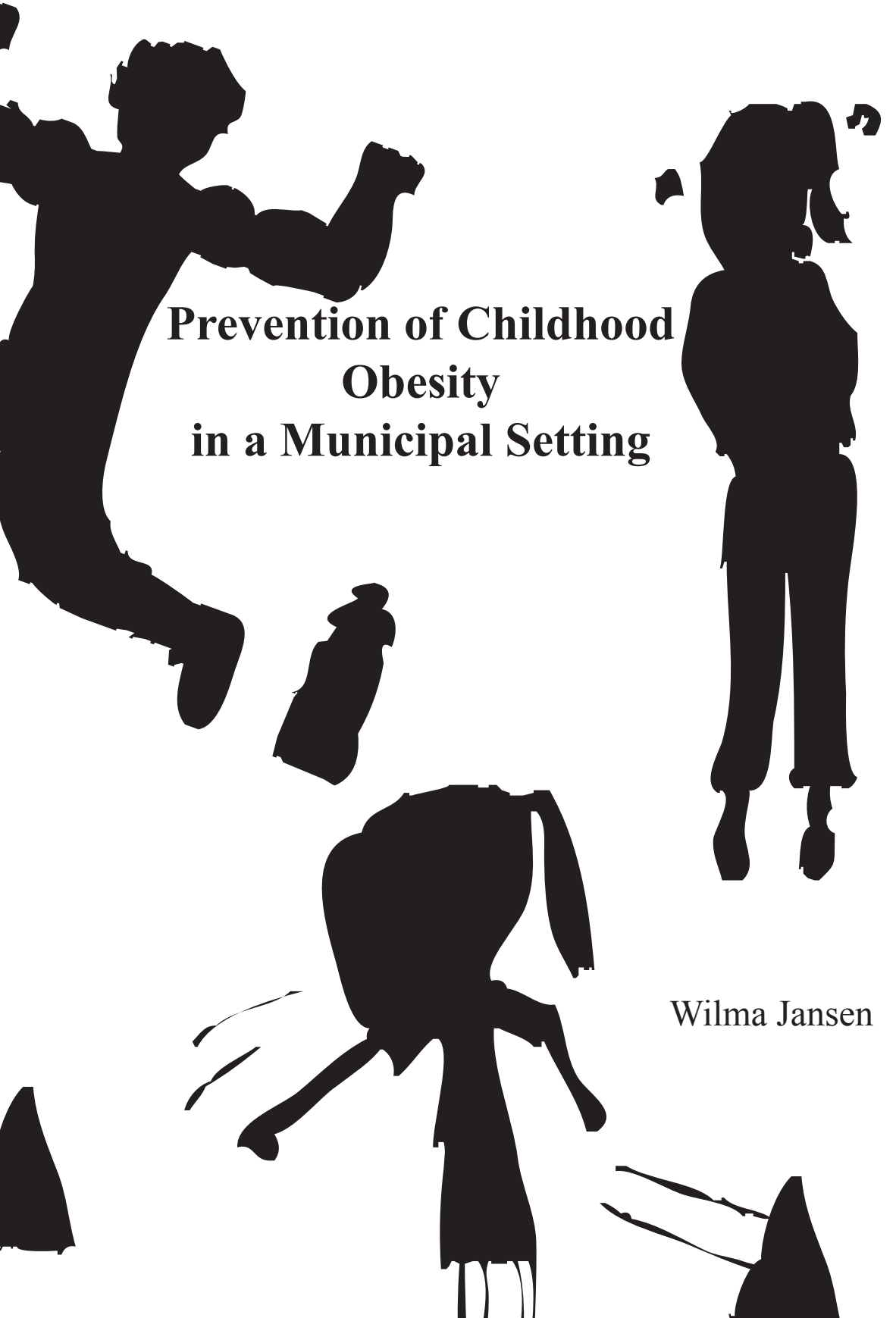

Prevention of Childhood Obesity in a Municipal Setting

Wilma Jansen

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Prevention of Childhood Obesity in a Municipal Setting

Preventie van overgewicht bij kinderen op lokaal niveau

Proefschrift

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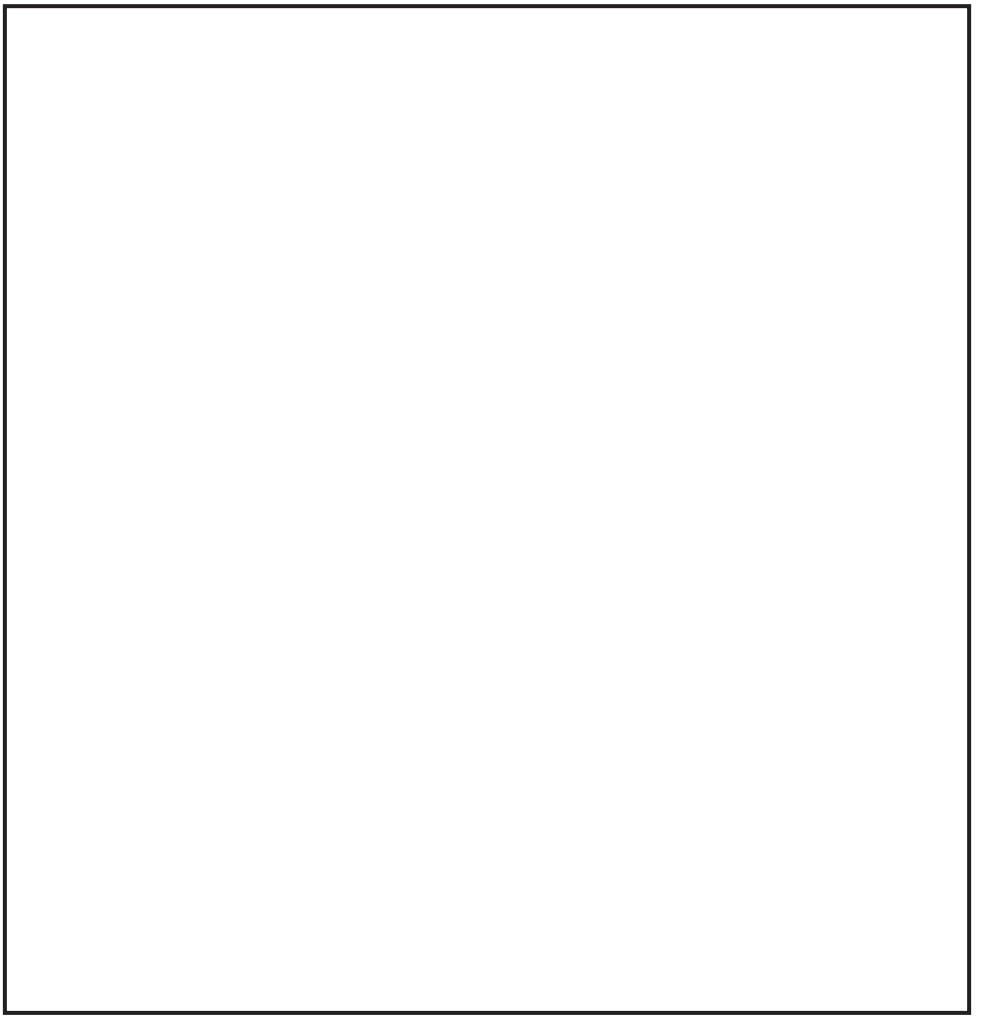

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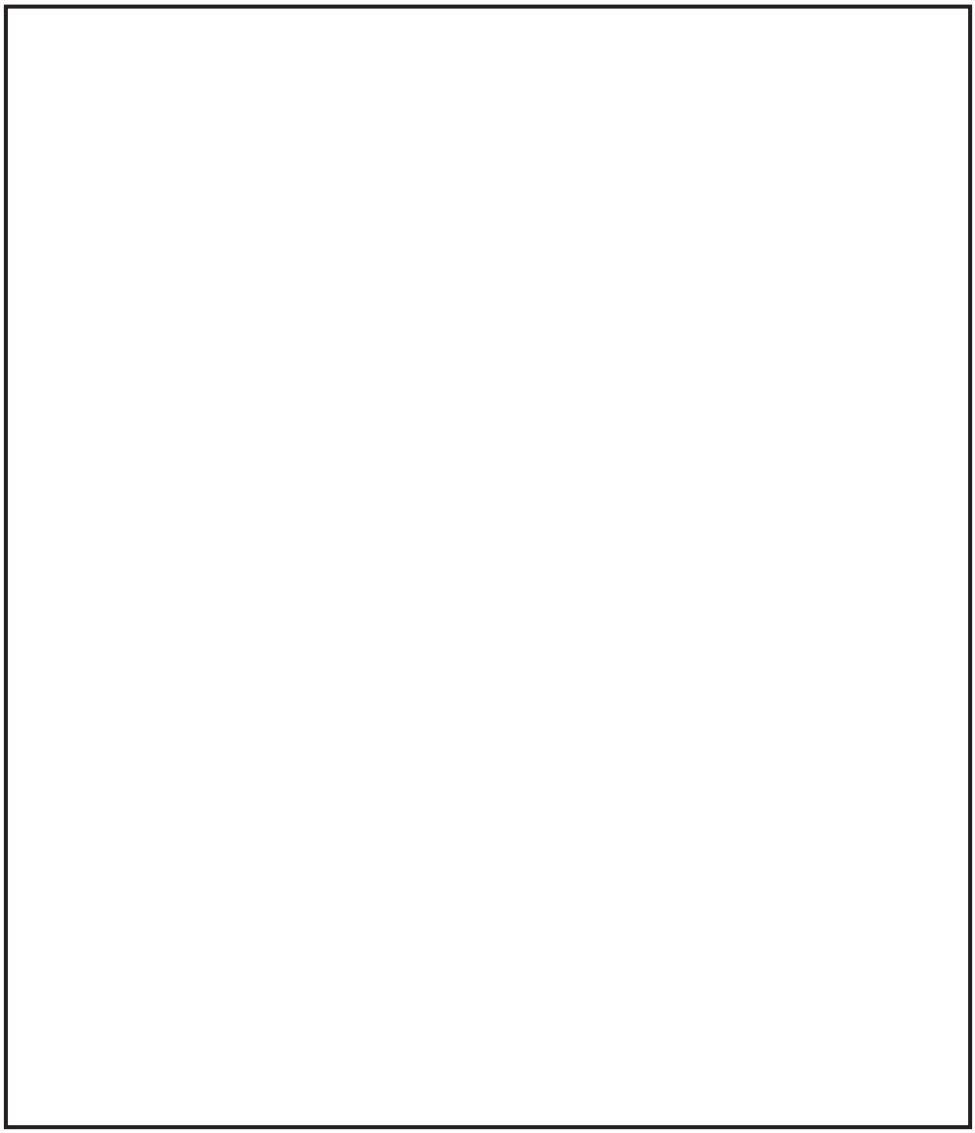
General introduction



1.1 Background

This thesis presents studies on the prevention of childhood overweight. In this general introduction public health issues of childhood overweight will be addressed and a model of planned health education and health promotion will be introduced. Following the different steps of this model, the research questions that are addressed in this thesis are described. The chapter finishes with a summary of the research questions, an overview of the study designs and study populations that were utilized for adressing the research questions, and an outline of the thesis.

1.2 Public health and childhood overweight

Childhood overweight has become a major public health issue worldwide, urging governments to take action[1]. The prevalence rates of childhood and adolescent overweight have increased very strongly in developed as well as developing countries around the world in the last few decades[2, 3]. The United States is undoubtedly experiencing the highest levels of childhood overweight in the world with over 35% of school-aged children being overweight in 2003-2004.[4] In European countries prevalence rates can be obtained from different sources. Data on parent or self-reported height and weight are available from larger international studies involving more European countries and data on measured height and weight can be obtained from several national samples measured in different years over the last decade.
The European Pro Children study collected parent-reported height and weight data among 11 year olds in mostly national representative samples in 2003[5] and the international HBSC (Health Behaviour in School-aged Children) study collected self-reported height and weight data among 13 and 15 year olds in mostly representative samples in 2001-2002 [6]. In these studies Spain, Portugal, Greece and Italy are among the countries with the highest prevalence rates of childhood and adolescent overweight. See table 1.1 for an overview.

Prevalence rates in European countries based on measured data from different national surveys using a single definition of overweight have been reported by Lobstein and Frelut.[7] Although the definition of overweight used in their study is the same as in the Pro Children and HBSC study and the available national samples were less recent, their estimates of childhood and adolescent overweight are usually higher than the estimates based on parent or self-reported height and weight data, but do also demonstrate higher prevalence rates in Southern European countries (Table 1.2).

Table 1.1 Prevalence rates of childhood and adolescent overweight across European countries based on parent or self-reported height and weight[5, 6]

Country	11 year olds in Pro Children study		13 year olds in HBSC study		15 year olds in HBSC study	
	Boys	Girls	Boys	Girls	Boys	Girls
The Netherlands	10.8%	5.9%	8.1%	4.5%	9.8%	7.9%
Belgium (Flemish)	9.5%	8.4%	11.7%	8.1%	12.7%	9.1%
Denmark	12.7%	7.3%	8.4%	9.2%	14.2%	9.5%
Sweden	15.7%	8.5%	11.2%	8.5%	14.6%	7.1%
Norway	14.7%	11.3%	15.3%	7.9%	14.6%	9.5%
Iceland	17.9%	10.8%	-	-	-	-
Austria	16.9%	13.7%	15.0%	11.0%	13.3%	8.2%
France	-	-	13.8%	8.7%	12.1%	10.0%
Portugal	26.5%	17.7%	20.4%	12.9%	16.8%	7.2%
Spain	20.4%	15.6%	24.7%	11.7%	20.6%	10.7%
Italy	-	-	21.0%	12.4%	19.6%	7.7%
Greece	-	-	20.3%	12.1%	23.0%	8.6%

Table 1.2 Prevalence rates of childhood and adolescent overweight across European countries based on measured height and weight[7]

Country	N	year	% overweight children around 7-11 years old	% overweight in adolescents around 14-17 years old
The Netherlands	14,377	1997	12	11
Denmark	11,218	1996-97	15	17
Sweden	6,700	2000-2001	18	[a]
Belgium	1,062	1992	18	[a]
UK	2,882	1998	20	21
Germany	32,429	1995	16	13
Switzerland	595	1999	22	[a]
France	1,582	2000	19	[a]
Greece	2,458	2000	31	22
Italy	41,149	2001	36	[a]
Spain	1,637	1998-2000	34	21
Cyprus	2,467	1999-2000	27	23
Croatia	6,419	1995-8	26	20
Bulgaria	6,655	1998	18	17
Czech republic	32,453	2001	17	9
Poland	10,654	1996-99	18	12
Russia	2,688	1998	10	9
Slowakia	5,514	1995-99	12	8

[a] = no data available

Prevalence rates of childhood overweight in the Netherlands did not reach the levels reached in the United States or most European countries. In fact, relatively speaking, The Netherlands are doing quite well. However, consecutive national growth studies have shown a fast increase in the proportions of children and adolescents who are overweight or obese in the Netherlands. Prevalence rates of overweight increased among school-aged children from 3.9% in boys and 6.9% in girls in 1980 to 9.7% in boys and 13.0% in girls in 1997 and further to 14.5% in boys and 17.5% in girls in 2003.[8] Furthermore, there are strong indications that overweight and obesity are more prevalent in certain population groups within the Netherlands, i.e. among people of lower socio-economic status and from certain ethnic minority groups, groups that are more prominent in the bigger cities in the Western part of the Netherlands.[9, 10]

Health consequences

Overweight and obesity in childhood tend to track into adulthood with consequences for future health.[11-13] Metabolic abnormalities with implications for future risk of type 2 diabetes, cardiovascular disease, like hypertension, raised blood lipid levels and cholesterol levels, impaired glucose tolerance and hyperinsulinaemia are among the health consequences of childhood overweight and may pass unnoticed for a long time.

More immediate health consequences of childhood obesity include sleep-associated breathing disorders, orthopaedic complications and fatty liver disease. Furthermore, overweight and obesity have been found to be associated with social issues, such as stigmatisation. [12, 14-18]

Overweight is associated with higher health care costs and productivity loss.[3] In the Netherlands overweight in adults was demonstrated to be the third largest contributor to health care costs and accounted for 2.0% of the total health care costs. Physical inactivity came fourth, accounting for 1.4% of the total health care costs.[19] Economic consequences of childhood overweight have received less attention than those of adult overweight, but studies in the USA demonstrate that obese children have a higher health care use than normal weight children [20] and that the number of hospital discharges for obesity-associated diseases, like diabetes and sleep apneu in American youth increased dramatically over the last decades.[21]

Governmental reaction

In 2006 a European Ministerial conference was held organised by the WHO Regional office for Europe and a charter on counteracting obesity was signed. The charter states that obesity is one of the most serious public health challenges in the WHO European region and puts special emphasis on childhood overweight. The charter includes broad priorities for action. It recognizes that changes are needed not only in personal motivations and choices but also in the social, physical, economical and political environment, so that healthy choices become better available, accessible and normative. The charter calls for collaborations of the public sector with other sectors such as food industry, marketing, entertainment, infrastructure

and transport. Actions on the international, national and local level on increasing physical activity as well as decreasing dietary intake are called for. The charter states that by the year 2015 the rising trend in overweight should be reversed.[22]
Most governments in Europe have adopted national strategies or plans to curb the obesity epidemic amongst their populations.[23] In its policy document 'Living longer in good health 2004-2007' [24] the Dutch government has set itself the task of halting the increase in the number of overweight adults and, in the case of children, to reverse the trend. An important strategy of the Dutch government to achieve its policy goals is to offer more guidance and (financial) support to local authorities. Within the Metropolitan Areas Policy Framework the Dutch government has for example entered concrete agreements with the larger cities in The Netherlands on the screening of children for overweight by youth health care (YHC) and consecutive preventive actions.[25, 26]

Prevention of childhood overweight at the local level

The above makes clear that in the Netherlands, local authorities (must) play an important role in the prevention of overweight in children. The legal basis for local health policy is formed by the Public Health Act.[26] It states that municipal authorities must take measures to achieve insight based on epidemiological analyses into the health of the population and to contribute to setting up, implementing and coordinating prevention programmes. The municipal authorities are also responsible for implementing YHC, for systematically tracking and identifying developments in the health of young people and the factors that promote or pose a risk to their health, for estimating care needs and for designing measures to control health threats.
Based on the Public Health Act three main municipal tasks can therefore be distinguished with regard to the prevention of childhood overweight:

- Producing insight in the local childhood overweight problem
- Preventive interventions in individual youth health care
- Preventive interventions at the population level

Performing these tasks according to a planned approach is likely to yield the best results. Brug and colleagues have proposed such a planned approach by using a simple six-phase model for planned health education and health promotion that suits well to local health policy.[27] The statutory municipal tasks that were described above fit well in the consecutive phases of the model. In the next paragraph the model and phases of planned health education and health promotion will be elucidated. Within each phase research questions are described, that will be answered in this thesis.
Herewith this thesis aims to contribute to the careful evidence-based planning and evaluation of childhood overweight prevention in a municipal setting. More in particular this thesis focuses on the epidemiologic analysis of the youth overweight health problem in the city of Rotterdam, the Netherlands, and on the development and evaluation of an intervention aiming to contribute to the prevention of overweight among primary school-aged children.

1.3 Planned health education and health promotion

The model of planned health education and health promotion is based on insights from the Precede – Proceed model by Green & Kreuter and the Intervention Mapping protocol described by Bartolomew and others.[28, 29] According to the model (see Figure 1.1), the first step in health education and health promotion planning is the identification of a health problem that is serious and prevalent enough to justify spending time, money and other resources on developing and implementing an intervention. As outlined in the first paragraphs of this introduction, childhood and adolescent overweight and obesity certainly qualify. In the second step, the specific behavioural and environmental risk factors for the health problem of interest should be identified, as well as population groups who are most at risk.

The third step in planned health education and health promotion is to investigate the individual and environmental determinants of exposure to risk factors. This planning phase should identify as precisely as possible why people in the population at risk engage in risk behaviour and what determinants could result in healthful behaviour change.

In the fourth step, interventions should be developed that target as close and specific as possible the most important and best modifiable behavioural determinants.

In the fifth and final step, interventions should be implemented and disseminated after effectiveness has been established.

The consecutive steps will be described in further detail below.

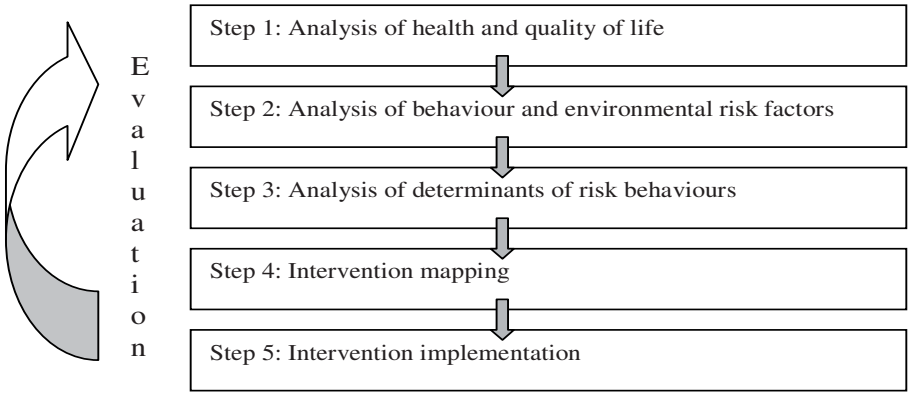


Figure1.1 A model for planned health education and health promotion[27]

Step 1. Analysis of health and quality of life

The first step in the planned health education and health promotion approach is to gain insight in the health of the population. Data on the prevalence of childhood overweight are needed. Data on possible adverse health consequences that accompany childhood overweight provide further insight in the health problem.

A municipality basically has the disposal of two data sources: youth health care and health surveys. Youth health care (YHC), provided by municipal public health services among school-aged children, offers routine health examinations to children at different ages between 0 and 19 years. During these health examinations individual growth is being monitored and height and weight are measured.[30] The protocol for these measurements is supplied by the uniform nationwide method of diagnosing overweight and obesity in children as has been developed by the Obesity Knowledge Centre as commissioned by the ministry of Health, Welfare and Sport.[31]

Routine health surveys are employed to provide (further) information on determinants of health and include typically lifestyle, psychosocial well-being, general health and socio-demographic characteristics.[32] Furthermore, in some municipalities these health surveys are used for computer tailored feedback to adolescents.[33] Related to overweight and obesity surveillance, these routine health surveys often gather self-reported data on height and weight among adolescents.

The prevalence rates for overweight found in the municipality of Rotterdam in the school year 2004/2005 based on YHC measurements in preschool and primary school aged children and self-reported height and weight in adolescents are presented in figure 1.2.[34]

Further inspection of the data reveal large differences in prevalence rates of overweight according to neighbourhood with prevalence rates up to 30% for primary school children in grade 2 and up to 25% for adolescents in grade 1 of secondary school.[35] See figures 1.3 and 1.4.

As compared to national prevalence rates of measured[8] and self-reported[6] height and weight data prevalence rates in the municipality of Rotterdam are higher. Fredriks et al.[9] already demonstrated that Dutch youths residing in large cities show alarming prevalence rates of overweight, making adequate prevention strategies urgently needed.

As described in the first paragraphs of this introduction, childhood obesity has important consequences for immediate and future health. Social consequences due to stigmatisation are expected to be among the direct health consequences of childhood overweight.[15, 36, 37]

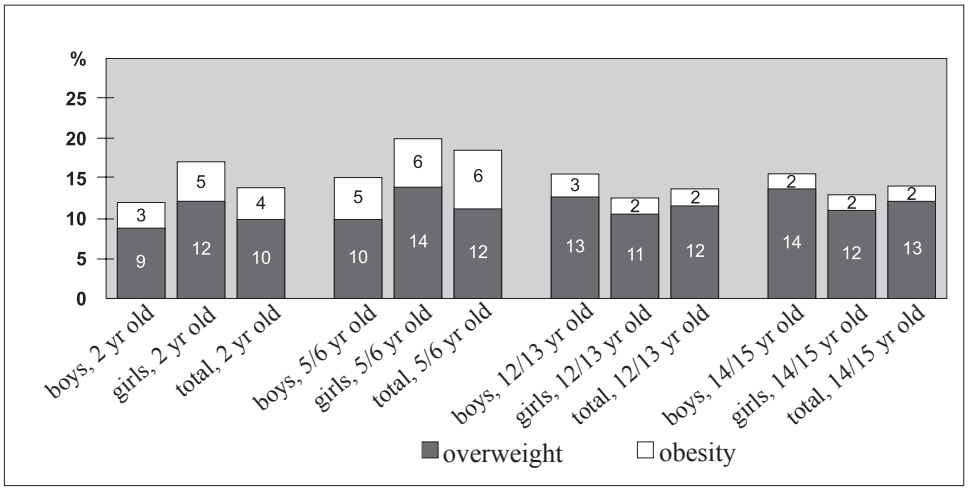


Figure 1.2 Prevalence rates of overweight and obesity in youth in Rotterdam, based on measured height and weight in2 –year old pre-school and 5/6 year old primary school children (grade 2) and self-reported height and weight in 12/13 and 14/15 year old secondary school pupils (grade 1 and 3)[34]

This thesis

To what extent self-reported height and weight provide valid data for the estimation of the prevalence of overweight and obesity and its trends in populations of children and/or adolescents is inconclusive.[38-41] This validity of data issue is also relevant for the use of self-reported height and weight data of adolescents for tailored preventive interventions. In this thesis the validity of self-reported height and weight measures in adolescents will be analysed and discussed (research question 1, chapter 2).

Not much is known about the relation between mental health and weight status among Dutch children and adolescents. Furthermore, controversies about the causal direction of the association between mental health and weight status exist in the scientific literature.[42, 43] Mediating effects of body weight perception may play a role as is brought forward by some researchers.[44-46] If this is the case, increasing prevalence rates of overweight might shape body weight perceptions of adolescents and change the relationship between mental health and weight status. That is, if overweight becomes more prevalent, it may be regarded as more normal, and may thus be associated with lower perceived overweight.

In this thesis we focus on the cross-sectional and longitudinal associations between psychosocial well-being and weight status, and perceived weight status in two age groups relevant for YHC, 9-10 year olds and 12-13 year olds (research question 2, chapter 3).

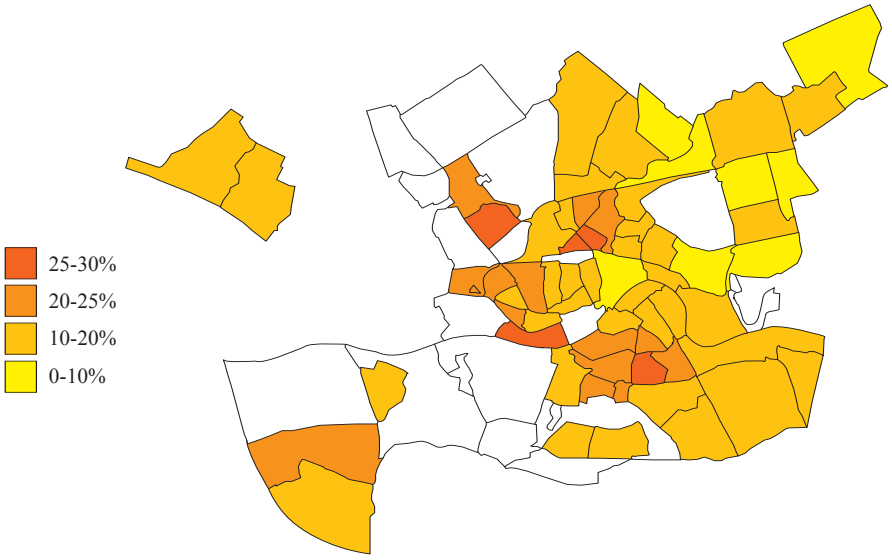


Figure 1.3 Prevalence rate of (measured) overweight in 5/6 year old (grade 2) pupils of primary schools in Rotterdam according to neighbourhood[35]

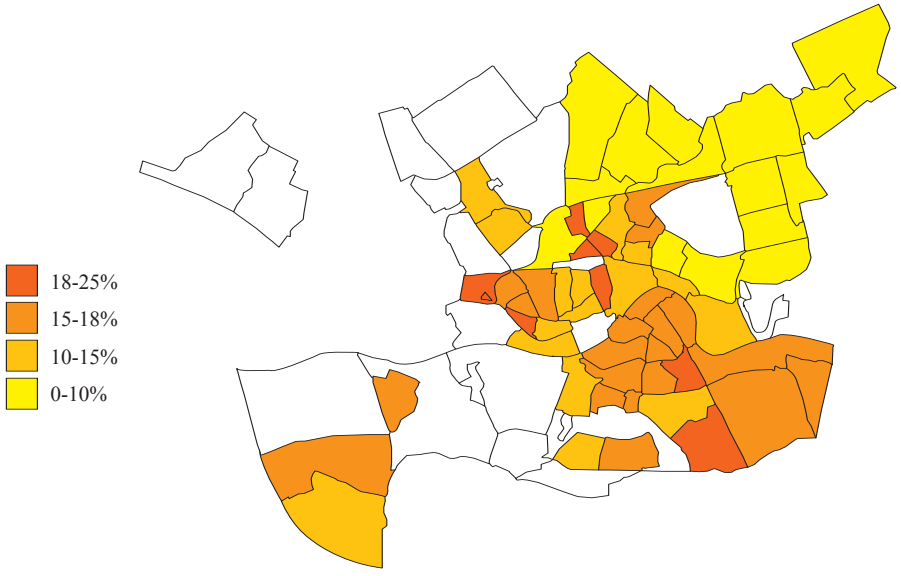


Figure 1.4 Prevalence rate of (self-reported) overweight in 12/13 year old (grade 1) pupils of secondary schools in Rotterdam according to neighbourhood[35]

Step 2. analysis of behaviour and environmental risk factors

The second step in the planned health education and health promotion approach is to identify behavioural and environmental risk factors for the development of childhood overweight. Essentially overweight is caused by a positive energy balance, i.e. when energy intake exceeds energy expenditure, over a sustained period of time. Many reviews have been published on risk factors of childhood overweight on either side of the energy balance. An expert committee appointed by the American Medical Association in 2004 recently reviewed the evidence on the prevention of child and adolescent overweight and obesity. Based on the available evidence they recommend a set of target behaviours for which consistent evidence has been found and they suggest an additional set of target behaviours based on available data and expertise for which evidence is mixed or insufficient so far.[47, 48] See table 1.3 .

Table 1.3 Target behaviours in the prevention of child and adolescent overweight and obesity.[47]

Evidence	Increases overweight/obesity	Decreases overweight/obesity
Consistent evidence	Eating out (particularly fastfood) Sugar sweetened beverages High portion sizes Television time	Daily breakfast
Mixed evidence		Fruits and vegetables
Insufficient evidence	Energy dense foods Total screen time	Diet rich in calcium High fibre diet Well balanced diet (macronutrients) 60 min a day moderate to vigorous physical activity Exclusive breastfeeding up to 6 months

The set of risk behaviours that was identified in the ENDORSE study (Environmental Determinants of Obesity in Rotterdam Schoolchildren)[49] is largely consistent with the list presented above. This is also true for the set of target behaviours as proposed by Swinburn et al.[50] as part of a joint WHO/FAO expert consultation on the prevention of obesity in all ages. Some differences exist though in the weighting of the evidence. Van der Horst and Swinburn et al. are more convinced on the evidence for dairy products, high fibre, physical activity and energy dense foods, but less convinced of the evidence for eating out, portion sizes and the role of fruit/vegetables.

The Minimum Intervention Strategy for childhood overweight that was developed by the Dutch Obesity Knowledge Centre for use in Youth Health Care as commissioned by the ministry of Health, Welfare and Sport, focuses on five risk factors.[51] These five risks factors are breastfeeding, skipping breakfast, lack of outdoor play, consumption of high-caloric sugar-containing drinks and watching television. In (primary) school aged children, the Minimum Intervention Strategy proposes that playing outdoors and having breakfast need to be encouraged and consumption of sugar sweetened drinks and television viewing need to be discouraged.

This thesis

Not much is known on the prevalence of the energy balance related behaviours that are targeted by the minimal intervention strategy among primary school children in The Netherlands and elsewhere. Research has been mainly focused on the association of these behaviours with BMI or overweight.[52-55] Its is largely unknown in what proportion of children these target behaviours are above or below recommended levels and whether these proportions vary according to socio-demographic characteristics.

In this thesis we describe the prevalence of the energy related behaviours that are targeted in the minimum intervention strategy by YHC as well as their associations with weight status (research question 3 first part, chapter 4).

Step 3. analysis of determinants of risk behaviours

The third step in a planned health education and health promotion approach is assessing the determinants of health related behaviour. Determinants can be divided into personal and environmental determinants. Kremers et al[56] describe a conceptual framework (EnRG) for determinants of energy balance related behaviours. In this framework energy balance related behaviours are influenced by environmental determinants, cognitive mediators and person and behaviour related moderators. See figure 1.5. Environmental determinants are subdivided in physical, political, economic and sociocultural at the micro and macro level according to the ANGELO framework described by Swinburn and Egger.[57] According to the EnRG model environmental determinants influence energy related behaviours either directly or indirectly. Indirect influences are mediated by cognitive determinants as for example described in the Theory of Planned Behaviour[58], including attitudes, subjective norms, perceived behavioural control and resulting behavioural intentions. The model also distinguishes several factors that may moderate the relations of the environmental and cognitive determinants with energy balance related behaviours. These possible moderators include demographic characteristics, personality, awareness, involvement, habit strength and clustering of behaviours.

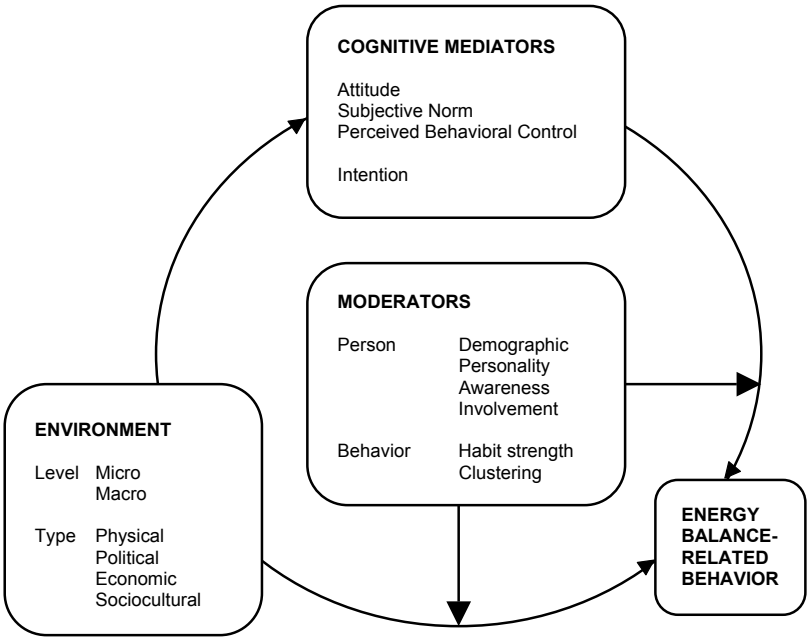


Figure 1.5 Environmental Research Framework for weight Gain prevention (EnRG)[56]

Much work has been done on the identification of determinants of energy balance related behaviours. Recently the evidence for environmental determinants of physical activity and of selected nutrition behaviours in youth has been investigated in two systematic reviews. [59, 60] Most of the identified studies were performed on the socio-cultural domain at the micro level. The conclusions drawn from these reviews therefore mainly relate to the household level. The strongest evidence was found for parental intake, parenting style, parental support and socio-demographic characteristics like parental educational level and socio-economic status. Many questions remain on the role of determinants in other domains and on the macro level as well as possible mediation and moderation by personal and behavioural factors, like motivation-related factors.

The above mentioned reviews underlined the importance of parents in the prevention of childhood overweight. Parents play an important role in the development of proper eating and exercise habits of children.[61, 62] Awareness in parents of the weight status of their child is of utmost importance to involve them in the prevention and treatment of overweight and obesity in children successfully.
For YHC raising awareness, if not present in parents, is the first main task as soon as overweight is diagnosed and forms the first step in applying the proposed minimal intervention strategy.[51]

This thesis
Not much in known on the influence of socio-demographic characteristics on the energy balance related behaviours targeted by Dutch YHC and the intentions to these behaviours. In order to better design preventive interventions more insight in these determinants is needed. This is especially true for the youth in the socially more deprived multi-ethnic inner-city areas of large cities like Rotterdam, where prevalence rates of overweight are high. In this thesis the influence of socio-demographic characteristics on these target behaviours and the intentions towards these behaviours are described (research question 3 part 2, chapter 4).

International studies into awareness of parents of the overweight in their child report proportions that vary greatly from 2%[63] up to 68%[64]. Differences in the definitions of overweight, prevalence of overweight and socio-demographic characteristics of the populations studied may all contribute to the incomparability of the results. To our knowledge no studies have been performed on awareness of parents in the Netherlands. This thesis addresses awareness in parents of the weight status of their child and investigates whether socio-demographic characteristics make a difference (research question 4, chapter 5).

Step 4. Intervention mapping
Based on the results of steps 1, 2 and 3 also summarized as the needs assessment of the planned health promotion approach, an intervention can be developed.
In response to the increasing prevalence of childhood overweight a wide variety of local programmes have been developed in the Netherlands.[65] An example of a local preventive program is the Nutrition and Exercise program of the municipality of Rotterdam.[66] This program consists of a variety of interventions and is carried out by three municipal services: the Department of Sport and Recreation, the Department of Youth, Education and Society and the Municipal Public Health Service.
In the mean time the national Nutrition Centre commissioned by the ministry of Health, Welfare and Sports has been drawing up a handbook for municipal authorities on sound local health policy regarding the prevention of overweight including a list of the most promising interventions according to age group and setting.[67]

Although an evidence based approach is not yet available, recent reviews and experts suggest that both ecological and behavioural determinants should be targeted[56, 57, 68-71], that engagement in physical activity is a critical intervention component[72-78] and that the school is a critical intervention setting.[72, 79, 80]
As part of the intervention program Nutrition and Exercise of the municipality of Rotterdam a new intervention was developed called "Lekker Fit!"[1] that takes into account all the above mentioned best practice characteristics. Lekker Fit! is a multi-component intervention targeted at primary school children in inner-city neighbourhoods, where prevalence rates of overweight children appeared to be the highest. The main aim of the intervention Lekker Fit! is to reduce overweight and inactivity in primary school-aged children by stimulating

[1] Former name "Elke dag bewegen".

a healthy lifestyle addressing both behavioural and environmental determinants. After the first four years of the prevention program (2005-2009) Lekker Fit! will be implemented in 90 of the approximately 200 primary schools in Rotterdam.

This thesis
In this thesis the intervention Lekker Fit! and its theoretic background is described in more detail as well as the study protocol for the evaluation of Lekker Fit! as required in step 5 of the planned health education and health promotion approach (chapter 6).

Step 5. intervention implementation and evaluation
The final step in planned health promotion is the implementation and evaluation of the developed intervention to determine if the expected health improvements were achieved.

This thesis
In this thesis we evaluate the effect of the intervention Lekker Fit! using a cluster randomized controlled design (research question 5, chapter 7).

1.4 Overview and outline of the thesis

This thesis aims to contribute to a evidence-based planned approach for the prevention of childhood overweight, by providing answers to research questions along the consecutive steps of the model of planned health education and promotion.
The research questions that are addressed in this thesis are summarised below.

Part 1. Analysis of health and quality of life

1. Do 12-13 year olds provide valid self-reported height and weight data? Is validity associated with socio-demographic characteristics? Can correction factors be applied to adjust these self-reported data?
2. Are psychosocial well-being and weight status associated among 9-10 year olds and 12-13 year olds cross-sectionnally and longitudinally? Is the association dependent on socio-demographic characteristics, body image or indicator of weight status (determined by self-reported versus measured height and weight)?

Part 2. Risk factors and determinants

3. What is the prevalence of overweight and unhealthy key energy balance related behaviours and intentions among 9-12 year olds. Are differences related to socio-demographic characteristics and weight status?
4. Do parents recognize overweight in their child and are socio-demographic characteristics associated with this ability?

Part 3. Implementation and evaluation

5. Is the intervention Lekker Fit! effective in reducing overweight and improving fitness levels in primary schoolchildren?

Design and study populations

The research questions in this thesis are answered using different designs and study populations.

For research questions 1, 2 and 4 data are used from the ongoing Youth Health Monitor Rotterdam (YMR). This health surveillance system monitors the general health, well-being, behaviour, and related factors of youth aged 0 to 19 years living in Rotterdam and surroundings in order to supply information for youth policy at the school, neighbourhood and municipality level. The YMR is incorporated in the regular check ups of the preventive youth health care system at the ages 2, 5–6 (grade 2 primary school), 9–10 (grade 6 primary school)[2], 12–13 (grade 1 secondary school), and 14–15 (grade 3 secondary school) years of age. The YMR therefore also contains data on measured height and weight.

For research questions 3 and 5 data are used from a cluster randomized controlled trial (cRCT) that was set up to evaluate the intervention Lekker Fit!. This intervention is targeted at primary schoolchildren attending schools in inner-city neighbourhoods of Rotterdam.

An overview of the different designs and study populations is given in table 1.4.

[2] Since 2003/04 pupils of grade 7 in stead of grade 6 are targeted by YHC in Rotterdam.

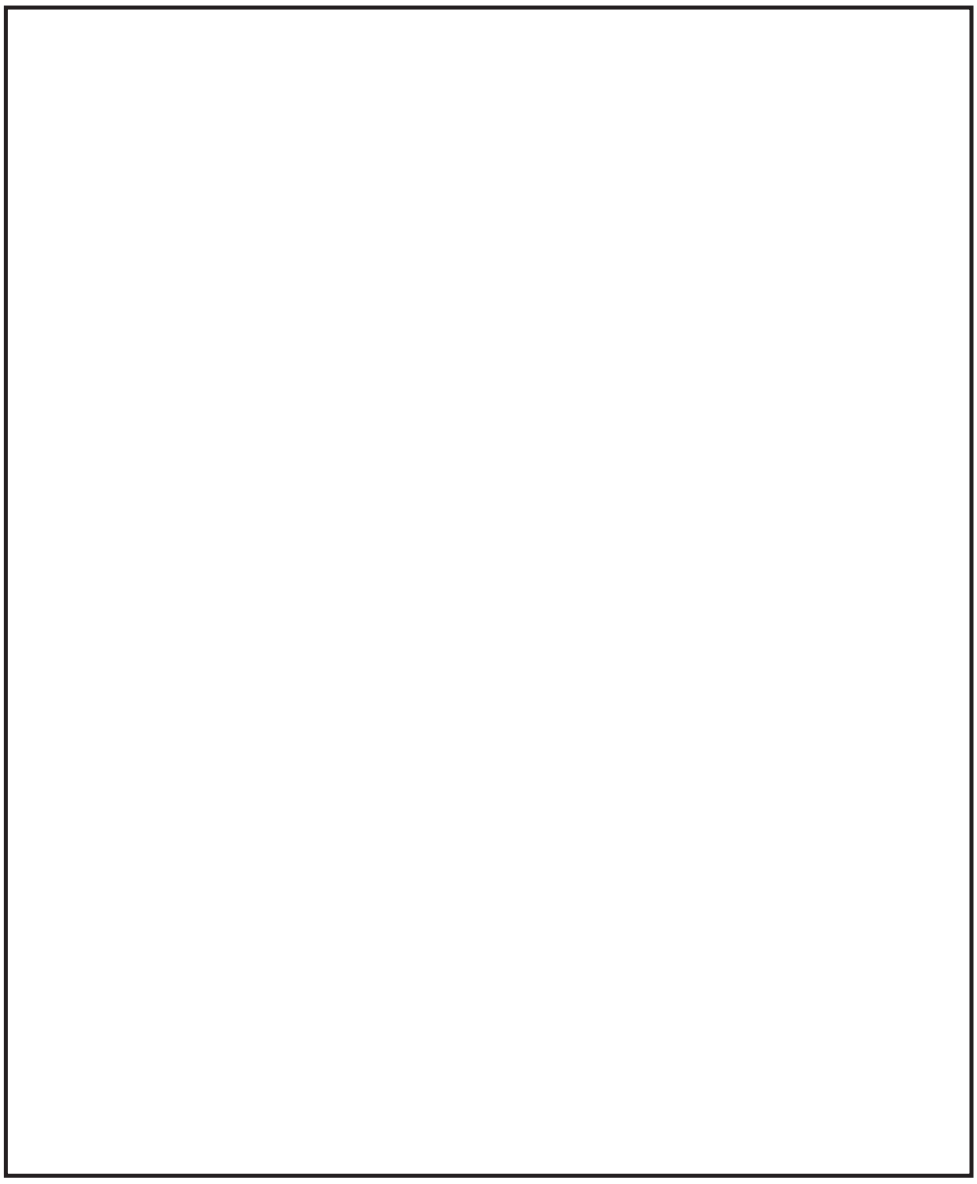
Table 1.4 Overview of studies, designs and study populations in the thesis

Chapter	Focus	Design	Year	Study population
2	Validity of self-report	Cross sectional sample of YMR	2003/04	Grade 1 secondary school
3	Weight status and psychosocial well-being	Cross sectional and longitudinal samples of YMR	2000/01	Grade 6 primary school
			2003/04	Grade 1 secondary school
4	Prevalence and determinants of energy balance related behaviours	c-RCT (baseline data)	2006/07	Grades 6-8 primary school
5	Parental awareness	Cross sectional sample of YMR	2000/01	Grade 6 primary school
7	Effectiveness of Lekker Fit!	c-RCT	2006/07	Grades 3-8 primary school

Outline of the thesis

Chapter 2 of this thesis deals with validity of self-reported height and weight data of young Dutch adolescents. Chapter 3 addresses the cross-sectional and longitudinal associations of psychosocial wellbeing and weight status. The prevalence of energy balance related behaviours and possible determinants are described in chapter 4. Chapter 5 assesses the awareness of parents of overweight in their child. In chapter 6 the intervention Lekker Fit! is described as well as the study protocol for the evaluation of Lekker Fit!. The effects of Lekker Fit! are described in chapter 7. The main conclusions and implications of the different studies are presented and discussed in the final chapter 8.

Part 1
Analysis of health and quality of life



2

Measured and self-reported height and weight

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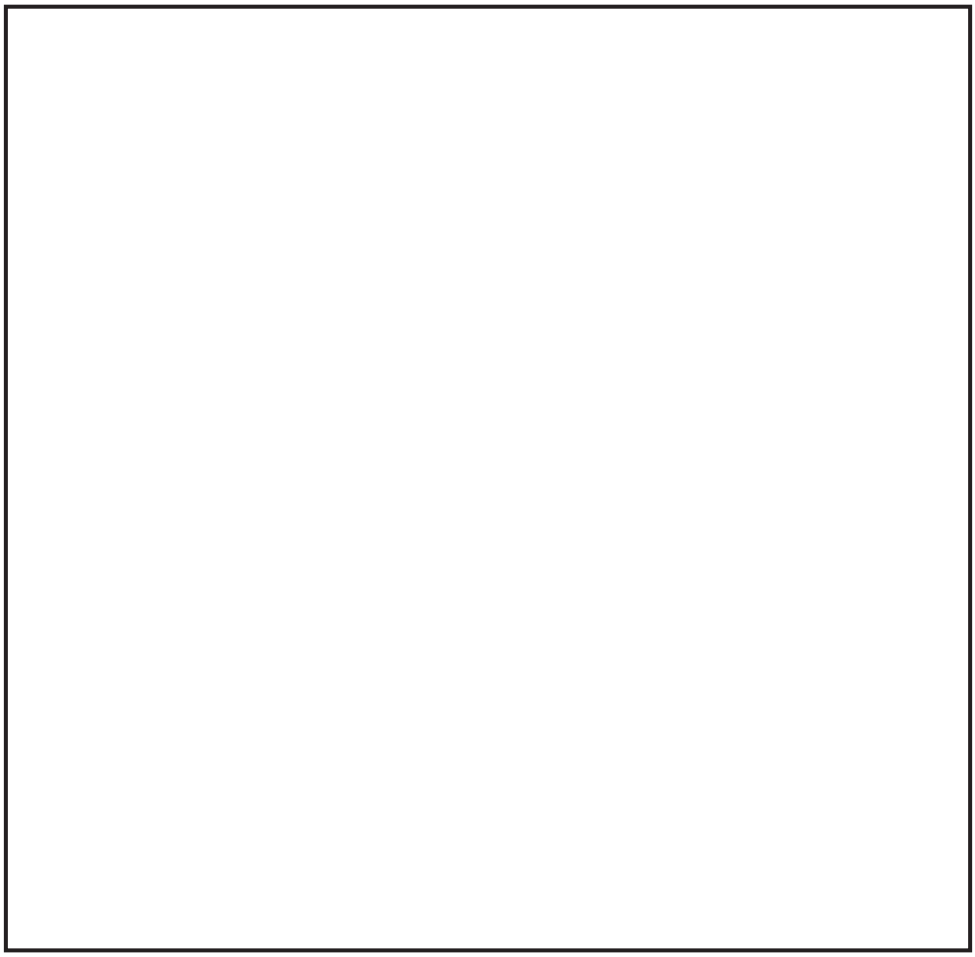

2.1 Abstract

Background: Monitoring overweight prevalence and its trends in Dutch youth is frequently based on self-reported data. The validity of self-reported data especially in young adolescents is not sufficiently known. The purpose of this study is to study the validity of self-reported height and weight in 12-13 year olds, to identify socio-demographic correlates and to explore whether correction factors can be developed to estimate the prevalence of overweight in youth.
Methods: 5,525 12-13 year old pupils the Rotterdam area filled in a confidential questionnaire on health topics, including their height and weight. In a sub sample of 499 pupils both self-reported and measured height and weight were available.
Results: Self-reported data led to a considerable underestimation of Body Mass Index and consequently the prevalence of overweight. Underestimation was higher in pupils who regarded themselves as more fat, were from non Dutch origin and in lower education levels .
Conclusion: Self-reported height and weight appeared to be inappropriate to estimate the overweight prevalence in 12-13 year olds, unless the figures were adjusted. Using adjusted self-reported BMI on an individual level is questionable. Actual measurements of height and weight are necessary to draw up valid correction formulas in new samples.

2.2 Introduction

In the Netherlands, as in most countries in the developed and developing world, the prevalence of overweight and obesity among children and adolescents is increasing.[7, 12] A national survey showed that in the Netherlands this prevalence increased by about 50% from 10% in 1980 to 15% in 1997.[81] Monitoring the prevalence of overweight and obesity, and its trends in the general population has therefore been adopted by several youth health care authorities in the Netherlands. Goals are to identify associated underlying risk factors and sub-groups at higher risk, to be targeted in preventive intervention measures and to (re) direct health policy decisions. However, many of these large-scale monitoring systems rely on self-reported data on weight and height, based on which the prevalence of overweight and obesity in the population under study is estimated. The question that therefore arises is to what extent self-reported methods are valid tools for estimating the prevalence of overweight and obesity and its trends in populations of children and/or adolescents. Another question is to what extent these self-reported data are valid tools to identify individuals with overweight, so they can be targeted for individual interventions. Measuring height and weight of large groups of individuals is costly and if self-reports are valid, one could use these to inform interventions tailored to weight status.[82]

A review of the literature on the validity of self-reported height and weight in children and adolescents (Table 2.1) suggests that, in most cases, height is over-reported, whereas weight is under-reported, thereby leading to an underestimation of the prevalence of overweight and obesity.[39, 40, 83-94] The differences between self-reports and objective assessments

may be associated with several factors such as gender [83, 85, 90], age [83, 85, 86, 92], ethnicity [83, 92], socio-economic status [92] and overweight/obesity status [85, 86, 88, 92, 93], although no consistent pattern appears from earlier studies. Upon the usefulness of self-reported data different conclusions are drawn. In many of the reviewed studies self-report was followed almost directly by an actual measurement, with subjects being aware of this procedure.[39, 83, 87, 90, 93] This might well have influenced the accuracy of the self-reported data and the conclusions drawn from these studies might not be valid for monitor systems which rely solely on self-report data.
Most studies on validity of self-reported height and weight have been conducted in the USA. Only a limited number of studies were performed in Europe (UK, Spain, Italy). In the Netherlands, the validity of self-reported height and weight measures among adolescents has never been evaluated, despite its use by several health care surveillance systems. Due to different population characteristics (for example ethnicity and overweight prevalence) the validity of self-report might not be the same in every population.
The number of studies that included self-reports of 12-13 year olds is also limited, while this age group is an official target age group in Dutch preventive youth health care.
The purpose of the present study is therefore three-fold: first, to study the validity of self-reported height and weight among a sample of Dutch 12-13 year olds; second, to identify socio-demographic correlates of discrepancies between the self-reported and the measured body dimensions; and third, to explore whether correction factors can be developed to adjust overweight and obesity estimates based on self-reports in youth.

2.3 Methods

Study design and subjects

The study sample was drawn from the ongoing Rotterdam Youth Monitor (RYM) Study. This health surveillance system monitors the general health, well-being, behaviour and related factors of youth aged 0 to 19 years living in Rotterdam and surroundings in order to supply information for youth policy at the school, neighbourhood and municipality level. Because the RYM is incorporated in the regular check ups of the preventive youth health care system, the RYM data are also used to detect potential individual health risks and problems in order to take necessary preventive measures (including referrals for treatment).

Table 2.1 Review of literature on validity of self-reported height and weight by adolescents

Ref	population	Country	Age	Sample type	later measure-ment known?	% overweight	Difference between self-reported and measured			Correlates of these differences	Conclusion on validity
							height	Weight	BMI		
[83]	4619 high school students	USA	14-19 y	Convenience	Yes	28% (> P85)	6.9 cm	-1.6 kg	-2.6	Girls underreport more, higher grades underreport more	Positive
[84]	151 girls	USA	11-13 y	Not repre-sentative, high SES	?	?	+1.4 cm	-1.2 kg	-	-	Incon-clusive
[85]	1240 adolescents	UK	16-17 y	Sub sample of national cohort study	?	8% for males, 12% for females (>25 kg/m²)	+1.1 cm for males, +0.8 for females	+0.4 for males, -0.9 for females	-0.1 for males, -0.5 for females	-	-
[86]	829 Mexican-American adolescents	USA	12-19 y	Representative of 5 states	?	?	-0.1% for males, 0.4% for females	+0.8% for males, -1.8% for females	1.3% for males, -2,4% for females	High BMI groups underreport BMI more than low BMI groups	Positive
[87]	568 adolescents	Spain	14-20 y	Representative for region	Yes	23% (BMI>25)	1.5 cm for males, 2.5 cm for females	-2 kg for males, -1 kg for females	-		Incon-clusive
[88]	725 adolescent patients	USA	14-20 y	Clinical	?	10% (>P90)	0.6 cm for males, 0.5 cm for females	-1.2 kg for males, -1.5 kg for females	-	High BMI groups underreport BMI more than low BMI groups	Negative

[89]	133 secondary school students	Italy	15-17y	Random sample of schools in Siena	?	17% for males, 12% for females (BMI>25)	0.8 cm for males, 2.3 cm for females	–1.8 kg for males, -1.9 kg for females	-0.8 for males, -1.3 for females	-
[90]	15,000 teenagers	USA	12-19 y	National longitudinal	yes	10% (>P95)	-	-0,2 kg for males, -1,0 kg for females	+0,3 for males, -2,7 for females	Girls underreport BMI more than boys. Positive
[91]	806 Indian Americans	USA	12-19 y	Convenience sample	?	34-44% (>P85)	1.5 cm for males, 0.5 cm for females	-1.5 kg for males, -2.1 kg for females	-	- Negative
[39]	14 million adolescents	USA	12-17 y	National representative (Nhanes 3)	Yes	?	-1.0 cm for males, -1.1cm for females	-0.5 kg for males, -1.2 kg for females	+0.2 for males, -0.1 for females	- Negative for age < 14 y
[92]	3797 students .	USA	12-18 y	project participants	?	33% (>P85)	1.2 cm for males, 2.4 cm for females	-1.6 for males, - 3.5 for females	-	- Positive
[40]	806 Caucasian sixth graders	USA	11-12 y	-	?	?	+0.5 cm for males, -0.5 cm for females	-2.1 kg for males, -4.0 kg for females	-	- Negative
[93]	1932 adolescents	USA	12-16 y	National representative (Nhanes 3)	Yes	27% (>P85)	-1.0 cm	0.1 kg for males, -1.0. kg for females	-	- Positive
[94]	204 adolescents	Austra-lia	14-15 y	Sub sample of prospective study	No	?	0.8 cm for males, 1.5 cm for females	-0.9 kg for males, -0.6 kg for females	-0.3 for males, -0.6 for females	- positive

In the 2003/2004 survey, 48 secondary schools (response rate 86%) in the Rotterdam area were visited by a school nurse of the Municipal Health Service who administered the RYM questionnaire during class hours to all 1st grade pupils. The questionnaire included questions on perceived health status, well-being and body image, and also on body height and weight. Pupils were told their answers would be treated confidentially, they would consult with the school nurse later on in the school year and the school nurse would not have access to their answers. Pupils were not told that they could be measured and weighted by the school nurse. A total of 5,525 (93% response rate) answered the questionnaire, of whom 3,939 provided self-reports on both height (expressed in cm) and weight (in kg); however among 66 pupils these answers were not plausible (height<120 cm or >220 and/or weight<30kg or >200kg), and were therefore excluded from further analyses. Multiple logistic regression analysis indicated that pupils with missing self-reported data on height and weight were on average older, from lower levels of education, perceived themselves more often as being overweight, and were more often from Moroccan origin.
About 3.2 (± 1.1) months later pupils were consulted by the school nurse. Three of the 29 school nurses were asked to measure height and weight of all the pupils who attended their consultations. The other nurses decided for themselves whether to measure pupils or not. For 499 pupils both self-reported and measured height and weight were obtained. These pupils constitute the sub-sample analysed in the current study; a sub-sample in which children from non-Dutch origin (71% versus 54%), from lower education levels (53% versus 28%), and with higher self-reported BMI's (19.5 ± 3.7 versus 18.5 ± 2.9) were somewhat over-represented as compared to the Rotterdam population of 12-13-year-olds at large .

Measures

Self-reported and measured height were reported to the nearest cm; self-reported and measured weight to the nearest kg. SECA roll up measuring bands were used for measuring height and calibrated SECA flat weighing scales for weight. Weight was measured without heavy clothing and shoes and was therefore corrected for light clothing by subtracting 1 kg. Body Mass Index (BMI) was calculated based on self-reported as well as measured length and weight. Weight status (not overweight, overweight) was determined according to the international guidelines presented by Cole et al.[95]
Country of origin was determined by country of birth of mother and father. If both parents had been born in the Netherlands, the child's country of origin was Dutch; if one or both parents were born in another country, the country of origin was defined according to that country; if both parents had been born in different foreign countries, the country of origin of the mother was deemed most important. Children were subsequently allocated to the following categories: Dutch, Surinam, Dutch Antillian or Aruban, Moroccan, Turkish, and other.
Body image was measured with one questionnaire item on a five-point scale ('far too thin', 'too thin', 'not thin / not fat', 'too fat', 'far too fat').
Pupils were classified into three different levels of education: 'basic pre-vocational training',

'theoretical pre-vocational training', 'general secondary education' (including junior and senior general secondary education and pre-university training) and three age groups 11-12, 13 and 14 years of age.

Data analyses / statistical methods

Differences in self-reported and measured height, weight and BMI were first explored with paired t-tests. Subsequently, hierarchal multiple linear regression analyses were conducted with measured BMI (BMIm) as dependent variable, self-reported BMI (BMIs) as well as time interval (in month) between the self-report and the actual measurement entered as first block of independents; socio-demographic variables as second block and body image as final block. The correlation between BMIs and body image was not higher than 0.6. Collinearity statistics were checked and the condition index did not exceed acceptable values. Country of origin was dummy-coded with Dutch as reference category. After assessing the main effects, potential modification effects of all socio-demographic independent variables were examined by adding interaction terms with self-reported BMI to the regression model.
Correction equations (including BMIs and socio-demographic variables and optionally body image) were derived from the regression model in order to estimate BMI from BMIs in the total population.
Sensitivity and specificity of overweight status based on BMIs and corrected BMIs were calculated and expressed as percentages.

2.4 Results

Socio-demographic and selected characteristics of the study population are given in table 2.2.
Self-reported height was 1.5 cm lower than measured height, self-reported weight 6.1 kg lower than measured weight, resulting in an underestimation of BMI of 1.5 kg/m². T-tests showed that all differences were significant at the $p < 0.001$ level (table 2.3). Correlations between self-reports and measurements ranged from 0.75 for BMI and 0.80 for weight to 0.85 for height. The prevalence of overweight in the study population based on self-reported data would be estimated as 18%, while the prevalence of overweight based on measured data appeared to be 33%. Mean differences in self-reported and measured height, weight and BMI by socio-demographic variables, body image, weight status and time interval between self-report and actual measurement are given in table 2.4.
Regression analyses showed that measured BMI was significantly associated with self-reported BMI but also - in order of largest effect size - with body image, country of origin and level of education (table 2.5). Underestimation of BMI was higher in pupils with a larger body image, pupils from non Dutch origin and pupils from lower levels of education. The time interval between self-report and measurement was not associated with the level of under-reporting. Effect modifications that contributed substantially to the model were not found.

Table 2.2 Selected and socio-demographic characteristics of sub sample (with self-reported and measured data) and total sample (with self-reported data)

	Sub sample N=499	Total sample N= 5,525
	%	
Gender		
Male	53	51
Female	47	49
Age		
11	<1	1
12	50	47
13	44	45
14	5	7
Level of education		
Basic pre-vocational training	51	30
Theoretical pre-vocational training	16	13
General secondary education	33	57
Country of origin		
Netherlands	29	46
Surinam	15	12
Dutch Antilles or Aruba	11	4
Morocco	13	10
Turkey	16	12
Other	16	16
Body image		
Far too thin	2	2
Too thin	9	11
Not thin / not fat	56	58
Too fat	27	24
Far too fat	6	5
Percentage overweight		
Based on self-report	18	13[A]
Based on measurement	33	-

[A] : percentage based on n=3,939 due to missing values

Table 2.3 Self-reported and measured height, weight and BMI (mean and 95% confidence interval), and Pearson correlations between both assessments

	Self-report	Measured	Difference	Pearson's R
Height	159.6 cm	161.2 cm	-1.5 cm	0.80
	(158.8-160.3)	(160.5-161.8)	(-2.0- -1.1)	
Weight	49.7 kg	55.8 kg	-6.1 kg	0.85
	(48.8-50.7)	(54.7-57.0)	(-6.7- -5.5)	
BMI	19.5 kg/m²	21.0 kg/m²	-1.5 kg/m²	0.75
	(19.2-19.8)	(20.6-21.3)	(-1.8- -1.3)	

All differences between self-reports and measured data were significant at the $p<0.001$ level

The constant and regression coefficients that were found in the regression analyses (see table 2.5) were used to calculate a corrected BMI. Two correction formulas were used, one based on BMIs and socio-demographic characteristics alone (explaining 62% of the variance) and the second based on BMIs, socio-demographic characteristics and body image as well (explaining 68% of the variance).
Applying the correction formulas to the total population of 12-13 year olds in Rotterdam yields a prevalence of overweight of 19.2%, when corrected for socio-demographic variables only, or 22.8% when corrected for body image as well, while non-adjusted self-reported data would have resulted in an estimate of 12.5%. Mean BMIs in the total population were adjusted with 1.0 kg/m² and 1.3 kg/m² respectively, resulting in a mean corrected BMIs of 19.7 kg/m² and 19.9 kg/m² respectively as compared to a mean non-corrected BMIs of 18.7 kg/m².
Sensitivity and specificity for overweight of self-reported BMI were 49% and 96% respectively. Correction of the self-reported BMI for socio-demographic variables resulted in an increase of the sensitivity to 70% and a decrease of the specificity to 89%.
Additional correction for body image resulted in a sensitivity and specificity of 77% and 85% respectively.
Based on these estimated prevalence's, the positive and negative predictive values of the corrected self-report data have been calculated. For both methods of correcting BMI the positive predictive value was 60% and the negative predictive value 93%.

2.5 Discussion

Self-reported data on height and weight of the 12-13 year olds in this study result in a considerable underestimation of BMI and prevalence of overweight. The under-reporting of BMI was higher in pupils who regarded themselves as more fat, were from non Dutch origin and in lower levels of education. A more accurate estimate of BMI was possible when self-reported data were corrected for socio-demographic variables and body image. The sensitivity improved to a great extent when self-reported data were corrected, but still about

one fourth of all overweight subjects would not be identified after applying the correction equation.

Table 2.4 Mean difference (SD) between self-reported and measured height, weight and BMI by socio-demographic characteristics, body image, measured weight status and time interval between self-report and measurement

Mean difference (SD) in:	Height (cm)	Weight (kg)	BMI (kg/m²)
Gender			
Male	-2.0 (4.9)	-6.5 (6.9)	-1.6 (2.8)
Female	-1.1 (5.6)	-5.7 (7.5)	-1.5 (3.1)
Age			
11-12	-1.5 (5.3)	-5.4 (6.6)	-1.2 (2.9)
13	-1.6 (5.3)	-7.0 (7.8)	-1.9 (3.1)
14	-1.4 (4.5)	-4.9 (6.2)	-1.1 (2.3)
Level of education			
Basic pre-vocational training	-1.7 (5.9)	-7.2 (8.1)	-1.9 (3.3)
Theoretical pre-vocational training	-1.5 (4.8)	-5.3 (5.0)	-1.2 (2.0)
General secondary education	-1.2 (4.4)	-4.6 (6.0)	-1.1 (2.5)
Country of origin			
Netherlands	-2.2 (3.8)	-5.1 (6.7)	-0.8 (2.4)
Surinam	-1.6 (4.2)	-6.2 (7.2)	-1.6 (3.0)
Dutch Antilles or Aruba	-1.6 (6.9)	-8.6 (9.1)	-2.5 (3.3)
Morocco	-2.1 (6.1)	-6.7 (6.5)	-1.7 (3.0)
Turkey	-0.4 (5.3)	-7.5 (7.0)	-2.4 (3.0)
Other	-0.6 (6.1)	-4.7 (5.5)	-1.3 (2.5)
Body image			
Far too thin	-1.3 (5.8)	-1.8 (8.5)	0.3 (4.4)
Too thin	-1.0 (4.1)	-2.5 (4.7)	-0.3 (2.0)
Not thin / not fat	-1.7 (5.3)	-5.2 (5.9)	-1.2 (2.4)
Too fat	-1.5 (5.8)	-9.0 (8.3)	-2.5 (3.4)
Far too fat	-1.5 (3.3)	-8.8 (9.9)	-2.5 (3.7)
Weight status (measured)			
Not overweight	-1.8 (4.9)	-3.5 (5.0)	-0.5 (2.1)
Overweight	-1.1 (6.0)	-11.4 (8.0)	-3.6 (3.2)
Time interval			
0-2 month	0.1 (4.5)	-5.2 (7.1)	-1.5 (2.7)
3 month	-1.7 (4.5)	-5.6 (6.5)	-1.3 (2.6)
4 month or more	-2.0 (5.7)	-6.5 (7.3)	-1.6 (3.1)

Table 2.5 Results of hierarchal regression analyses with measured BMI as dependent variable

	R^2	B	95% CI of B	ß	P value
Block 1	*.59*				
(Constant)		2.58	1.02-4.14		.001
BMIs		0.94	.87-1.00	.77	.000
Time interval		0.06	-.15-.28	.02	.550
Block 2	*.62*				
(Constant)		2.19	0.43-3.95		.015
BMIs		0.91	0.84-0.98	.74	.000
Time interval		0.06	-0.16-0.27	.02	.593
Gender		0.24	-0.26-0.74	.03	.338
Surinam origin		0.69	-0.10-1.47	.06	.085
Dutch Antillian / Aruban origin		1.36	0.46-2.28	.10	.003
Moroccan origin		0.93	0.11-1.74	.07	.026
Turkish origin		1.53	0.76-2.30	.13	.000
Other origin		0.45	-0.32-1.22	.04	.250
Age		0.29	-0.13-0.71	.04	.177
Theoretical pre-vocational training		-0.49	-1.20-0.22	-.04	.174
General secondary education		-0.66	-1.24--0.08	-.07	.025
Block 3	*.68*				
(Constant)		1.20	-0.43-2.83		.149
BMIs		0.68	0.60-0.76	.56	.000
Time interval		-0.02	-0.21-0.18	-.00	.874
Gender		0.02	-0.44-0.48	.00	.934
Surinam origin		1.06	0.33-1.78	.09	.004
Dutch Antillian / Aruban origin		1.66	0.83-2.50	.12	.000
Moroccan origin		1.50	0.74-2.26	.12	.000
Turkish origin		1.91	1.19-2.62	.16	.000
Other origin		0.73	0.02-1.44	.06	.044
Age		0.23	-0.16-0.61	.03	.252
Theoretical pre-vocational training		-0.49	-1.14-0.16	-.04	.139
General secondary education		-0.67	-1.20--0.14	-.07	.014
Body image		1.72	1.36-2.07	.31	.000

Underestimation of weight and BMI is found in all of the reviewed studies on validity of self-reported data, although in four of these studies only for females.[84-86, 93] The degree of underestimation in our study (6.1 kg for weight and 1.5 kg/m² for BMI) seems to be larger than in the reviewed studies. Only two studies [40, 92] report an underestimation of weight greater than 2.5 kg (in both cases for girls only) and only three studies [83, 89, 90]

report an underestimation of BMI with more than 1 kg/m² (in two cases only for girls).
There are several possible explanations for the higher level of under-reporting of weight and BMI in our study. In our study pupils knew their self-report data would be treated confidentially and under- or over-reporting would not be noticed either by the school nurse who did the actual measurement or anyone else. In six of the reviewed studies on validity of self-reports, subjects knew self-report would be followed by actual measurement [83, 87, 92, 93], which sometimes even took place in the same room [39, 90]. In a confidential situation, like in our study, it is possible that adolescents are more likely to underreport their weight.
Another possible explanation for the high level of under-reporting is that the percentage of overweight subjects in our study population was relatively large (33%). Since overweight subjects appeared to have the high levels of under-reporting BMI this might also contribute to the explanation of our results. The percentage of overweight subjects is not reported in every reviewed study on validity of self-reported height and weight, but in two there are comparable percentages of overweight subjects (34-44% and 33%) and also relatively high under-reporting of weight (1.5 kg and 1.6 kg for boys and 2.1 and 3.5 for girls).[91, 92]
Still other explanations are the young age of our study population, coinciding with a period of rapid growth, and the relatively low education level.
The time interval between administering self-report and actual measurement in our study was relatively large (3 month on average). The difference of 1.5 cm in self-reported and measured height might very well be explained by this time-interval. The under-reporting of weight might also be partly attributed to this time-interval. Our analyses showed that the length of the time interval was not associated with BMI. But BMI is not expected to change as rapidly over time as height and weight.
Our study also showed that many 12-13 year olds were unable to provide self-reported height and weight data (30% of the total population 12-13 year olds). Himes and Faricy 2001 [39] also report high percentages of missing data in 12 and 13 year olds in the NHANES III study (41% and 25% respectively), Hauck et al 1995 [96] report 16-17% missing data in a sample of Indian-Americans and Shannon et al 1991 report 10% implausible or missing data in a sample of sixth graders.
In conclusion, as far as Dutch 12-13 year old pupils in the Rotterdam area are able to provide self-report data on their height and weight, these self-reported data result in a considerable underestimation of BMI and prevalence of overweight. By adjusting self-reported BMI for socio-demographic variables and body image a more accurate estimate of the prevalence of overweight can be given. The usefulness of self-reported height and weight data for the identification of overweight individuals or for use in studies into determinants or correlates of overweight remains questionable. Even if self-report data are adjusted, the sensitivity and specificity do not seem to be sufficient for these purposes.
Applying correction formulas to self-reported height and weight data results in a more accurate estimate of overweight in a society, but since overweight is most probably strongly associated with under-reporting of BMI and prevalence of overweight might differ in different populations or change over time, the usefulness of the correction formulas of the

present or any study is limited. Actual measurements in a sub sample will always be needed to draw up new correction formulas for adjustment of self-reported height and weight data in a new sample.

3

Weight status and psychological well-being

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Feeling fat rather than being fat may be associated with psychological well-being in young dutch adolescents.
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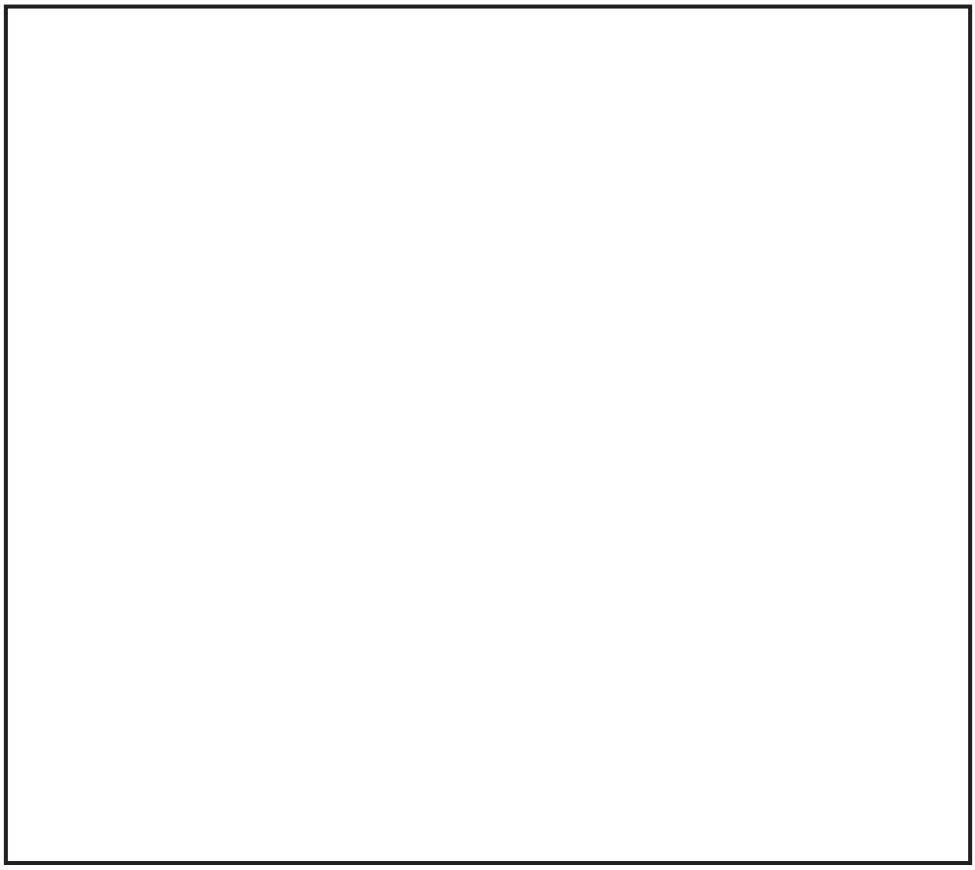


3.1 Abstract

Background: To contribute to a further exploration of the association of psychosocial well-being with overweight and weight perception among young Dutch adolescents.
Methods: Data from the ongoing Rotterdam Youth Health Monitor were used from 1,923 9-10 year olds and 3,841 12-13 year olds. The association of mental health indicators with weight status based on self-report and measured height and weight was studied with logistic regression analyses in both age groups cross-sectionally. Additional longitudinal analyses were conducted among the 787 pupils for whom follow-up data were available. Interactions with gender and ethnic background were explored. Among the 12-13 year olds the role of weight perception was also studied.
Results: 9-10 year old obese boys scored more favourably on social anxiety than non-overweight boys. Among 12-13 year olds body weight perception, rather than self-reported or measured weight status was associated with mental health indicators. Mental health indicators at age 9-10 did not predict self-reported weight status at age 12-13 or change in weight status between 9-10 and 12-13 years, nor did weight status at age 9-10 predict later mental health indicators or change in these indicators.
Conclusion: This study provides no evidence that overweight does coincide with less favourable psychological well-being in young adolescents. In 12-13 year olds feeling overweight appears to be important rather than being overweight.

3.2 Introduction

Childhood obesity has important short and longer-term consequences for physical health. Additionally the importance of psychological consequences with which children are faced is often emphasized.[15, 36, 37, 97, 98] However, the evidence for a strong and predictive or causal relationship between childhood overweight and psychological well-being is not convincing, as is demonstrated and accentuated in a recent review by Wardle and Cooke.[43] They reviewed 53 recent studies on the relation between obesity and body dissatisfaction, self-esteem and depression, distinguishing clinical and community samples. They conclude that whilst levels of body dissatisfaction are higher in community samples of overweight and obese children and adolescents than in their normal-weight counterparts, few are significantly depressed or have low self-esteem. The findings of Wardle and Cooke are largely consistent with the findings of an earlier review by French [42], who reviewed cross-sectional studies on the relation between self-esteem and overweight. In 13 out of 25 studies a significant association was found. Furthermore, because most of the reviewed studies were cross-sectional, even for the studies that showed significant associations, it remains unclear if weight status predicts psychological problems or vice versa.
A number of longitudinal studies have been conducted that are better suited to investigate the possible predictive relation between overweight and psychological distress [99-108]. Some of these longitudinal studies find no associations between weight status and (changes in) psychological well-being (such as depressive symptoms, self-esteem, mood, anxiety).

[100, 106, 108] In 6 out of 10 studies evidence was found that psychological distress predicts overweight or weight gain [99, 101-104, 107], and in one study behaviour problems appeared to predict becoming overweight.[102] In conclusion, the available longitudinal studies show more evidence for psychological problems predicting future obesity or weight gain than for the reverse. One of the explanations for the fact that an association between overweight and psychosocial well-being is not always found, possibly lies in a mediating effect of body weight perception. A limited number of cross-sectional studies in adolescents showed that body weight perception rather than 'true' weight status is associated with suicidal ideation and suicide attempts in American high school students [44], low self-esteem in American female adolescents from 7-12 grade [45] and internalising and externalising problems in Dutch adolescents (11-16 yrs).[46] Feeling 'fat' appeared to be more important than being 'fat'.

Moreover adolescent body dissatisfaction has proven to be related to the development of eating problems, eating disorders and depression.[109, 110]

The purpose of the present study was to further explore the association of psychosocial well-being and overweight, with a specific emphasis on weight perceptions, based on cross-sectional and longitudinal data gathered among 9-10 year olds and 12-13 year olds, collected within the ongoing Rotterdam Youth Health Monitor (RYM) study. The purpose was to explore if an association exists within these age groups, what the direction of the association is, and if this association differs according to the way weight status is measured. More specifically, our research questions were:

Is there a cross-sectional association between psychological well-being and weight status in the two age groups?

Is this association dependent on the indicator of weight status, i.e. BMI based on measured height and weight or BMI based on self-reported height and weight?

Does body weight perception mediate the association between psychological well-being and weight status?

Does weight status predict future psychological well-being, or does psychological well-being predict future weight status?

Are the above associations moderated by gender and country of origin?

3.3 Methods

Study design and population

Data were drawn from the ongoing Rotterdam Youth Health Monitor (RYM). This health surveillance system monitors the general health, well-being, behaviour and related factors of youth aged 0 to 19 years living in Rotterdam and surroundings in order to supply information for youth policy at the school, neighbourhood and municipality level. The RYM is incorporated in the regular check ups of the preventive youth health care system at the ages 2, 5-6, 9-10, 12-13 and 14-15 years of age.

For this study data were drawn from the 2000/2001 RYM survey of primary school grade

six pupils (9-10 year olds) and from the 2003/2004 RYM survey of secondary school grade one pupils (12-13 year olds).
In the 2000/2001 RYM survey 2,431 (response rate 91%) pupils from primary school grade 6 (9-10 yr olds) of 86 (44%) out of the 195 primary schools in the Rotterdam area completed the Youth Health Monitor classroom questionnaires prior to their health examination by the school nurse. Of 1,923 (response rate 72%) pupils measured data on height and weight were also available collected by the school nurse during the health examination. Non-response to the classroom questionnaire was mainly due to absence through illness; non-response to the measured data of height and weight was due to not attending the health examination that children are invited to accompanied by (one of) their parents. Pupils with measured data on height and weight differed slightly from the total sample that completed the classroom questionnaire in terms of country of origin (pupils of Turkish origin were better represented), but not in terms of gender. This sample will be referred to as T1 sample. With regard to country of origin the T1 sample was again not fully representative of the total population of this age in Rotterdam. There was a slight overrepresentation of Moroccan and Turkish pupils (respectively 13% and 17% versus 10% and 13% in the total Rotterdam population).
In the 2003/2004 RYM survey 5,525 pupils (93% response rate) from the first grade of secondary school of 48 (86%) out of the 56 secondary schools in the Rotterdam area completed the Youth Health Monitor classroom questionnaires prior to their health examination by the school nurse. Non-response was mainly due to absence through illness. The questionnaire included questions on body height and weight, which were answered by 3,939 of the pupils. Only pupils with plausible self-reported data on height and weight (height<120 cm or >220 cm and/or weight<30kg or >200kg) were included, resulting in a total of 3,841 pupils (response rate 65%). Pupils with missing self-reported data on height and weight were on average older, from lower levels of education and were more often of Moroccan origin. In comparison with the total population of this age group in Rotterdam, this sample was representative with respect to gender and country of origin. This sample will be referred to as T2 sample.
Of a convenience sub sample of 498 pupils of the T2 sample measured as well as self-reported height and weight data were available. In this sub sample the health examination by the school nurse - in this age group consisting of an interview about psychosocial wellbeing - was extended with the measurement of height and weight. Compared to the total 2003/2004 sample, this sample included more pupils of non-Dutch origin (48% versus 29%), lower education levels (48% versus 26% in basic pre-vocational training) and higher self-reported BMI (19.5 versus 18.7). This sample will be referred to as T2 sub sample.
The number of children who could be followed longitudinally and for whom data on both measurements (i.e. who were represented in both the T1 and T2 samples) were available for self-reported height, weight and mental health variables was 787 children (41% of the T1 sample and 20% of the T2 sample). In comparison with the total population of Rotterdam of this age more children of Turkish (23% versus 13%) and Moroccan origin (13% versus 10%) and fewer children of smaller minority groups (16% versus 20%) could be followed longitudinally. Differences in mental health variables and weight status between children in

this sample and the original samples (T1 and T2 sample) were checked by means of t-tests and chi-square tests. The mean score on depressive symptoms (T1) and the frequency of suicidal ideation (T2) appeared to be higher in children that could not be followed in time ($p=0.004$ and $p=0.037$). The effect sizes of the differences were very small according to the definitions of Cohen ($d=.14$ and $d=.08$).[111] Other significant differences were not found. This sample will be referred to as T1-T2 sample.
All data (including the questionnaires) were gathered within and as part of the government approved routine health examinations of the preventive youth health care. Separate informed consent therefore was not requested. Only anonymous data were used. RYM classroom questionnaires are completed on a voluntary basis. Parents receive written information on these questionnaires and are free to object to participation of their child.

Measurements

Weight status
The school nurse collected data on height and weight in the T1 sample and in the T2 sub sample. Height was measured with SECA 206 roll up measuring bands and reported to the nearest 0.1 cm; weight with calibrated SECA 761 flat weighing scales to the nearest 0.5 kg without heavy clothing and shoes and was therefore corrected for light clothing by subtracting 1 kg (weight of jeans) according to a standard protocol used in official youth health care in the Netherlands.[31, 112, 113] Self-reported height (only in the T2 samples) was reported to the nearest cm; self-reported weight (only in the T2 samples) to the nearest kg.
Overweight and obesity were defined using the age and gender specific cut-offs that correspond to adult cut-offs for BMI of 25 and 30 kg/m² as published by the International Obesity Task Force (IOTF).[95]

Body weight perception
Body weight perception was measured only in the T2 sample with one questionnaire item on a five-point scale ('far too thin', 'too thin', 'not thin / not fat', 'too fat', 'far too fat'). Answer categories 'far too thin' and 'too thin' were combined to one category because only 2% of the sample used the answer category 'far too thin'.

Mental health
The RYM questionnaire contained questions on depressive symptoms and social anxiety regarding appearance in the T1 sample and questions on well-being, suicidal ideation and suicide attempts in the T2 sample. Depressive symptoms (T1 sample) were measured using the 9- item Short Depression Inventory for Children ($\alpha = .74$) with two answer categories (for example: I have been feeling rather sad lately, true/false).[114, 115] Social anxiety regarding appearance (T1 sample) was measured using a 12-item scale ($\alpha = .80$) from the Dutch social anxiety scale for children with two answer categories (for example: if everybody looks at me, I get nervous/I do not get nervous).[116]

Well-being (T2 sample) was measured using the 5-item subscale emotional symptoms (α =.63) of the Strength and Difficulties Questionnaire (SDQ).[117] Suicidal ideation (T2 sample) was measured with a single item regarding the last year (very often, often, sometimes, never), and suicide attempts (T2 sample) with a single item (how many attempts ever: more than once, once, never).[118]

Demographic characteristics

Country of origin was determined by country of birth of mother and father according to definitions of Statistics Netherlands. If both parents had been born in the Netherlands, the child's country of origin was Dutch; if one or both parents were born in another country, the country of origin was defined according to that country; if both parents had been born in different foreign countries, the country of birth of the mother was deemed most important. Children were subsequently allocated to the following categories: Dutch, Surinam, Moroccan, Turkish and other.

Level of education was classified as primary school (T1 sample) and three different levels of secondary school (T2 sample): low for basic pre-vocational secundary education, middle for theoretical/combined pre-vocational secundary education and high for general secondary education (including pre-university training).[119]

Table 3.1 gives an overview of the available measures.

Table 3.1 Available measures in the different samples used

T1 sample of 9-10 yr olds	T2 sample of 12-13 yr olds	T2 sub sample of 12-13 yr olds
Gender	Gender	Gender
Country of origin	Country of origin	Country of origin
Level of education	Level of education	Level of education
Measured height, weight	Self-reported height, weight	Self-reported height, weight
Depressive symptom score		Measured height, weight
Social anxiety score (regarding physical appearance)	SDQ emotional symptoms score	SDQ emotional symptoms score
	Suicidal ideation	Suicidal ideation
	Suicide attempts	Suicide attempts

Data analysis

To study the association between weight status and mental health indicators in the cross sectional T1 and T2 samples (our first research question) logistic regression was used. Logistic rather than linear regression was used because of the use of cut-offs in youth health care practice and consequently its clearer implications for clinical practice. Measured (T1 sample) or self-reported (T2 sample) weight status (not overweight, overweight or obese)

was entered in the model as well as gender, country of origin (Dutch, Surinam, Turkish, Moroccan or other) and level of education (only for the T2 sample), since these socio-demographic characteristics are known to be associated with mental health.[120] Mental health indicators were dichotomised as outcome measures using existing cut-off points: 4 or more answers indicating depression versus less on the Short Depression Inventory for Children [114], a score of ≥ 5 (boys) or ≥ 6 (girls) on the SDQ emotional problems scale versus less [121]; or using worst upper 20th percentile in the present full samples: 6 or more answers indicating anxiety on the 12 item social anxiety scale versus less. Suicidal ideation was dichotomised as (very) often versus sometimes or never; suicide attempts as once or more than once versus never.[118] For each mental health indicator a separate logistic regression was performed.

The same analyses as described above for the T2 sample were performed in the T2 sub sample with measured weight status and self-reported weight status in order to answer our second research question.

To study the possible mediating effect of body weight perception (third research question), the same logistic models were used as described above in the T2 sample and T2 sub sample, but now with body weight perception entered as second step.

To study the potential predictive value of overweight on future well-being and vice versa (fourth research question), two different sets of logistic regression models were used in the T1-T2 sample. The first set of models used mental health status indicators at T2 as dependent variables. For every mental health indicator at T2 a separate model was used. Weight status at T1 was entered, controlled for depressive symptoms and social anxiety at T1, gender and country of origin. The second set used self-reported weight status at T2 as dependent variable. Mental health indicators at T1 were entered in the model, controlled for weight status at T1, gender and country of origin.

Finally, to study the possible prediction of change in weight status, the T1-T2 sample was divided into four groups based on weight status (overweight at T1 and T2, overweight at T1, overweight at T2, not overweight on T1 and T2) and these groups were compared regarding mental health status at T1 using analysis of variance. To study the possible change in mental health status, the T1-T2 sample was also accordingly divided in four groups based on mental health status indicators on T1 and T2 (no high scores on any of the mental health indicators at T1 and T2, high score on one or more of the mental health indicators at T1, high score on one or more of the mental health indicators at T2, high scores on one or more of the mental health indicators at both T1 and T2) and these groups were compared regarding BMI and weight status at T1. Gender, country of origin and level of education were adjusted for.

To study the possible modifying effects of gender and country of origin on all the associations explored (research question five), (two-way) interaction terms of weight status (or mental health status) with gender and country of origin were introduced as final step in each of the logistic models as well as in the analyses of variance described above.

Complete data analysis was used for each separate research question, missing data were not imputed.

3.4 Results

Demographic characteristics, weight status and body weight perception of the samples used are given in Table 3.2.

Association of measured weight status and well-being in 9-10 year olds

In the T1 sample 22% of the pupils were overweight and 7% were obese.
Weight status was not associated with a high score on depressive symptoms or on social anxiety regarding physical appearance (Table 3.3). For gender an interaction effect was found with social anxiety. Obese boys were showing more favourable scores on social anxiety than non-overweight boys (OR=0.31; 95% CI=0.11-0.89).

Association of self-reported weight status and well-being in 12-13 year olds

In the T2 sample (based on self-reported height and weight) 11% of the pupils were overweight and 2% were obese. Self-reported overweight was associated with a high SDQ emotional problem score and suicide attempts. No significant interaction effects of weight status with gender and country of origin on mental health indicators were found (Table 3.4).

Association of measured versus self-reported weight status and well-being in 12-13 year olds

In the T2 sub sample based on measured data 24% of the pupils were overweight and 9% obese, based on self-reported data 13% and 5% respectively. Measured weight status was not associated with any of the mental health indicators. Self-reported obesity was associated with a high SDQ emotional problem score, while suicidal ideation or suicide attempts were not reported by self-reported obese pupils in this sub sample (Table 3.5). No significant interaction effects of weight status with gender and country of origin on mental health indicators were found.

Table 3.2 Demographic characteristics, weight status and body weight perception in the different samples used

	T1 sample of 9-10 yr olds	T2 sample of 12-13 yr olds	T2 sub sample of 12-13 yr olds a)	T1-T2 sample b)
N	1923	3841	498	787
Gender				
Boys	51%	51%	53%	52%
Girls	49%	49%	47%	48%
Country of origin				
Netherlands	37%	48%	29%	36%
Surinam	13%	12%	15%	13%
Morocco	13%	9%	13%	13%
Turkey	17%	12%	16%	23%
Other	20%	19%	26%	15%
Level of education				
Primary education	100%			
Secondary education				
Low		26%	48%	25%
Middle		29%	30%	32%
High		45%	22%	43%
Measured weight status at T1				
Not overweight	71%			75%
Overweight	22%			21%
Obese	7%			5%
Measured weight status at T2				
Not overweight			67%	
Overweight			24%	
Obese			9%	
Self-reported weight status at T2				
Not overweight		87%	82%	85%
Overweight		11%	14%	12%
Obese		2%	4%	3%
Body weight perception at T2				
(Far) too thin		13%	11%	11%
Not thin/not fat		59%	56%	60%
Too fat		24%	27%	25%
Far too fat		5%	6%	4%

a) sub sample of T2 sample with self-reported as well as measured weight, height

b) longitudinal sample with pupils who are represented in both the T1 and T2 sample

Table 3.3 Odds ratios (OR) and 95% confidence interval (CI) for the associations between weight status and adverse mental health outcomes in 9-10 year olds a)

	High depressive symptoms score b)		High social anxiety score regarding physical appearance c)	
	% N=1900	OR (95% CI)	% N=1900	OR (95% CI)
Weight status				
Not overweight	25.9	1	19.8	1
Overweight	24.1	0.86 (0.66-1.11)	21.7	1.03 (0.78-1.36)
Obese	26.6	0.96 (0.64-1.43)	18.0	0.77 (0.49-1.26)

a) all analyses adjusted for gender and country of origin

b) 4 or more (of nine) depression indicating items of the short depression inventory

c) 6 or more (of twelve) anxiety indicating items of the subscale regarding physical appearance of the social anxiety scale

In order to explain the different results found between measured and self-reported weight status in the T2 sub sample the sample was further explored. The correlation between self-reported and measured BMI was 0.75 with a mean difference of 1.5 (CI 1.3-1.8, t-test $p<0.001$). Table 3.6 in where overweight and obesity are combined into one category shows that about half (85 of 162) of the pupils with measured overweight would not be categorised as overweight according to self-reported height and weight, and a small number (13 of 336) would be wrongly categorised as overweight based on self-reported data. Pupils with both measured and self-reported overweight appeared to have higher measured BMI (27.6 versus 24.7) and heavier body weight perception (84% feels fat versus 48%) than those with only measured and not self-reported overweight (Table 3.6).

Effect of body weight perception among 12-13 year olds

Body weight perception appeared to be a strong confounder for the association between weight status and mental health indicators among 12-13 year olds. Body weight perception was significantly associated with all mental health indicators at T2. Feeling too thin, too fat and especially far too fat were associated with worse mental health outcomes in comparison with feeling neither thin nor fat.

After adjustment for body weight perception the association between self-reported as well as measured weight status with mental health outcomes changed with self-reported obese even showing significant better mental health outcomes than non-overweight pupils (Table 3.4 and 3.5).

Table 3.4 Odds ratios (OR) and 95% confidence interval (CI) for the associations between self-reported weight status and adverse mental health outcomes in T2 sample of 12-13 year olds with and without body weight perception in the model a)

	High score on SDQ emotional symptoms b)		Suicidal ideation (very) often c)		Suicide attempts once or more d)	
	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)
	N=3754		N=3731		N=3702	
Model with self-reported weight status						
Weight status						
Not overweight	20.1	1	3.1	1	6.3	1
Overweight	27.2	1.51 (1.16-1.96)	4.8	1.50 (0.90-2.49)	11.1	1.75 (1.22-2.50)
Obese	27.3	1.45 (0.82-2.56)	2.6	0.73 (0.18-3.05)	6.6	0.89 (0.35-2.27)
Model with self-reported weight status and body weight perception						
Weight status						
Not overweight	20.1	1	3.1	1	6.3	1
Overweight	27.2	0.90 (0.67-1.20)	4.8	0.74 (0.42-1.30)	11.1	1.21 (0.80-1.81)
Obese	27.3	0.46 (0.25-0.87)	2.6	0.17 (0.04-0.76)	6.6	0.33 (0.12-0.91)
perception						
Too thin	17.5	1.46 (1.11-1.92)	2.9	1.39 (0.75-2.55)	7.6	1.47 (0.99-2.20)
Not thin / fat	12.5	1	2.2	1	5.2	1
Too fat	22.0	2.22 (1.79-2.75)	4.6	2.32 (1.50-3.61)	7.6	1.35 (0.97-1.88)
Far too fat	37.4	5.95 (4.05-8.74)	12.8	8.66 (4.72-15.87)	19.7	4.45 (2.72-7.26)

a) all analyses adjusted for gender, country of origin and level of education

b) score of ≥ 5 (boys), ≥ 6 (girls)

c) versus sometimes or never

d) versus never

Predictive value of weight status on later well-being and vice versa (data not shown)

Weight status measured at T1 was not associated with any of the mental health indicators at T2. Similarly, none of the mental health indicators at T1 were significantly associated with self-reported weight status at T2. No significant interaction effects of weight status with gender and country of origin were found.

The proportion of pupils not overweight at T1(measured) or T2 (based on self-report) was 70%, 5% was not overweight at T1, 16% was not overweight at T2 (based on self-report) and 9% was overweight at both T1 and T2. Mental health indicators at T1 did not differ between these groups. No significant interaction effects of weight status with gender and country of origin were found.

Table 3.5 Odds ratios (OR) and 95% confidence interval (CI) for the associations between measured and self-reported weight status and adverse mental health outcomes in the T2 sub sample of 12-13 year olds with and without body weight perception in the model a)

	High score on SDQ emotional symptoms b)		Suicidal ideation (very) often c)		Suicide attempts once or more d)	
	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)
	N=483		N=479		N=477	
Model with self-reported weight status						
Weight status						
Not overweight	14.5	1	3.9	1	8.9	1
Overweight	17.6	1.47 (0.73-2.99)	6.1	2.08 (0.64-6.84)	9.1	1.43 (0.55-3.71)
Obese	27.3	**3.06 (1.08-8.66)**	0	0	0	0
Model with self-reported weight status and body weight perception						
Weight status						
Not overweight	14.5	1	3.9	1	8.9	1
Overweight	17.6	0.94 (0.43-2.08)	6.1	1.15 (0.31-4.22)	9.1	1.08 (0.36-3.25)
Obese	27.3	0.98 (0.29-3.31)	0	0	0	0
Perception						
Too thin	14.8	1.19 (0.49-2.92)	5.6	3.23 (0.73-14.41)	15.1	2.90 (1.09-7.73)
Not thin / fat	11.3	1	1.8	1	6.3	1
Too fat	18.8	1.79 (0.95-3.35)	7.6	**4.23 (1.32-13.53)**	8.3	1.43 (0.61-3.36)
Far too fat	38.7	**7.07 (2.55-19.57)**	6.5	6.03 (0.96-37.98)	16.1	**4.13 (1.12-15.17)**
Model with measured weight status						
Weight status						
Not overweight	19.4	1	4.3	1	9.4	1
Overweight	18.8	1.55 (0.85-2.84)	3.1	1.05 (0.32-3.45)	7.6	1.03 (0.45-2.35)
Obese	25.0	1.55 (0.66-3.66)	6.3	1.69 (0.43-6.67)	6.4	0.90 (0.25-3.23)
Model with measured weight status and body weight perception						
Weight status						
Not overweight	19.4	1	4.3	1	9.4	1
Overweight	18.8	1.03 (0.51-2.08)	3.1	0.62 (0.16-2.35)	7.6	0.99 (0.39-2.52)
Obese	25.0	0.44 (0.15-1.33)	6.3	0.64 (0.13-3.32)	6.4	0.47 (0.09-2.43)
Perception						
Too thin	14.8	1.19 (0.48-2.94)	5.6	2.99 (0.66-13.44)	15.1	**2.88 (1.07-7.80)**
Not thin / fat	11.3	1	1.8	1	6.3	1
Too fat	18.8	**1.99 (1.04-3.81)**	7.6	**4.91 (1.43-16.84)**	8.3	1.47 (0.61-3.53)
Far too fat	38.7	**10.88 (3.65-32.42)**	6.5	5.11 (0.72-36.09)	16.1	3.77 (0.91-15.53)

a) all analyses adjusted for gender, country of origin and level of education

b) score of ≥ 5 (boys), ≥ 6 (girls)

c) versus sometimes or never

d) versus never

Table 3.6 Self-reported BMI, measured BMI and body weight perception in sub sample of 12-13 year olds (T2 sub sample) according to their self-reported and measured weight status

	N	%	Self-reported BMI (SD)	Measured BMI (SD)	% feeling too thin	% feeling not thin/ fat	% feeling too fat	% feeling far too fat
Not measured and not self- reported overweight	323	64.9	17.8 (2.0)	18.5 (1.9)	16.7	66.0	15.4	1.9
Measured but not self-reported overweight	85	16.9	19.6 (1.8)	24.7 (2.3)	0.0	51.8	42.4	5.9
Measured and self-reported overweight	77	15.5	25.5 (3.7)	27.6 (4.0)	0.0	15.8	57.9	26.3
Not measured but self-reported overweight	13	2.6	24.1 (3.0)	20.2 (0.9)	7.7	61.5	30.8	0.0
Total	498	100%	19.5 (3.7)	21.0 (4.4)				

The percentage of pupils not having any high scores on the measured mental health indicators at T1 and T2 equalled 58%, 10% had high scores on one or more of the mental health indicators at T2, 24% only at T1 and 8% had a high score on both the mental health indicators at T1 and T2. BMI or overweight status at T1 did not differ between these groups. No significant interaction effects of weight status with gender and country of origin were found.

3.5 Discussion

Only one significant association between measured or self-reported weight status and mental health indicators was found in the present study cross-sectionally and none longitudinally. In our cross-sectional sample of 9-10 year olds, obese boys reported more favourable social anxiety scores regarding physical appearance than non-overweight boys. The initially found association between self-reported weight status and mental health indicators in 12-13 year olds could be attributed to body weight perception rather than to weight status.

The lack of association between mental health indicators and overweight that was found in our study confirms results found in the majority of earlier cross-sectional studies.[43] Research in Finland has shown that the increasing prevalence of overweight in adolescents in the last two decades has been associated with a decreasing prevalence of feeling too fat. [122] This might explain the lack of association found between mental health indicators

and overweight in our and other recent studies. Now that larger proportions of populations are overweight, being overweight has become more 'normal' and feelings of being too fat and the accompanying psychological distress nowadays might have been shifted to higher BMI's than before.

In contrast with most of the longitudinal studies performed, we did not find earlier psychological well-being to predict later overweight or obesity. This discrepancy may be caused by the age group included in our study. Richardson et al.[104], who studied adolescents of 11 to 26 years of age, only found a predictive effect of depression on later obesity in girls in late adolescence. Tanofsky et al.[108] and Stice et al.[106] also found no evidence that depressive symptoms predict increase in body fat mass among 6-12 and among 11-15 year olds, respectively.

Our results indicate that feeling overweight rather than being overweight may be associated with psychological well-being in young adolescents. Body dissatisfaction during adolescence is assumed to be a risk factor for later eating disturbances and depression [123]. Paxton et al.[124] showed that body dissatisfaction was a unique predictor of 5 year later depressive mood and low self-esteem in early-adolescent girls and mid-adolescent boys after controlling for BMI. Our results are supportive to these findings. Furthermore body dissatisfaction might influence the way pupils self-report on their height and weight, possibly explaining our finding that only self-reported and not measured weight status is associated with mental health indicators (not corrected for body perception).

In our study we only used a crude measure of body perception.[125] This measure was available only at T2. Our finding that 9-10 year old obese boys show less social anxiety, therefore could not be adjusted for body perception and should be interpreted with caution. Also we included various but certainly not all indicators of psychological well-being. It is therefore possible that a predictive relationship between weight status and psychological well-being exists, but for other indicators than were included in the present study.

Another possible limitation of our study is that all mental health indicators are based on self-reports. The use of self-report indicators for assessing mental health in children is subject to debate. However, there is evidence to support that self-report indicators of mental health can provide useful information on experiences of health and distress in children and adolescents.[126]

Further possible limitations of our study are the relatively small size of the sub sample with measured in addition to self-reported height and weight at T2, the rather large number of children with missing self-reported height and weight data and the number of children that were lost to follow up. However with respect to psychological well-being and weight status we found no or only minor differences between children for whom follow-up data were and were not available. No further analysis of the possible bias that might have been introduced by the loss of pupils with missing self-reported height and weight was possible.

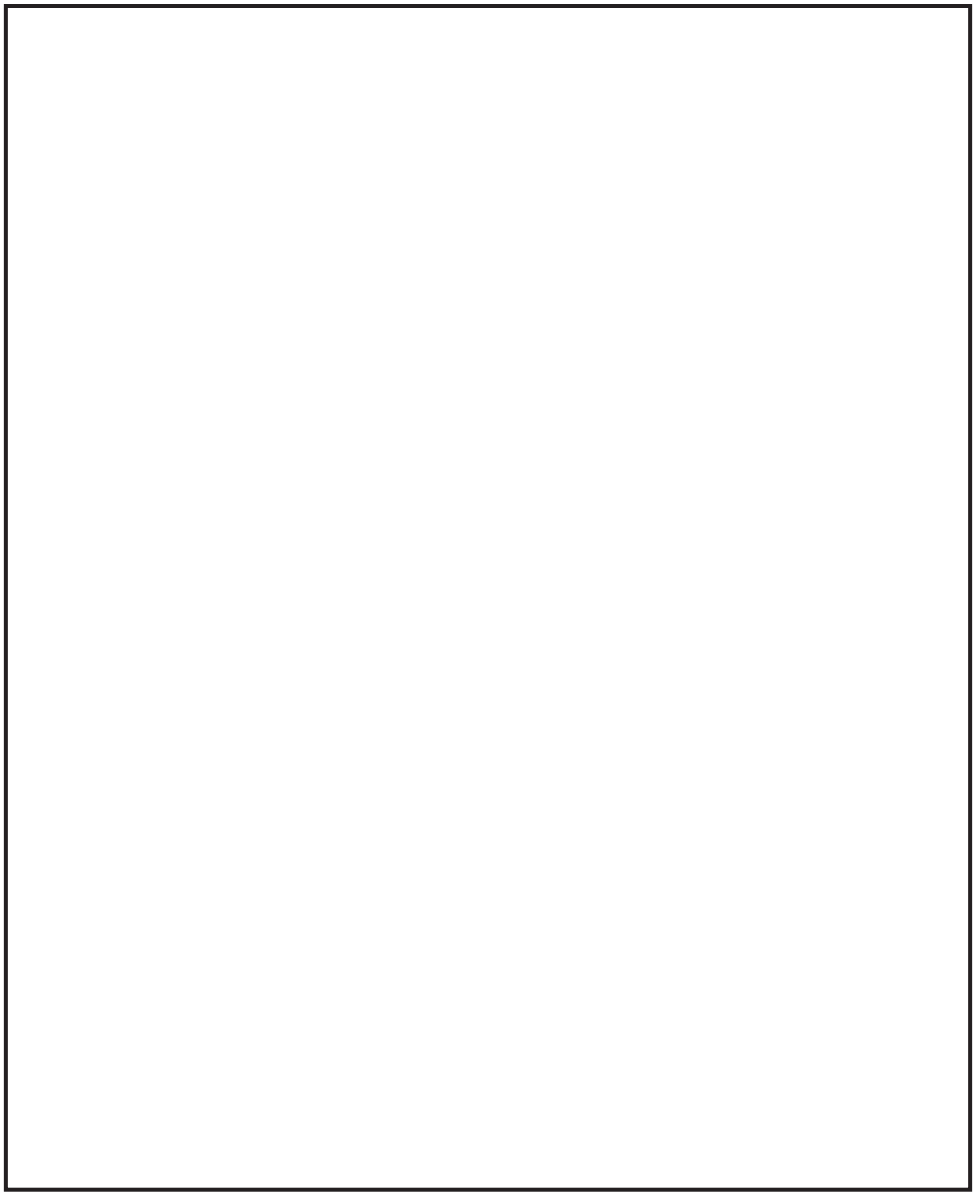
Finally, BMI is a crude measure for overweight status. Some experts recommend to use waist circumference or BMI z-scores to identify children and adolescents with high body fat.[127, 128]

In conclusion, we found no evidence that overweight coincides with less favourable

psychological well-being in a sample of Dutch adolescents (9-10 and 12-13 year olds). Psychological well-being does not seem to predict future overweight and vice versa neither overweight nor obesity seems to predict future psychological well-being in young adolescents. However, feeling fat may be more important than being fat for psychological well-being in 12-13 year olds.

Future research might answer the question why some overweight children feel fat and others do not and how psychological distress caused by body dissatisfaction can be prevented.

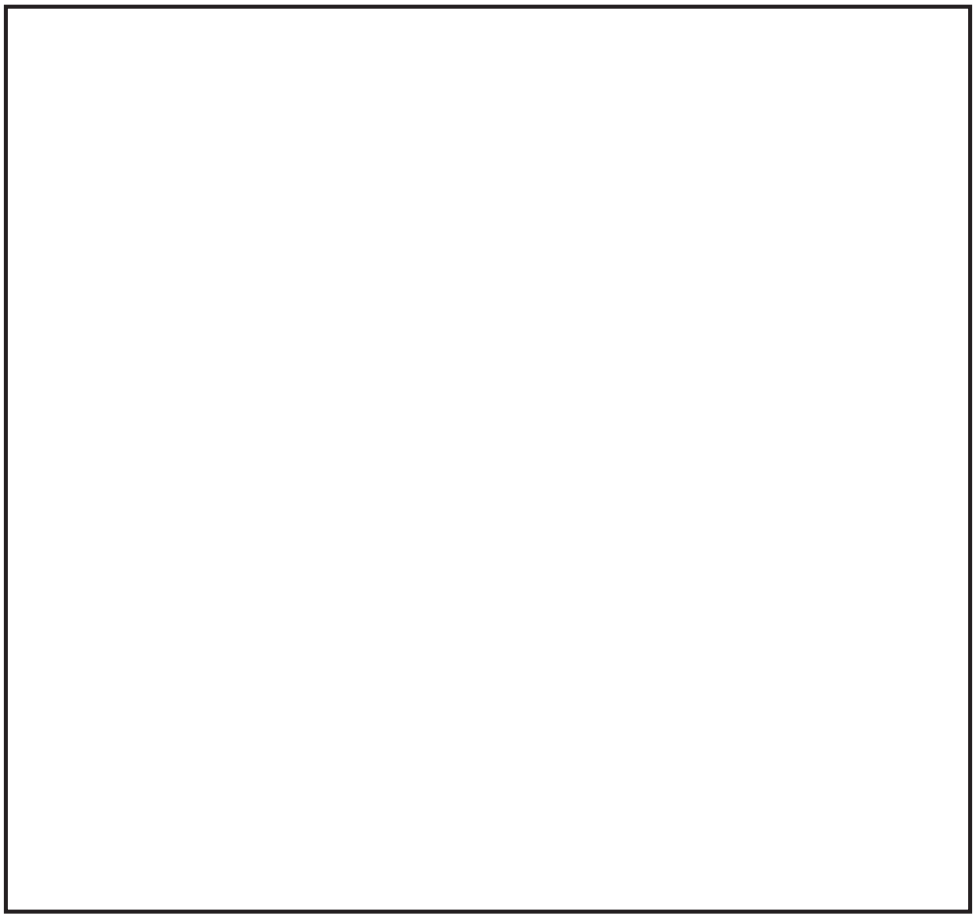
Part 2
Risk factors and determinants



4

Weight status, behaviours and intentions

Submitted for publication:
Jansen, W., Mackenbach, J.P., Joosten-van Zwanenburg, E., Brug, J. (2008)
Weight status, energy-balance behaviours and intentions in 9 to 12-year-old inner-city children: associations and differences according to socio-demographic characteristics



4.1 Abstract

Background: Promoting four energy-balance behaviours ('increasing physical activity', 'reducing sedentary behaviour', 'reducing sugar-containing drinks', 'not skipping breakfast') has been adopted by youth health care in the Netherlands for prevention of obesity among primary schoolchildren. However, data on the prevalence of these behaviours and intentions to engage in these behaviours among children in the Netherlands and elsewhere is limited, especially for multi-ethnic inner-city populations.
Methods: Data on behaviours and intentions were collected using classroom questionnaires. Height and weight were measured by trained staff. Seventeen primary schools in Rotterdam participated. Data on 1,095 pupils aged 9-12 years (82% response rate) were available for analysis.
Results: The prevalence of overweight and obesity was 30% and 9%, respectively. Few significant associations between socio-demographic characteristics and weight status were found.
Engagement in energy-balance behaviours varied from 59% for outdoor play (>1 h previous day) to 86% for active transportation to school (day of survey). The highest positive intentions were reported for engaging in sports (84%), the lowest for reducing computer time (41%). Some significant differences in behaviours and intentions according to gender, age and ethnicity were found. Skipping breakfast and the total number of energy-balance behaviours were associated with overweight. Overweight children reported more positive intentions towards doing sports and less positive intentions towards having breakfast than normal weight children.
Conclusion: The prevalence of overweight among inner-city schoolchildren in the Netherlands is high, and engagement in energy-balance behaviours can be improved. A general rather than a differentiated approach is needed for obesity prevention among inner-city schoolchildren.

4.2 Introduction

The increasing prevalence of childhood overweight is a major public health challenge. In the Netherlands a national plan has been developed for youth preventive health care to contribute to prevention of childhood overweight and obesity. This plan specifically targets schoolchildren who are overweight and focuses on promotion of four energy-balance promoting behaviours: 'increasing physical activity', 'reducing sedentary behaviour', 'reducing consumption of sugar-containing drinks' and 'not skipping breakfast'[51]. These four behaviours are very similar to those suggested by Whitaker[129] as well as Barlow [47] and have been identified by means of a literature review indicating that these behaviours may contribute to a lower likelihood of overweight and obesity in youth [52-54, 74, 98, 130-132]. Motivational interviewing techniques combined with a stages-of-change approach are part of the planned approach in Dutch youth preventive health care to promote the energy-balance behaviours [51, 133]. Although still lower than in many other countries

[3, 134], among Dutch children (4-16 years of age) the prevalence rates of overweight and obesity have increased from 3.9% for boys and 6.9% for girls in 1980 to respectively 14.5% and 17.5% in 2003[8]. Higher prevalence rates are found for ethnic minorities and children living in large cities.[9]
Although the associations of the four targeted behaviours with overweight are subject of many studies, figures on the prevalence of the four targeted behaviours in primary schoolchildren in the Netherlands as well as elsewhere are limited, especially among inner-city populations with a diverse ethnic composition, and from a lower socio-economic background. As a result, it remains unclear for how many children improvement in energy-balance behaviours up to recommended levels can be achieved and whether there are important differences according to socio-demographic characteristics that need to be taken into account in designing interventions and providing preventive health care. The number of studies on intentions towards energy-balanced behaviours in primary schoolchildren is even more limited [135-141], while research on the prevalence of intentions is highly relevant for interventions tailored to motivational stages-of-change. Positive associations between behavioural intentions and physical activity have been demonstrated in a few of these studies.[136, 140, 141]
Therefore, we studied the prevalence of these behaviours and intentions among 9 to 12-year-old inner-city children, as well as differences in behaviours and intentions according to gender, age, ethnic background and socio-economic status (SES), and the associations of these behaviours and intentions with weight status.

4.3 Methods

Twenty primary schools located in multi-ethnic, mostly low-income, inner-city neighbourhoods in Rotterdam participated in the study. From September to October 2006 data were collected on socio-demographic characteristics, specific food habits and physical activity using questionnaires among children in the three highest grades of primary school (9 to12-year-olds) administered in the classroom, guided by the teacher, on a normal weekday except for Mondays. The questionnaire developed in the ENDORSE-study to examine energy-balance related behaviours and its determinants was used, after minor adjustments to make it better applicable to primary schoolchildren [49]. Height and weight were measured during physical education classes. Parents received information on the study and supplied their consent through the schools. Children could object to participate. The study was approved by the Medical Ethics Committee of Erasmus MC.
Of the 1,341 eligible pupils, 1,207 (90.0%) completed the questionnaire. Data on height and weight were available for 1,209 (90.2%) pupils. Complete data were available for 1,095 pupils (81.7%).

Socio-demographic characteristics included gender, age, ethnicity, and neighbourhood income level. Ethnicity was determined by country of birth of parents according to definitions of Statistics Netherlands. If both parents had been born in the Netherlands,

the child's ethnicity was defined as Dutch; if one or both parents were born in another country, ethnicity was defined according to that country; if both parents had been born in different foreign countries, the country of birth of the mother was taken. Children were subsequently allocated to the categories: Dutch, Surinamese, Antillean, Moroccan, Turkish, Cape Verdean and 'other'.
Neighbourhood income level was determined by most recent data on average 2003 personal gross income level per postal code, provided by Statistics Netherlands. In our sample postal codes refer to on average 37.3 (±35.9) houses and 95.3 (±86.4) inhabitants. The postal code was missing for 23.5% of the children; for those children, neighbourhood income level was imputed with the school average or, in case this was not available (in 2 schools all postal codes of 133 pupils were missing), the school average of a school matched on neighbourhood, size and proportion of migrant children.

Body mass index (BMI) was calculated using weight (kg) divided by squared height (in m). Height was measured to the nearest 0.1 cm using a mobile stadiometer, weight was measured to the nearest 0.2 kg using a flat electronic weighing scale (SECA 888) in light clothing by trained staff during the physical education class following a standardized protocol [31]. Pupils were categorised as underweight, normal weight, overweight, or obese. Overweight and obesity were defined using the age and gender specific cut-offs that correspond to adult cut-offs for BMI of 25 and 30 kg/m² as published by the International Obesity Task Force [95]. Underweight was defined using the age and gender specific cut-offs corresponding to adult cut-offs for BMI of 18.5 kg/m² derived from the 1996/1997 Dutch national growth survey.[142]

Physical activity was measured using the following questions: i) 'How long did you play outdoors after school yesterday?' ('did not' / 'less than half an hour' / '½-1 hour'/ '1-2 hours', '2-3 hours', 'more than 3 hours'); ii) 'On how many days did you do sport outside school hours last week?' (0 through 7); iii) 'How did you come to school today?' ('walking' / 'cycling' / 'public transport or car' / 'other'); iv) on how many days last week did you walk or cycle to school? (0 through 5). Children were categorised according to time played outdoors the previous day (at least 1 hour vs. less than 1 hour), according to participation in sport activities during the last week (at least on 2 days vs. less), and according to active transportation (cycle or walk to school on the day of survey vs. not). Active play for one hour per day and sport activities for one hour on at least two days per week are in accordance with Dutch norms on minimal requirements for physical activity in children.[143]

Sedentary behaviour was assessed using two questions: i) 'How long did you watch television, DVD or video outside school hours yesterday?' ('did not' / 'less than half an hour' / '½-1 hour'/ '1-2 hours', '2-3 hours', 'more than 3 hours')'; ii) 'How long did you spend on the computer or game-computer outside school hours yesterday?' ('did not' / 'less than half an hour' / '½-1 hour'/ '1-2 hours', '2-3 hours', 'more than 3 hours'). Children were categorised according to TV viewing time, computer time and total screen time on the

day before administration (2 hours or less vs. more than 2 hours). A maximum of 2 hours screen time per day is the recommendation given by youth health care in the Netherlands. [51]

Consumption of sugar-containing drinks was assessed with one question, after giving examples of such drinks (i.e. lemonade, soft drinks, sport drinks, chocolate milk, yoghurt drinks, fruit juices; exceptions: light drinks, orange or grapefruit juice): i) 'How often did you have a sugar-containing drink yesterday?' (0 through 5 or more). Children were categorised as having had 2 drinks or less vs. more than 2, according to the recommendations of Dutch preventive youth health care.

Not skipping breakfast was measured with two questions: i) Did you have breakfast this morning?' ('yes' / 'no'); ii) 'on how many days last week did you have breakfast before going to school?' After checking the answer categories of both questions, children were categorised according to having had breakfast on the day of survey in accordance with the other behaviours.

Additional questions concerned being member of a sports club, owning a bicycle, having a television in one's bedroom, and having a computer and/or game-computer at home.

Intentions to engage in outdoor playing, doing sports, having breakfast, and to reduce television time, computer time and consumption of sugar-containing drinks were measured with single-item questions: i.e. "Do you intend to increase your outdoor play, (continue) doing sports, to reduce TV time, to reduce computer time, to reduce consumption of sugar-containing drinks, to (continue) having breakfast in the coming 6 months?"('yes certainly'/ 'yes probably'/ 'maybe yes, maybe no'/ 'probably not'/ 'certainly not'. Children were categorised as having positive intentions or not.

Statistical analysis

Associations between socio-demographic characteristics and weight status were determined using multiple logistic regression analyses, with weight status dichotomised as normal weight (excluding underweight) vs. overweight (including obese) and normal weight (excluding underweight) vs. obese (excluding overweight, non obese children) as dependent variables. Associations between socio-demographic characteristics and the energy-balance behaviours were determined using multiple logistic regression analyses with the energy-balance behaviours as dependent variables. Summarising the number of energy-balance behaviours children engaged in (i.e. at least 1 hour outdoor play, at least 2 days sports last week, active transportation to school, less than 2 hours total screen time, less than 2 sugar-containing drinks and had breakfast) resulted in a 'healthy behaviour score', ranging from 0 through 6. Associations between this score and socio-demographic characteristics were determined using analysis of variance with the health behaviour score as the dependent variable.

Multiple logistic regression analyses as described above were also used to determine associations between socio-demographic characteristics and being member of a sports club, owning a bike, having a television in one's bedroom, having a (game-) computer and the intentions towards the energy-balance behaviours.
To determine whether weight status was associated with the energy-balance behaviours, multiple logistic regression analyses were used with weight status as dependent variable. Each type of behaviour was entered as an independent variable in a separate model; finally a model was tested with the healthy behaviour score as the independent variable. All models were adjusted for socio-demographic characteristics. Weight status was dichotomized as normal weight (excluding underweight children) vs. overweight (including obese children), and as normal weight (excluding underweight children) vs. obese (excluding overweight, non obese children).
To determine whether intentions towards the energy-balance behaviours were dependent on weight status, multiple logistic regression analyses were used with positive intentions as dependent and weight status (as normal weight and overweight, excluding underweight) as independent variable, controlling for socio-demographic characteristics. SPSS 15.0 was used for all analyses.

4.4 Results

Socio-demographic characteristics and weight status are presented in Table 4.1.

Weight status and associations with socio-demographic characteristics

Overweight was prevalent in 30.4% of the children, obesity in 9.0%. Differences in overweight according to gender, ethnic background, age and neighbourhood income level did not reach significance, nor did any interaction between these socio-demographic characteristics (Table 4.2). Obesity was more prevalent in children from Cape Verdean ethnicity than from Dutch ethnicity (Table 4.2), and obesity was more prevalent in older girls (OR=1.64; CI 1.17-2.31).

Energy-balance behaviours and associations with socio-demographic characteristics

The engagement in energy-balance behaviours and the odds ratios (ORs) according to socio-demographic characteristics are given in Table 4.2. At least 1 hour outdoor play on the day prior to the questionnaire administration was reported by 59% of the children, at least 2 days sport last week by 66%, active transport to school on the day of the survey by 86%, up to 2 hours TV viewing on the previous day by 76%, up to 2 hours computer on the previous day by 86%, with total screen time up to 2 hours by 62%, up to 2 sugar-containing drinks the previous day by 78%, and having breakfast on the day of survey by 78%. A favourable score on all behaviours was reported by 13% of the children, and on none of the

behaviours by 0%. On average the children engaged in 4.2 ± 1.2 of the six above-mentioned energy-balance behaviours.

Table 4.1 Socio-demographic characteristics, BMI and weight status of the study population (n=1,095)

Gender	
Male	48.5%
Female	51.5%
Ethnicity	
Dutch	9.3%
Surinamese	13.2%
Antillean	4.5%
Moroccan	31.0%
Turkish	24.5%
Cape Verdean	6.4%
Other	11.0%
Weight status	
Underweight	6.3%
Normal weight	63.3%
Overweight (not obese)	21.4%
Obese	9.0%
Mean BMI (sd)	19.3 (4.01)
Mean age in years (sd)	10.8 (0.97)
Mean neighbourhood income level in euros per month (sd)	1,511 (297)

sd = standard deviation

Most children (82%) who used active transport to school on the day of survey, reported using active transport all school days last week. Of the children who used inactive transport to school on the day of survey, 57% reported using inactive transport all school days last week.

Most children (81%) who reported to have had breakfast on the day of survey reported having breakfast all school days last week. Of those who reported not to have had breakfast, 43% reported skipping breakfast all days last week.

Table 4.2 Differences in proportions (%), odds ratios (OR) and 95% confidence intervals (95% CI) in weight status and energy-balance behaviours according to socio-demographic characteristics

	Overweight a) n=1,023		Obese b) n=789		>=1 h outdoor play previous day n=1,092		>= 2 days sports last week n=1,071		Active transport to school on day of survey n=1,072	
	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)
Total sample	32.5		12.5		58.6		66.1		85.9	
Gender										
Male	30.8	1	12.5	1	64.0	1	79.5	1	87.1	1
Female	34.1	1.18 (0.90-1.53)	12.5	1.01 (0.65-1.55)	53.7	**0.65 (0.51-.83)**	53.5	**0.29 (0.22-0.38)**	84.7	0.81 (0.57-1.15)
Ethnicity										
Dutch	31.3	1	9.3	1	64.7	1	67.3	1	80.8	1
Surinamese	28.3	0.88 (0.49-1.56)	8.1	0.94 (0.32-2.79)	46.5	**0.48 (0.28-0.81)**	62.1	0.77 (0.44-1.34)	72.7	0.58 (0.31-1.10)
Antillean	46.8	1.93 (0.94-3.96)	13.8	1.81 (0.47-6.94)	40.8	**0.41 (0.20-0.83)**	70.2	1.34 (0.61-2.93)	72.9	0.54 (0.24-1.25)
Moroccan	26.4	0.80 (0.48-1.33)	9.3	1.19 (0.46-3.03)	66.1	1.16 (0.72-1.87)	66.0	0.98 (0.59-1.62)	89.6	1.63 (0.86-3.09)
Turkish	40.0	1.49 (0.90-2.46)	17.5	2.32 (0.94-5.72)	59.3	0.83 (0.51-1.35)	66.0	0.92 (0.55-1.55)	88.3	1.48 (0.78-2.83)
Cape Verdean	36.9	1.31 (0.67-2.56)	21.2	**3.06 (1.05-8.95)**	54.3	0.70 (0.37-1.31)	75.7	1.58 (0.77-3.24)	89.7	1.61 (0.62-4.16)
Other	29.0	0.90 (0.49-1.65)	12.6	1.68 (0.59-4.79)	55.0	0.74 (0.42-1.28)	62.2	0.88 (0.49-1.59)	92.3	**2.38 (1.00-5.63)**
Age (in yrs)		0.98 (0.86-1.12)		1.23 (0.98-1.53)		1.05 (0.92-1.19)		1.01 (0.88-1.16)		1.19 (0.99-1.43)
Neighbourhood income level (in 100 € / month)		1.01 (0.96-1.05)		1.06 (1.00-1.13)		1.04 (0.99-1.09)		1.01 (0.96-1.06)		**0.93 (0.87-0.98)**

Table 4.2 Differences in proportions (%), odds ratios (OR) and 95% confidence intervals (95% CI) in weight status and energy-balance behaviours according to socio-demographic characteristics (continued)

	<= 2 h TV previous day n=1,092		<=2 h computer previous day n=1,092		<= 2 sugar-sweetened drinks previous day n=1,078		Breakfast day of survey n=1,080	
	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)
Total sample	75.8		85.8		78.2		77.9	
Gender								
Male	73.1	1	80.2	1	73.9	1	78.2	1
Female	78.4	**1.32 (1.00-1.75)**	91.0	**2.48 (1.73-3.56)**	82.5	**1.71 (1.27-2.30)**	77.5	0.96 (0.71-1.28)
Ethnicity								
Dutch	85.3	1	85.3	1	75.2	1	83.0	1
Surinamese	74.3	**0.51(0.26-0.98)**	85.4	0.99 (0.47-2.05)	72.7	0.89 (0.49-1.60)	81.3	0.87 (0.44-1.70)
Antillean	69.4	**0.39 (0.17-0.88)**	83.7	0.75 (0.29-1.97)	72.9	0.85 (0.39-1.89)	76.6	0.66 (0.28-1.56)
Moroccan	79.1	0.66 (0.36-1.23)	86.4	1.00 (0.52-1.97)	79.8	1.34 (0.78-2.32)	80.2	0.81 (0.44-1.48)
Turkish	72.0	**0.45 (0.25-0.84)**	85.1	0.95 (0.49-1.85)	83.8	**1.80 (1.02-3.18)**	75.9	0.64 (0.35-1.16)
Cape Verdean	67.1	**0.36 (0.17-0.77)**	88.6	1.26 (0.49-3.27)	72.9	0.93 (0.45-1.89)	74.3	0.58 (0.27-1.24)
Other	76.7	0.57 (0.28-1.14)	85.8	0.90 (0.41-1.96)	75.6	1.00 (0.53-1.88)	69.7	**0.46 (0.24-0.89)**
Age (in years)		0.98 (0.85-1.13)		**0.81 (0.68-0.97)**		**0.82 (0.71-0.96)**		**0.85 (0.74-0.99)**
Neighbourhood income level (in 100 € / month)		1.01 (0.96-1.06)		0.96 (0.91-1.01)		1.00 (0.95-1.05)		0.98 (.93-1.03)

a) normal weight (excluding underweight) versus overweight children (including obese)
b) normal weight (excluding underweight) versus obese children
Statistical significant differences are shown in bold

Table 4.3 Differences in proportions (%), odds ratios (OR) and 95% confidence intervals (95% CI) in related goods according to socio-demographic characteristics

	Owning a bike N=1,082		Being member of sports club n=1,081		Having TV in bedroom n=1,083		Owning (game-) computer n-1,085	
	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)
Total sample	83.4		40.0		47.6		94.0	
Gender								
Male	84.8	1	49.5	1	53.6	1	95.8	1
Female	82.1	0.83 (0.60-1.16)	31.1	**0.44 (0.34-0.57)**	41.9	**0.62 (0.48-0.79)**	92.3	**0.53 (0.31-0.91)**
Ethnicity								
Dutch	97.0	1	55.0	1	69.3	1	99.0	1
Surinamese	88.2	**0.23 (0.07-0.81)**	43.4	0.63 (0.37-1.07)	45.1	**0.36 (0.21-0.62)**	95.1	0.19 (0.02-1.60)
Antillean	81.6	**0.16 (0.04-0.61)**	58.3	1.41 (0.69-2.89)	58.3	0.66 (0.32-1.35)	98.0	0.55 (0.03-9.07)
Moroccan	76.6	**0.12 (0.04-0.40)**	36.7	**0.54 (0.34-0.87)**	43.0	**0.33 (0.21-0.55)**	90.8	**0.11 (0.02-0.86)**
Turkish	84.2	**0.19 (0.06-0.62)**	32.1	**0.41 (0.25-0.67)**	42.1	**0.31 (0.19-0.52)**	96.6	0.31 (0.04-2.48)
Cape Verdean	79.7	**0.15 (0.04-0.54)**	48.5	0.91 (0.48-1.72)	58.0	0.60 (0.31-1.16)	87.1	**0.08 (0.01-0.62)**
Other	85.8	**0.22 (0.06-0.79)**	37.8	0.59 (0.34-1.04)	46.7	**0.40 (0.23-0.71)**	94.9	0.22 (0.03-1.89)
Age (in years)		0.88 (0.75-1.04)		0.97 (0.85-1.10)		**1.17 (1.03-1.33)**		1.13 (0.87-1.48)
Neighbourhood income level (in 100 € / month)		**1.12 (1.04-1.21)**		**1.07 (1.02-1.12)**		1.02 (0.97-1.06)		1.11 (0.98-1.26)

Statistical significant differences are shown in bold

Table 4.4 Differences in proportions (%), odds ratios (OR) and 95% confidence intervals (95% CI) in intentions towards energy-balance behaviours according to socio-demographic characteristics

	More outdoor play N=1,077		More days sports n=1,081		Less hrs TV N=1,077		Less hrs computer n=1,083		Less sugar-sweetened drinks n=1,075		More breakfast n=1,084	
	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)
Total sample	59.9		83.9		46.3		41.3		50.2		82.2	
Gender				Ns		Ns		Ns		Ns	82.1	Ns
Male	62.8	1	84.7		47.7		41.0		50.7		82.2	
Female	57.2	**1.28 (1.00-1.64)**	83.0		44.9		41.7		49.7			
Ethnicity						Ns		Ns				
Dutch	66.7	1	88.0	1	43.9		40.0		41.6	1	87.1	1
Surinamese	63.6	ns	85.9	ns	45.1		42.3		55.3	**0.56 (0.34-0.95)**	90.2	Ns
Antillean	59.2	ns	83.3	ns	44.9		44.9		51.0	ns	79.2	Ns
Moroccan	59.3	ns	88.7	ns	47.0		42.3		55.9	**0.52 (0.33-0.83)**	82.1	Ns
Turkish	54.9	**1.67 (1.02-2.73)**	74.8	**2.41 (1.23-4.71)**	46.0		41.7		47.0	ns	74.6	**2.00 (1.04-3.83)**
CapeVerdean	66.7	ns	85.7	ns	37.7		38.6		52.9	ns	82.6	ns
Other	58.8	ns	83.3	ns	52.5		37.5		39.3	ns	86.6	ns
Age (in years)		**1.15 (1.01-1.30)**		Ns		**1.15 (1.01-1.30)**		**1.30 (1.15-1.48)**		Ns		Ns
Neighbourhood income level (in 100 € / month)		Ns		ns		Ns		Ns		ns		**0.90 (0.84-0.97)**

Statistical significant differences are shown in bold

Some differences in energy-balance behaviours according to socio-demographic characteristics were found (Table 4.2). Boys were more likely to report high on active behaviours, as well as on screen time and consumption of sugar-containing drinks, than girls. Overall, due to their high scores on active behaviours boys had a significantly higher healthy behaviour score than girls (4.3 ± 1.2 vs. 4.1 ± 1.2). Differences according to ethnicity varied across the different behaviours, although children from Surinamese and Antillean ethnicity had a slightly lower average healthy behaviour score (3.9 ± 1.2 and 3.8 ± 1.2, respectively). Older children were more likely to report high on screen time and consumption of sugar-containing drinks than younger children. Children in higher income neighbourhoods were more likely to use inactive transportation to school than children in lower income neighbourhoods.

Additional questions and associations with socio-demographic characteristics

Most children reported owning a bike and a (game-) computer and many reported having a television in their bedroom and being member of a sports club, with small differences according to socio-demographic characteristics (Table 4.3).
Ethnicity was associated with being member of a sports club among girls: girls of Surinamese (OR=0.39; CI 0.18-0.83), Moroccan (OR=0.22; CI 0.11-0.43), Turkish (OR=0.19; CI 0.09-0.38) and other ethnic background (OR=0.26; CI 0.12-0.58) were less likely to report being member of a sports club than girls from Dutch ethnicity (38%, 22%, 20%, 26% vs. 57%, respectively).
Children with a television in their bedroom were more likely to watch more than 2 hours TV the previous day (OR=0.73; CI 0.54-0.98), and more likely to have at least one hour outdoor play the previous day (OR=1.40; CI 1.07-1.83). Children with a (game-)computer were more likely to have more than 2 hour computer time (OR=0.12; CI 0.02-0.91). Children who were member of a sportsclub were more likely to engage in sports at least two days last week (OR=2.28; CI 1.66-3.12), and have at least one hour outdoor play the previous day (OR=1.33; CI 1.01-1.75).

Intentions and associations with socio-demographic characteristics

The prevalence and ORs of the intentions towards the energy-balance behaviours according to socio-demographic characteristics are given in Table 4.4. Positive intentions towards doing sports and having breakfast were reported by most children, while intentions to reduce computer time were reported by less than half of the children. Some differences in intentions according to socio-demographics were found. Girls were less likely to report positive intentions towards outdoor play than boys. Children from Turkish ethnicity were less likely to report positive intentions towards outdoor play, sports and breakfast than children from Dutch ethnicity. Older children were less likely to report positive intentions towards outdoor play and reduction of screen time than younger children.
Children with positive intentions were more likely to show favourable energy balance

related behaviours for all types of behaviours (data not shown).

Table 4.5 Differences in proportions (%), odds ratios (OR) and 95% confidence intervals (95% CI) in weight status (overweight including obese vs. normal weight and obese vs. normal weight) according to energy-balance behaviours (adjusted for socio-demographic characteristics)

	Overweight (incl obese)		Obese	
	%	OR (95% CI)	%	OR (95% CI)
>= 1 h outdoor play previous day				
No	34.4	1	10.7	1
Yes	31.1	.91 (.69-1.19)	13.6	1.33 (.84-2.10)
>=2 days sports last week				
No	36.0	1	16.0	1
Yes	30.9	.81 (.61-1.09)	11.2	**.61 (.38-.97)**
Active transport to school day of survey				
No	31.4	1	9.6	1
Yes	33.0	1.11 (.75-1.66)	13.1	1.36 (.67-2.77)
<= 2 h TV previous day				
No	36.2	1	16.5	1
Yes	31.3	.85 (.63-1.16)	11.3	.71 (.44-1.14)
<= 2 h computer previous day				
No	31.5	1	10.5	1
Yes	32.6	1.05 (.72-1.55)	12.8	1.46 (.74-2.87)
<= 2 sugar-sweetened drinks previous day				
No	29.4	1	10.5	1
Yes	33.5	1.17 (.84-1.64)	13.1	1.33 (.76-2.32)
Breakfast day of survey				
No	45.6	1	23.0	1
Yes	28.8	**.49 (.36-.66)**	10.0	**.41 (.26-.65)**
Score on healthy behaviours		**.89 (.79-.1.00)**		.90 (.75-1.08)
1	31.6		18.8	
2	44.6		20.0	
3	33.8		11.9	
4	34.0		11.9	
5	30.7		13.1	
6	26.1		9.5	

Statistical significant differences are shown in bold

Associations with being overweight

Associations of the energy-balance behaviours with being overweight or obese vs. normal weight are shown in Table 4.5. Skipping breakfast was significantly associated with being overweight or obese. Doing sports less than 2 days a week was significantly associated with being obese. Children who reported a higher number of energy-balance behaviours were less likely to be overweight.
Owning a bike, being member of a sports club, having a television in one's bedroom, and having a (game-) computer were not significantly associated with being overweight or obese (data not shown).
Overweight children were significantly more likely to report positive intentions toward outdoor play (64% vs. 58%) and doing sports (87% vs. 83%) than normal weight children (OR=0.76; CI 0.57-1.00 and OR=0.64; CI 0.43-0.95, respectively). On the other hand, overweight children were less likely to indicate positive intentions towards having breakfast (73% vs. 86%) than normal weight children (OR=2.12; CI 1.52-2.96).

4.5 Discussion

The prevalence of overweight in 9 to12-year-old Dutch inner-city children was high (30%), and for most children there is room for improvement in energy-balance behaviours. Most of the children expressed the intention to (continue) doing sports and having breakfast, while less than half of the children intended to reduce television and computer time. Socio-demographic characteristics were not associated with being overweight and few with being obese. However, gender, ethnicity and age were associated with engagement in some of the energy-balance behaviours and intentions.
Total number of healthy energy-balance behaviours and skipping breakfast were associated with being overweight; skipping breakfast and not doing sports at least twice a week with being obese. Overweight children reported more healthy intentions towards outdoor play and doing sports, but less healthy intentions towards having breakfast in comparison with normal weight children.

Alarming prevalence rates of overweight in the Netherlands among Turkish (23.4% for boys, 30.2% for girls) and Moroccan (15.8% for boys and 24.5% for girls) youth, as well as among Dutch youth (12.6% for boys and 16.5% for girls) in large cities were reported, based on the 1996/1997 national survey among 2 to 21-year-olds.[9] In our sample, the prevalence of overweight is even higher, reflecting the further rise in overweight prevalence in the last decade in the Netherlands [8] and possibly the specific situation in deprived inner-city areas.

No association between weight status and our measure of SES was found in contrast with other studies [144-149], but in agreement with a study in low income inner-city neighbourhoods in Montreal.[150] In the latter study three different measures of SES (parental level of

education, parental employment status, and income sufficiency) were not associated with weight status. The mean neighbourhood income level in our sample was 500 € per month lower than the national mean neighbourhood income level. A possible explanation for the lack of association found between SES and weight status might, therefore, be the relative homogeneity with respect to (low) SES in our inner-city sample.

According to our findings a considerable proportion of inner-city children do not meet Dutch norms on minimal requirements for physical activity outside their school hours. The Dutch norms for children are based on the work of Sallis and Biddle [151, 152] and state that children should be active at least 1 hour a day and engage in sports twice a week.[143] This finding underlines the importance of physical activity and exercise offered through schools in order to meet daily minimal requirements of physical activity. This applies even more for girls than for boys, as also reported by others.[6, 73, 153-155]

Our findings on television time and total screen time seem relatively favourable in comparison with findings on usual television time in other studies.[132, 154, 156, 157] In the Pro-Children study [154] among 12,000 children (8-13 year olds) from 9 European countries 40.6% of boys and 35.0% of girls in the overall sample and 50.2% of boys and 45.5% of girls in the Dutch sample, reported watching more than 2 hours television a day. However, because the Pro-Children study investigated usual television time, the results might not be fully comparable with our data on television time on the day preceding questionnaire administration. Our favourable findings on television and total screen time might also be subject to seasonal variation.

The prevalence rates of breakfast skipping in our study are comparable to the ones reported in a recent review of studies on breakfast habits in children and adolescents mainly performed in populations in the US and Europe [158], but much higher than the 8% for previous day breakfast skipping as reported by 10 to 12-year-old Dutch children in an earlier nation-wide study [159]. Our findings are also in contrast to those of the Health Behaviour in Schoolchildren study of 2001-2002, in which 90% of the 11-year-olds in the Dutch sample reported to usually have breakfast on all school days.[6] In the earlier Dutch nation-wide study, skipping breakfast was found to be more prevalent among older children, children of non-Dutch origin, those with lower parental educational level, and living in urban areas. These correlates of breakfast skipping characterize our inner-city population and could therefore explain the difference in prevalence rates found.

Being overweight was associated with a higher number of healthy energy-balance related behaviours. With regard to the separate behaviours, only skipping breakfast and doing sports were associated with weight status. Due to the cross-sectional design of our study no conclusions can be drawn on the direction of the associations found. Plausible mechanisms for both directions exist.[160, 161] The lack of associations found between weight status and the other energy-balance behaviours needs to be interpreted with caution for the same

reason. Our findings are in accordance though, with recent findings of a longitudinal study among 10 year olds in the USA, in where no associations were found between BMI, television viewing, soft drinks and PA.[162] Longitudinal designs are needed to confirm these study findings, as well as to study the association between behavioural intentions and future behaviour.

Several limitations of the present study should be addressed. Firstly, because the study schools were not a random sample of all schools in the deprived neighbourhoods of Rotterdam, generalizing the results to all inner-city schools in the Netherlands or elsewhere might be limited. Secondly, our measures were largely derived through self-report in a relatively young study population. Recall problems have been reported in children [163], but we took these into account by making the recall periods short. Therefore, although our data might be inadequate to characterize usual behaviour patterns of an individual, they can be regarded as sufficient to characterize the behaviour patterns of groups of children.
Strengths of our study are the combination of important energy-balance behaviours and the inclusion of intentions towards these behaviours, which have seldom been reported for this age group.

In conclusion, we find a high prevalence rate of overweight in Dutch inner-city 9 to12-year-olds. Even though few associations with weight status were found, the promotion of the four energy-balance behaviours seems desirable for many inner-city children. Some differences according to gender, ethnic background and age should probably be taken into account but, overall, our results indicate that a general rather than a differentiated approach is needed for obesity prevention among inner-city primary schoolchildren. Promoting not to skip breakfast might be a promising target behaviour for interventions. Promoting physical activity connects best with the intentions most children express towards doing sports.

5

Parental awareness of childrens' weight status

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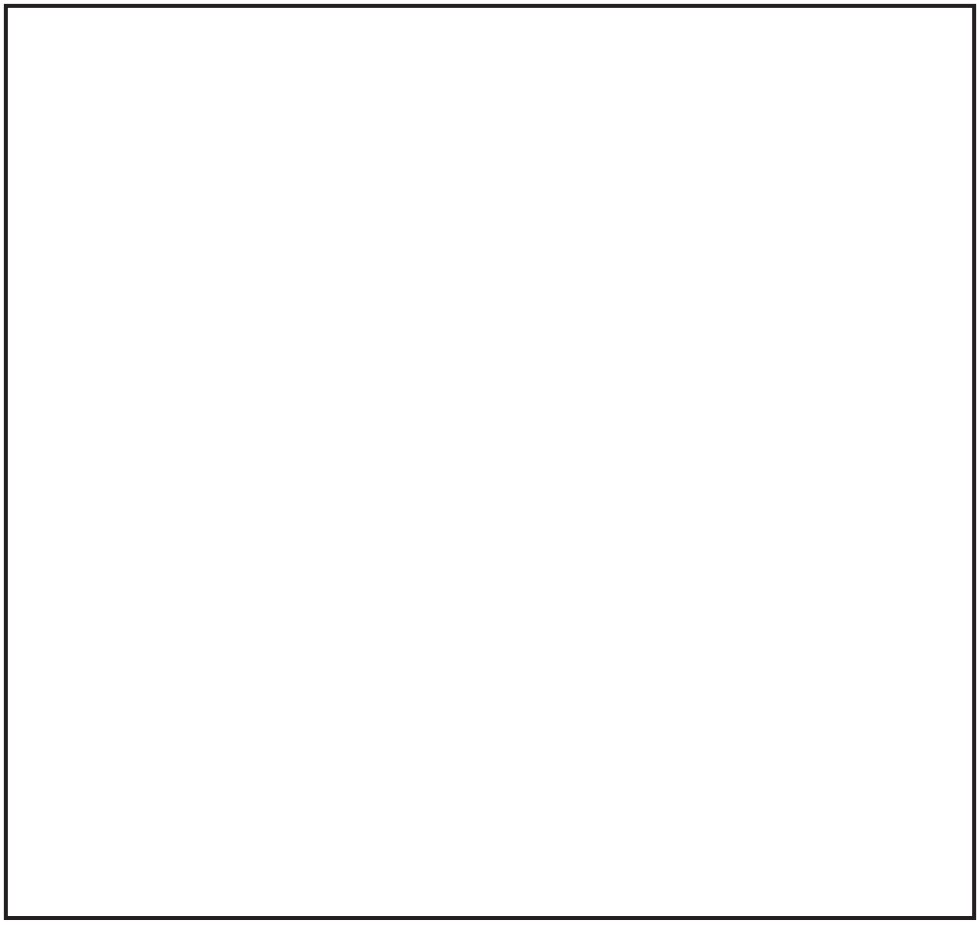


5.1 Abstract

To involve parents successfully in the treatment of overweight in their child, they first need to be aware of the problem and its accompanying health risks. Data on 1,840 9-11 year olds from the Rotterdam Youth Health Monitor were analyzed to investigate whether awareness of parents differs according to socio-demographic characteristics. In the overweight children 50 percent of the parents does not recognize that their child is overweight. Except for age none of the investigated socio-demographic characteristics, including ethnicity and parental educational, was associated with awareness. Parents of obese children show greater awareness than parents of overweight children.

5.2 Introduction

Parents are of key importance in the prevention of childhood overweight. To involve parents in the prevention and treatment of obesity and overweight in their children successfully, awareness is of the utmost importance. Awareness that their child is at risk is an important prerequisite for the motivation to act.[133]
People tend to make self-assessments by comparing their own 'performance' to that of others.[164] Since this may also be true for the weight status of children, awareness may differ according to the social group to which their parents belong. The prevalence of childhood overweight and obesity in the Netherlands, that reached a prevalence of more than 10 percent in 1997, is higher among children from ethnic minority groups and from parents with lower education as compared with native Dutch children and children of parents with higher education.[165]
In order to explore awareness of children's weight status among parents, we analysed data that were collected in the framework of the Rotterdam Youth Health Monitor in grade 6 children (9-11 year olds). Two research questions were addressed: firstly, which proportions of parents are realistic, overly optimistic or pessimistic about their child's weight status? Secondly, do these proportions differ according to the socio-demographic characteristics of the parent, more specifically age, ethnicity as defined by the country of origin, and education?

5.3 Methods

The Rotterdam Youth Health Monitor from which the data were drawn, is a surveillance system that monitors the general health, well-being, behaviour and related factors of youth aged 0 to 19 years living in the Rotterdam area in order to supply information for youth policy at the school, neighbourhood and municipality level. The Rotterdam Youth Health Monitor is incorporated in the regular check ups of the preventive youth health care system. In the 2000/2001 survey 2,669 parents were invited for a check up of their grade 6 child by the school nurse. Together with the invitation parents received a questionnaire to fill in prior to the check up. A total of 2,163 (81 percent) parents attended the check up with their child.

A fully completed parent questionnaire and data on height and weight were available for 1,819 (68 percent) children. Non-participants did not differ from participants in gender or country of origin. With regard to country of origin the sample was not fully representative of the total population of this age in Rotterdam. There was a slight overrepresentation of Moroccan and Turkish children and an under-representation of children from the category other country of origin.The parent questionnaire included the question "Is your child overweight" with answer categories 'not true', 'somewhat true' and 'very true', as well as the following socio demographic characteristics: gender, age and country of origin of child, respondent (mother, father, other), family composition (both parents, single parents, unknown), highest education of mother, categorized as low (primary or pre-vocational education), medium (secondary or vocational training) or high (university education), highest education of father, employment status of mother and father. The school nurse collected data on height and weight. Height was measured with SECA roll up measuring bands and reported to the nearest 0.1 cm; weight with calibrated SECA flat weighing scales to the nearest 0.5 kg. Weight was measured without heavy clothing and shoes and was therefore corrected for light clothing by subtracting 1 kg. Overweight was defined according to the IOTF guidelines.[95] Descriptive analyses were conducted to describe the distribution of the parent-rated and measured weight status and parents were categorized as realistic (parent-rated status the same as measured status); optimistic (parent-rated status = not overweight; measured status = overweight), or pessimistic (parent-rated status = overweight; measured status = not overweight). Because of the recent trends in childhood overweight and obesity, we were especially interested in a comparison between optimistic and realistic parents. Multivariate logistic regression was used to explore the differences in socio-demographic characteristics between these groups.

5.4 Results

Overweight and obesity were present in respectively 21.4 percent and 7.4 percent of the children. Among parents of non-overweight children 97.2 percent rated their children as not overweight. Among parents of overweight children, 60.5 percent rated their children as not overweight. This was true for 20.0 percent of the parents of obese children.
In the sub-sample of overweight and obese children (n=524) the differences between optimistic (50 percent) and realistic parents (50 percent) were further explored (table 5.1). No differences were found between the optimistic and realistic parents regarding gender of child, ethnicity of the child, respondent to questionnaire (mother, father or other), family composition (both parents, single parent, unknown), highest education of the child's mother, highest education of the father, or employment status of the mother or father. Parents of obese children appeared to be more realistic than parents of overweight children. Parents of older children also appeared to be more realistic than parents of younger children.

Table 5.1 Differences (percentages and odds ratio's) between optimistic and realistic parents concerning the overweight in their child with regard to weight status and socio demographic characteristics

			Optimistic parents	Realistic parents	OR (95% CI)
		N	%	%	
Weight status	Overweight	389	60	40	1
	Obese	135	20	80	6.2 (3.7-10.2)
Gender	Male	260	48	52	
	Female	264	52	48	
Age	9	309	54	46	1
	10	188	46	54	1.5 (0.9-2.3)
	11	27	30	70	4.0 (1.5-10.6)
Country of origin	Netherlands	158	53	47	Ns
	Surinam	74	46	54	
	Dutch Antilles or Aruba	28	43	57	
	Morocco	56	55	45	
	Turkey	113	44	56	
	Cape Verde	28	54	46	
	Other	59	56	44	
Questionnaire filled in by	Mother	393	49	51	Ns
	Father	80	49	51	
	Unknown	43	58	42	
Family composition	Both parents	387	50	50	Ns
	Single parent	66	53	47	
	Unknown	42	43	57	
Highest education mother	Low	39	49	51	Ns
	Medium	85	54	46	
	High	302	49	51	
	Unknown	90	49	51	
Highest education father	Low	52	42	58	Ns
	Medium	80	63	37	
	High	211	47	53	
	Unknown	173	50	50	
Mother employed	Yes	225	48	52	Ns
	No	246	48	52	
	Unknown	45	67	33	
Father employed	Yes	277	50	50	Ns
	No	85	46	54	
	unknown	154	53	47	

Ns=not significant

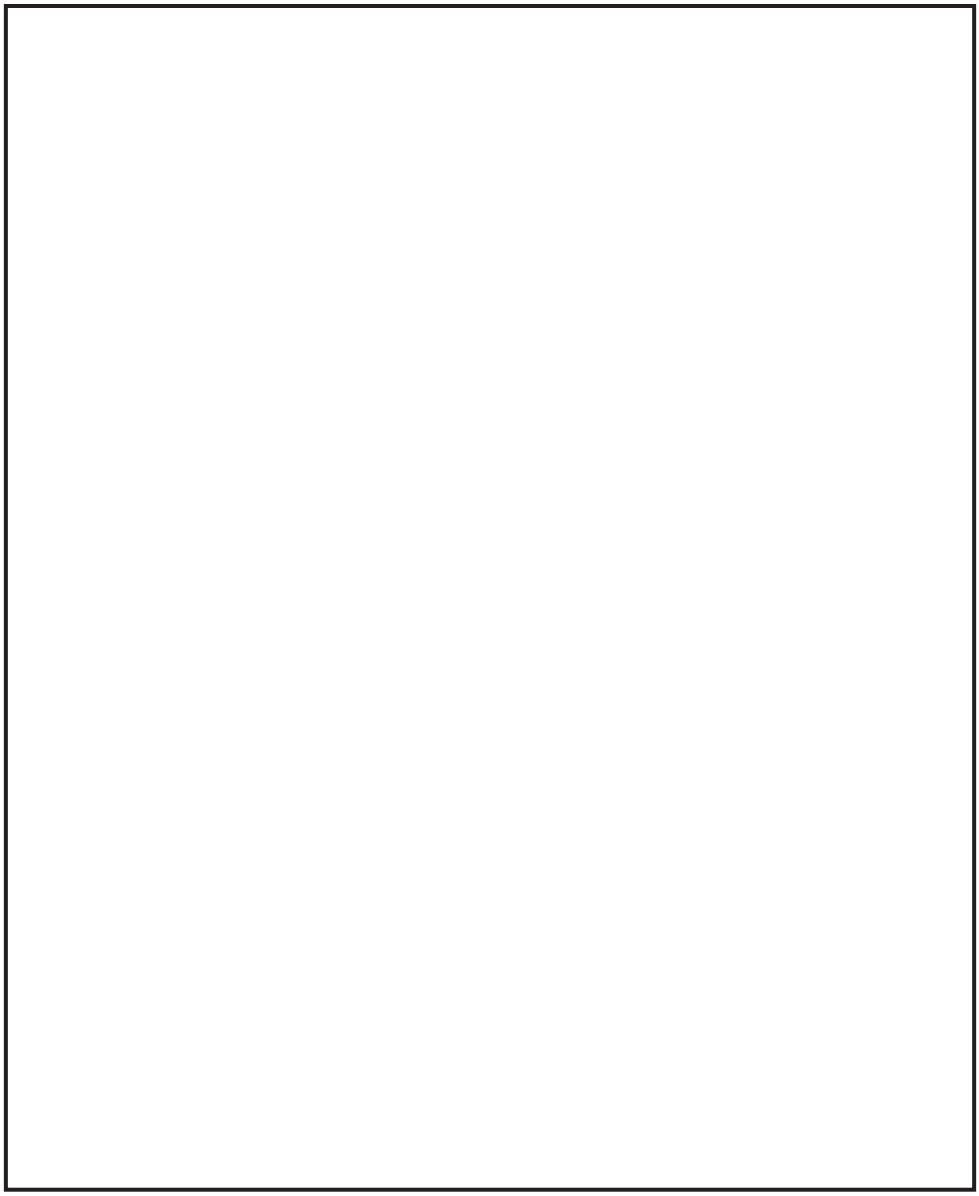
5.5 Discussion

Although most parents are realistic about their children's weight status, more than half of parents of children with overweight did not recognize or admit this. Very few parents are pessimistic about the weight status of their children. The observed unawareness of overweight status was not dependent on ethnicity, level of education or gender of the child. The finding that many parents do not recognize or deny the overweight in their child has been reported before among different age groups[63, 64, 166-169], varying from 28 to 98 percent of the parents. These variations may partly depend on differences in definitions of overweight. In our study we applied the internationally recognized definitions proposed by Cole and others[95], and we explored possible socio-demographic correlates of unawareness.

The non-response rate in our study was 32 percent due to non-attending the preventive check up and missing data. Since important socio demographic characteristics (gender and country of origin) of non-participants and participants did not differ, the influence of non-response to our findings can be expected to be small.

An important implication of our findings in the prevention of childhood overweight, is that health professionals addressing the parent of an overweight or obese child should keep in mind that many parents may not be aware of or may deny the overweight in their child. Raising awareness should therefore be given first priority before making recommendations for changes in eating and physical activity behaviours. Our results suggest that this implication is true regardless of parental level of education, ethnicity or occupational status.

Part 3
Implementation and evaluation



6

Evaluation-study of a school-based intervention

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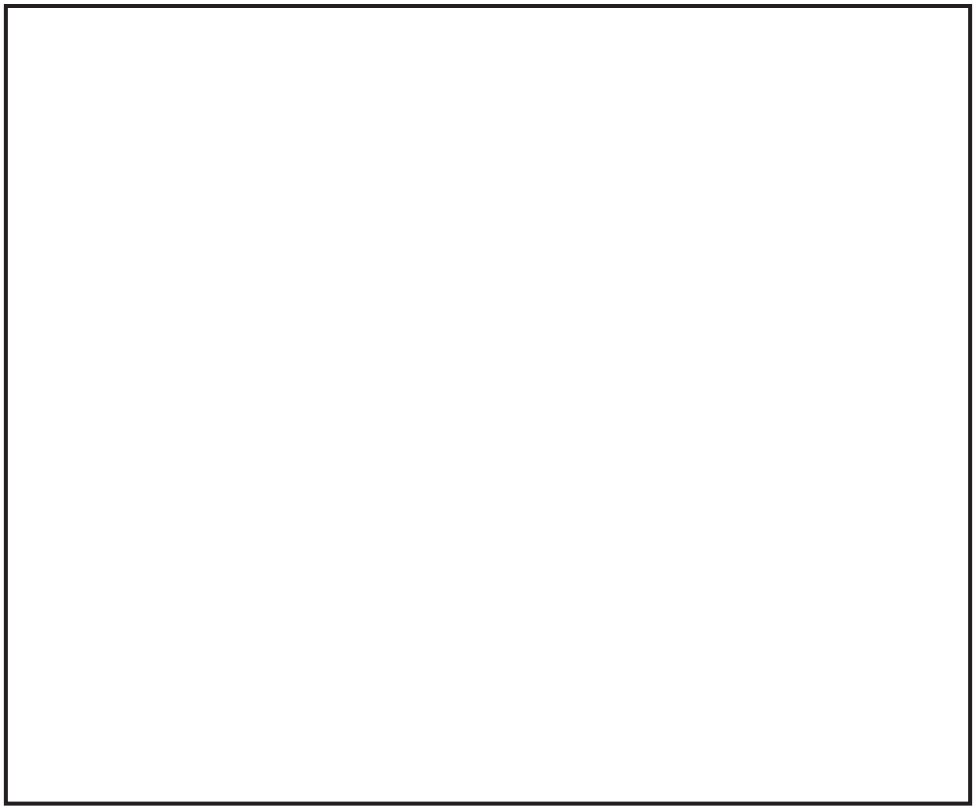
A school-based intervention to reduce overweight and inactivity in children aged 6-12 years: study design of a randomized controlled trial.
BMC Public Health. 8, 257



6.1 Abstract

Background: Effective interventions to prevent overweight and obesity in children are urgently needed especially in inner-city neighbourhoods where prevalence of overweight and inactivity among primary school children is high. A school based intervention was developed aiming at the reduction of overweight and inactivity in these children by addressing both behavioural and environmental determinants.
Methods: The main components of the intervention (Lekker Fit!) are the re-establishment of a professional physical education teacher; three (instead of two) PE classes per week; additional sport and play activities outside school hours; fitness testing; classroom education on healthy nutrition, active living and healthy lifestyle choices; and the involvement of parents. The effectiveness of the intervention is evaluated through a cluster randomized controlled trial in 20 primary schools among grades 3 through 8 (6-12 year olds). Primary outcome measures are BMI, waist circumference and fitness. Secondary outcome measures are assessed in a subgroup of grade 6-8 pupils (9-12 year olds) through classroom questionnaires and constitute of nutrition and physical activity behaviours and behavioural determinants. Multilevel regression analyses are used to study differences in outcomes between children in the intervention schools and in control schools, taking clustering of children within schools into account.
Conclusion: Hypotheses are that the intervention results in a lower prevalence of children being overweight and an improved mean fitness score, in comparison with a control group where the intervention is not implemented. The results of our study will contribute to the discussion on the role of physical education and physical activity in the school curriculum.

6.2 Introduction

Effective interventions to prevent overweight and obesity in children are urgently needed.[72] The prevalence of childhood overweight and obesity is increasing worldwide with all its consequences for immediate health, already apparent from increasing health care costs for obesity related morbidity in youth, as well as for health in later life, due to tracking of overweight and obesity into adulthood.[2, 12, 15, 21, 36, 37, 170, 171] The increase in childhood overweight and obesity can be attributed to behavioural and social ecological factors causing long-term imbalance between energy intake and energy expenditure.[68, 69] In fact, the environment has been recognized more and more as 'obesogenic' agent in the aetiology of obesity.[56, 57, 70, 172] Physical, socio-cultural, economic and political environmental influences on energy balance related behaviours can be distinguished at the micro level (households, schools, neighbourhoods) as well as at the macro level (health care, media, public transport, town planning).[57] Programmes on the prevention of childhood obesity should therefore address both behavioural and environmental determinants.
Many obesity prevention programmes have been developed and evaluated, but so far only yielded 'best practice' recommendations. A recent, large synthesis research of 147 programmes on prevention and treatment of childhood obesity over the last two decades

revealed that engagement in physical activity (PA) is a critical intervention in childhood obesity prevention programmes.[72] These findings are supported by other reviews. [73-77] The school emerged as a critical setting.[72] In a review of 25 school-based childhood overweight prevention programmes 17 of 25 were effective based on a statistically significant reduction in body mass index or skin-folds in the intervention group compared to the control group.[79] Another review included 14 intervention studies in the school arena, of which half were successful and had an effect on either overweight or obesity.[80]

In the Netherlands most recent figures demonstrate that prevalence rates of overweight in 4-16 year olds are rising at an even faster rate than before. Prevalence rates of overweight (including obesity) reached 14.5% for boys and 17.5% for girls in 2003 as compared to 9.7% and 13.0% in 1997 and 3.9% and 6.9% in 1980.[8] The largest increase in prevalence of overweight and obesity in the Netherlands occurred among primary schoolchildren [10] and the highest rates of childhood overweight and obesity are found in ethnic minorities and metropolitan areas.[9]
Figures on the amount and trends of PA in Dutch primary school children are largely lacking, but a recent study on physical activity in relation to the physical environment in the Netherlands demonstrated that only 3-5% of the primary schoolchildren in inner-city neighbourhoods was physically active for the recommended one hour a day, as measured by self-report and accelerometry.[173]
Apparently, relatively high prevalence rates of childhood overweight and obesity coincide with low rates of PA in inner-city neighbourhoods, at least in The Netherlands, urging schools and local governments to take action.

In order to contribute to the prevention of overweight in primary schoolchildren, a school based intervention was developed targeted at the reduction of overweight and inactivity in primary schoolchildren attending schools in inner-city areas in Rotterdam addressing both behavioural and environmental determinants. This paper describes the intervention and the study design for assessing the effectiveness of the intervention.

6.3 Methods

The intervention
The intervention Lekker Fit!, which can be translated as ‘enjoy being fit’, focuses on the promotion of healthy eating behaviour and active living rather than the achievement of an ideal body weight. By choosing this focus the intervention aims to reduce the chance of stigmatization of overweight children and of contributing to eating disorders or distorted perceptions of body image.[61, 72, 174]
The intervention targets individual behaviours as well as the environment and is based on the theory of planned behaviour [58, 175] and the ecological model of Egger and Swinburn. [71] According to the theory of planned behaviour a given behaviour can be predicted form the intention to display that behaviour. The intention in turn is predicted by attitude,

social influence and self-efficacy. The model acknowledges perceived behavioural control as a potential barrier between intention and behaviour. Within the ecological model the intervention concentrates on the physical and socio-cultural environmental influences on energy balance related behaviours, especially PA, within the micro environment of schools and to a lesser extent of home environments.
The targeted population consists of children attending primary schools in the more deprived, inner-city areas of Rotterdam where prevalence rates of overweight and obesity are relatively high.[176]
The intervention consists of multiple components, which will be described below.

Intervention components

Three physical education (PE) classes a week by a professional PE teacher
The first component of the intervention constitutes a structural change in the school environment by the implementation of three PE sessions a week during school hours by a professional PE teacher for grades 3 through 8 (6-12 years of age). The usual curriculum of primary schools consists of two PE sessions a week by the classroom teacher or a professional PE teacher, dependent on the schools policy. The PE teachers of the intervention are paid for and supervised by the Municipal Sport Department for two years and arrange their lessons according to a standardised protocol.[177] Participating schools express the intention to keep the PE teacher after the two year intervention period.

Sport and play activities outside school hours
A second component of the intervention is the organisation of additional sport and play activities outside school hours. These non-curricular activities are organised by the PE teacher and can be attended by the children on a voluntary basis. The focus of the activities is enjoying physical activity. Fun activities like rope skipping and dance are examples of the organized activities.
The total number of days a week children can be involved in sport and play activities inside and outside school hours ranges between 3 (only within school hours) to 5 (within and outside school hours).

Cooperation with Sport clubs
A third component of the intervention is the cooperation with local sport clubs and professional sport clubs. Local sports clubs are given the opportunity to present themselves during PE classes and outside school hours in order to let pupils get acquainted with several types of sports and promote sport club membership. Moreover, sport clubs are encouraged and supported by the Municipal Sport Department to establish satellite clubs in the more deprived neighbourhoods.

Eurofit test and Fitmeter
At the beginning and at the end of the school year the Eurofit test is administered by trained

staff from the Municipal Sport Department during PE class.
The Eurofit test comprises of measurements of height, weight and nine different fitness tests, i.e. measuring balance, endurance, flexibility, power, speed and strength as shown in table 6.1.[178] The skin fold measurements that originally are part of the Eurofit test battery are replaced by the simpler and quicker measurement of waist circumference.
Children receive a score card (see figure 6.1) to take home with their test results compared with reference scores.[179] When their BMI is above age and gender specific thresholds for overweight [95] parents receive a letter and are offered individual counselling by the school nurse. When needed motoric remedial teaching is offered.
All individual Eurofit scores are stored in a web-based computer application – the Fitmeter - that was especially developed for this purpose and allows PE teachers to follow the development and progress of individual pupils and classes in comparison with reference scores. Additionally, the Fitmeter offers PE teachers a planning module for within and after school hour's activities and a registration module for attendance to voluntary activities of individual pupils.
Parents provide informed consent for storing test results in the Fitmeter and sharing individual scores with the Municipal Sport and Recreation department and Municipal Health Department for evaluation purposes.

Classroom education
Three classroom lessons and an introduction lesson are developed for all grades. The three lessons deal with healthy nutrition, active living and healthy lifestyle choices and are provided by the regular classroom teacher, who receives an extensive manual on the lessons. Central theme of the lessons is to enjoy a fit and healthy lifestyle. Each lesson starts with a homework assignment to be completed with the help of the parents. Assessment and awareness of the child's behaviour are the central themes of the home assignment. Each classroom lesson consists of a theoretical and practical part, during which knowledge is transferred and subsequently applied through activities like games, puzzles and tests. Each lesson finishes with goal setting by drawing up a joint agreement regarding lifestyle for the period until the next lesson. Education material and classroom posters for writing down the agreements are part of the provided material (www.lekkerfitopschool.nl).

Parent involvement
Parents are important agents in shaping children's eating and physical activity behaviours. [61, 180-183] Besides the homework assignments and fitness score card, parents are involved by providing them with written information on the intervention and inviting them for a gathering at the beginning of the school year. During this gathering information is provided by the school nurse or a dietician about a healthy lifestyle, focusing on reducing sedentary activities (watching TV and playing on the computer), promotion of outdoor play, and reduction of sugar-sweetened beverage intake and promotion of having breakfast daily. All of these behaviours have been shown to be associated with childhood obesity.[47, 129]

Table 6.1 Description of the Eurofit test components, dimensions tested and units of measurement

Test component	Dimension	Description	Unit of measurement
Flamingo balance	Balance	Standing for 1 minute on one leg, while holding the other leg bend backwards in one hand	Number of attempts that were needed
Plate tapping	Speed	Tapping 2 plates (edges 60 cm apart) alternately, with the preferred hand, until each plate was touched 25 times.	Time needed measured to the nearest 0.1 second.
Sit and reach	Flexibility	Bending the trunk and reaching forward as far as possible while sitting on the floor with stretched legs and with the feet placed against a test box with a ruler placed on the top of the box.	Difference between feet soles and the tip of the largest finger measured in cm.
Standing broad jump	Power	Jumping from standing position	Distance in cm
Hand-grip	Strength	Squeezing a hand-dynamo meter as hard as possible with preferred hand	Kg to nearest 0.5 kg
Sit-ups	Endurance	Making as many sit ups as possible for 30 sec	Number of sit ups
Bent-arm hang	Endurance	Maintaining a bent arm position with an over-grip as long as possible while hanging from a bar.	Duration measured to the nearest 0.1 sec.
10x5 m shuttle run	Speed agility	Running as fast as possible 10 times between 2 lines, 5 m apart.	Time in sec.
20 m shuttle run	Endurance	Running 20 m forth and back with an initial running pace of 8.0 km/h and a progressive 0.5 km/min raise of the running speed given by a sound.	Last completed stage with a precision of 0.5.

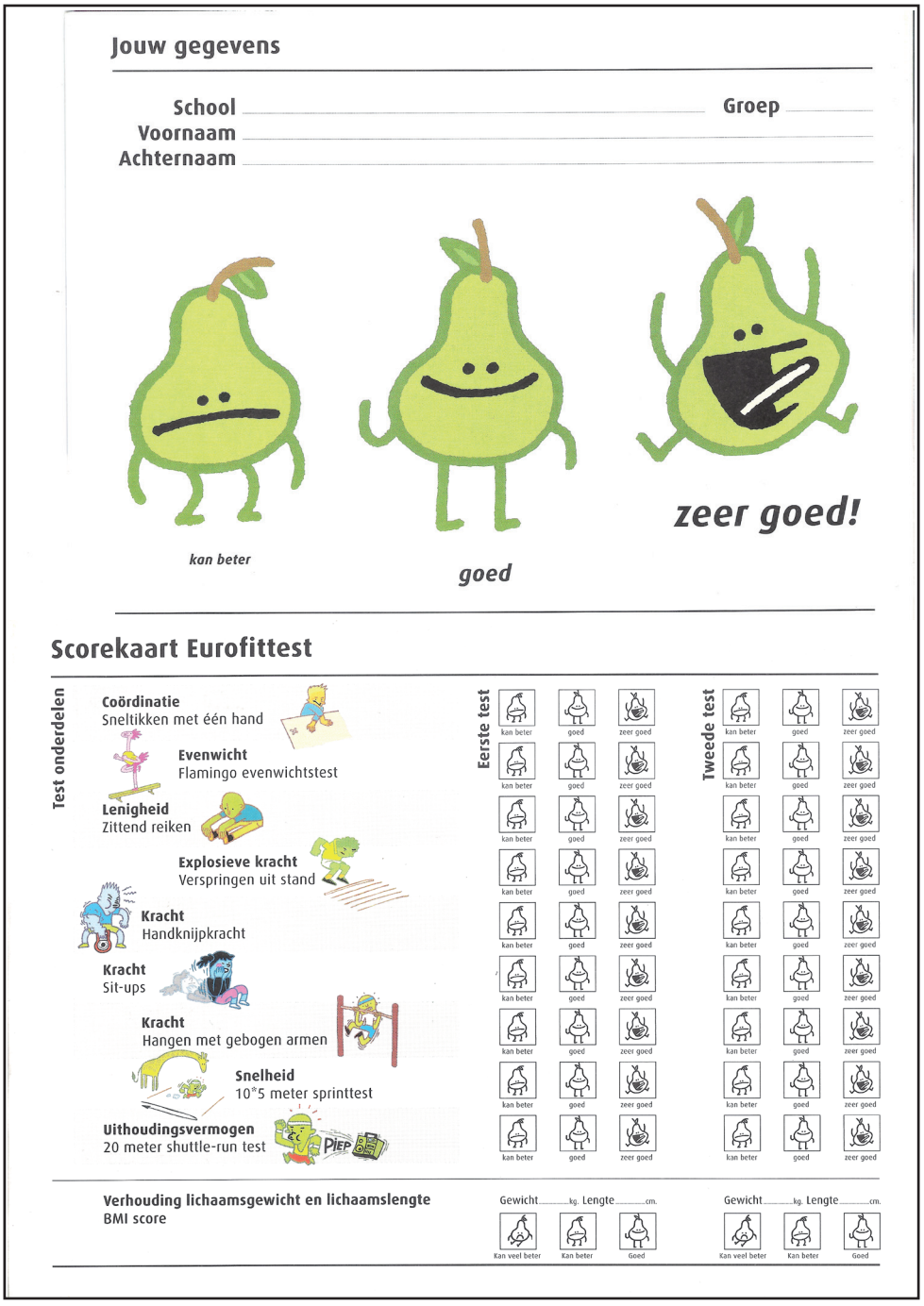


Figure 6.1 Score card with individual fitness scores, height, weight and weight status

The study on the effectiveness

Study design and procedures

A cluster randomized controlled study design is used to evaluate the effectiveness of the intervention with baseline measurements at the beginning of the school year 2006/2007 and follow-up measurements at the end of the same school year.

The main outcome measures consist of BMI, waist circumference and fitness and are measured among all pupils of grade 3 through 8 by trained staff during physical education class. High levels of habitual PA and increases in PA have been shown to be associated with improvements of fitness in children.[184-187]

Secondary outcome measures consist of selected energy balance related behaviours and possible mediators and moderators as described in the Environmental Research Framework for weight Gain prevention.[56] In this framework energy balance related behaviours are influenced by environmental influences in a direct way or an indirect way through cognitive mediators (attitude, subjective norm, perceived behavioural control and intention). Moderators of the relations between environmental influences and cognitive mediators on the one hand and energy balance related behaviours (i.e. specific nutrition and physical activity behaviours that contribute significantly to energy balance) on the other hand, are personality, awareness, habit strength, clustering of behaviours and personal characteristics like gender, ethnicity, and socio-economic status. Secondary outcome measures are gathered via classroom questionnaires in a subgroup of the study population consisting of grades 6 through 8 (9-12 years of age), administered on a normal weekday except for Mondays and guided by the classroom teacher. The questionnaire was developed in the ENDORSE-study and adjusted to make it better applicable to primary schoolchildren.[49]

Parents receive written information on the study and provide their informed consent. Children in grades 6 through 8 also receive written information on the study. The study is approved by the Medical Ethics Committee of Erasmus MC.

Recruitment and randomization procedure

Primary schools in Rotterdam with large populations of foreign ethnicity were free to apply for participation in the intervention, which was already implemented on 30 schools in the school year 2005/2006. Spontaneous applications made further active recruitment unnecessary. Schools that applied for participation were informed of the study and were offered a chance of 50% to participate in school year 2006/2007 versus a chance of 50% to be allocated to the control group in school year 2006/2007 continuing with their usual curriculum and to participate in the intervention in the next school year 2007/2008. All of the 27 schools that spontaneously applied, agreed to participate in the study. Schools were paired according to size, ethnicity and neighbourhood into 13 comparable pairs. One school could not be paired and was excluded from the study. Randomization took place within each pair with the toss of a coin.

After randomization 3 pairs were lost to the study, due to withdrawal of schools (1 pair) and implementation of the intervention components prior to the study (2 pairs).

Eventually, twenty primary schools located in multi-ethnic, mostly low-income, inner-city neighbourhoods in Rotterdam participated in the study.

Measures

Anthropometric measures
Body mass index (BMI) was calculated using weight (kg) divided by squared height (in m). Height was measured to the nearest 0.1 cm using a commercial mobile stadiometer, and weight was measured to the nearest 0.2 kg using a flat electronic weighing scale (SECA 888) in light (sport) clothing following a standardized protocol.[31] Pupils were categorised as underweight, normal weight, overweight, or obese. Overweight and obesity were defined using the age and gender specific cut-offs that correspond to adult cut-offs for BMI of 25 and 30 kg/m² as published by the International Obesity Task Force (IOTF).[95] Underweight was defined using the age and gender specific cut-offs corresponding to adult cut-offs for BMI of 18.5 kg/m² derived from the 1996/1997 Dutch national growth survey.[142]
Waist circumference was measured over the naked skin using flexible bands (SECA) with an accuracy of 0.1 cm, half-way between the lower rib and the top of the iliac crest at the end of a gentle expiration.[188]

Fitness
Fitness was assessed by the Eurofit test.[178, 179] See figure 6.1. The first 8 test components were administered during one PE session, the shuttle run test was administered one week later.

Questionnaires

Energy balance related behaviours
Physical activity was measured using the following questions: i) 'How long did you play outdoors after school yesterday?' ('did not' / 'less than half an hour' / '½-1 hour'/ '1-2 hours', '2-3 hours', 'more than 3 hours'); ii) 'On how many days did you do sport outside school hours last week?' (0 through 7); iii) 'How did you come to school today?' ('walking' / 'cycling' / 'public transport or car' / 'other'); iv) on how many days last week did you walk or cycle to school? (0 through 5). Dutch norms on minimal requirements for physical activity for children state that children should be active at least 1 hour a day and engage in sports twice a week.[143]

Sedentary behaviour was assessed using two questions: i) 'How long did you watch television, DVD or video outside school hours yesterday?' ('did not' / 'less than half an hour' / '½-1 hour'/ '1-2 hours', '2-3 hours', 'more than 3 hours')'; ii) 'How long did you spend on the computer or game-computer outside school hours yesterday?' ('did not' / 'less than half an hour' / '½-1 hour'/ '1-2 hours', '2-3 hours', 'more than 3 hours'). A maximum of 2 hours screen time per day is the recommendation given by youth health care in the

Netherlands.[51]

Consumption of sugar-containing drinks was assessed with two questions, after giving examples of such drinks (i.e. lemonade, soft drinks, sport drinks, chocolate milk, yoghurt drinks, fruit juices; exceptions: light drinks, orange or grapefruit juice): i) 'How many glasses of sugar-containing drinks did you have yesterday?' (0 through 5 or more); ii) 'How many days last week did you take sugar-containing drinks to school?'(0 through 5). A maximum of 2 sugar-containing drinks a day is recommended by Dutch Youth Health care.[51]

Consumption of fruit (including orange juice and grapefruit juice), was assessed with two questions, after giving examples of pieces of fruit: i) 'How many pieces of fruit did you have yesterday?' (0, ½, 1, 1½, 2 or more); ii) 'How many glasses of orange or grapefruit juice did you have yesterday?'(0, 1, 2 or more). Two pieces of fruit a day or one piece of fruit in combination with one glass of orange or grapefruit juice is the Dutch recommendation for children (9-12 years).[189]

Skipping breakfast was measured with two questions: i) Did you have breakfast this morning?' ('yes' / 'no'); ii) 'on how many days last week did you have breakfast before going to school?'

Potential mediators and moderators
As potential mediators attitudes and intentions towards energy balance related behaviours were included in the questionnaire. Attitudes towards outdoor playing, doing sports, watching television, using computer, having sugar-containing drinks, having fruits and having breakfast were measured with two questions: i.e. "I think (selected energy balance behaviour) is …."('very good'/ 'good'/ 'not good, not bad'/ 'bad'/ 'very bad') and "I think (selected energy balance behaviour) is …."('very nice'/'nice'/'not that nice'/'not nice at all'), representing cognitive and affective attitudes. Intentions to engage in outdoor playing, doing sports, having fruits, having breakfast, and to reduce television time, computer time and consumption of sugar-containing drinks were measured with single-item questions: i.e. "Do you intend to increase your outdoor play, to (continue) doing sports, to reduce TV time, to reduce computer time, to reduce consumption of sugar-containing drinks, to increase consumption of fruits, to (continue) having breakfast in the coming 6 months?"('yes certainly'/ 'yes probably'/ 'maybe yes, maybe no'/ 'probably not'/ 'certainly not'.
As potential moderators perceived health ('very good'/ 'good' / 'moderate' / 'not well' / 'bad'), body weight perception ('far too thin' / 'little too thin' / 'not thin, not fat' / 'little too fat' / 'far too fat'), weight worries ('no'/ 'a little'/ 'a lot'), being member of a sports club ('yes' / 'no'), owning a bicycle, having a television in one's bedroom, having a computer and/or game-computer at home and questions on sport participation of father and mother ('never' / 'seldom' / 'once a week' / 'more than once a week') and body size of father and mother using Stunkard's body figure rating scales [190] were included as single item

questions in the questionnaire.

Socio-demographic characteristics
Socio-demographic characteristics included gender, age, ethnicity and postal code.
Ethnicity is determined by country of birth of mother and father according to definitions of Statistics Netherlands. If both parents have been born in the Netherlands, the child's ethnicity is defined as Dutch; if one or both parents are born in another country, ethnicity is defined according to that country; if both parents have been born in different foreign countries, the country of birth of the mother is deemed most important.
Postal code is used to determine neighbourhood income level. Most recent data on average 2003 personal gross income level per postal code are provided by Statistics Netherlands. Postal codes refer to on average 20 (SD 17) houses and 46 (SD 38) inhabitants.

Process measures
Process measures are taken from the Fitmeter, registration forms for classroom teachers and registration forms for the school nurse or dietician.

Power considerations and data analysis
Power calculations showed a total number of children of 2,778 children in 20 schools are needed to detect a difference of 0.45 kg/m² between intervention and control group, assuming a standard deviation of 3.0 kg/m² for BMI and an intraclass correlation of 0.01 [191], with a power of 0.80 en alpha 0.05 (one-sided) and accounting for 10% loss to follow up.
Multilevel regression analysis will be used to test for post-test group differences on the main outcome measures corrected for pre-test measurements.[192]

6.4 Discussion

The intervention combines structural changes in the amount of PA children receive with behavioural change through the school curriculum. A specific element is the implementation of three PE classes a week by a professional PE teacher, while two PE classes a week by a classroom teacher constitute the usual mandatory curriculum. Another specific characteristic of the intervention is the targeting of a population with relatively low SES and a high proportion of migrant children. A population that has been underserved so far. [72]
Several evaluated obesity prevention programmes have targeted PE or increased PA in the primary school setting.[193-204] Most of these interventions altered the content of existing PE lessons [195-197, 199-201, 204], others increased PA in the classroom [198] or during breaks [202]. Only a few actually augmented the amount of PE lessons a week for six months [193] or for 8 weeks[203].

Strengths of the study are the use of a cluster randomized controlled study design, the size of the study and the objectively measured primary outcome measures of weight status and

fitness.
Weaknesses of the study are that secondary outcome measures are derived from self-report questionnaires and no objective measure of PA is used. Furthermore, in the self-report questionnaires the choice was made to measure a large amount of concepts to cover all aspects of the intervention. To keep the length of the questionnaires acceptable for children in the age of 9-12 years many single item questions were used at the cost of using validated questionnaires. The debate on self-report by children largely concerns recall problems of actual energy balance related behaviours.[163] We took those into account by making recall periods short. Self-reports by children on determinants of energy balance related behaviours like attitudes and intentions have not been subject to debate.
We hypothesize that the intervention will reduce the number of overweight children and improve fitness scores due to increased physical activity in comparison with the control condition. Furthermore, we hypothesize that the intervention will impact positively on energy balance related behaviours and its determinants in the intervention group as compared to the controls.
The results of our study are especially important for decisions on the amount of PE classes in the usual school curriculum and the position of a professional PE teacher within this curriculum.

7

Effectiveness of a school-based intervention

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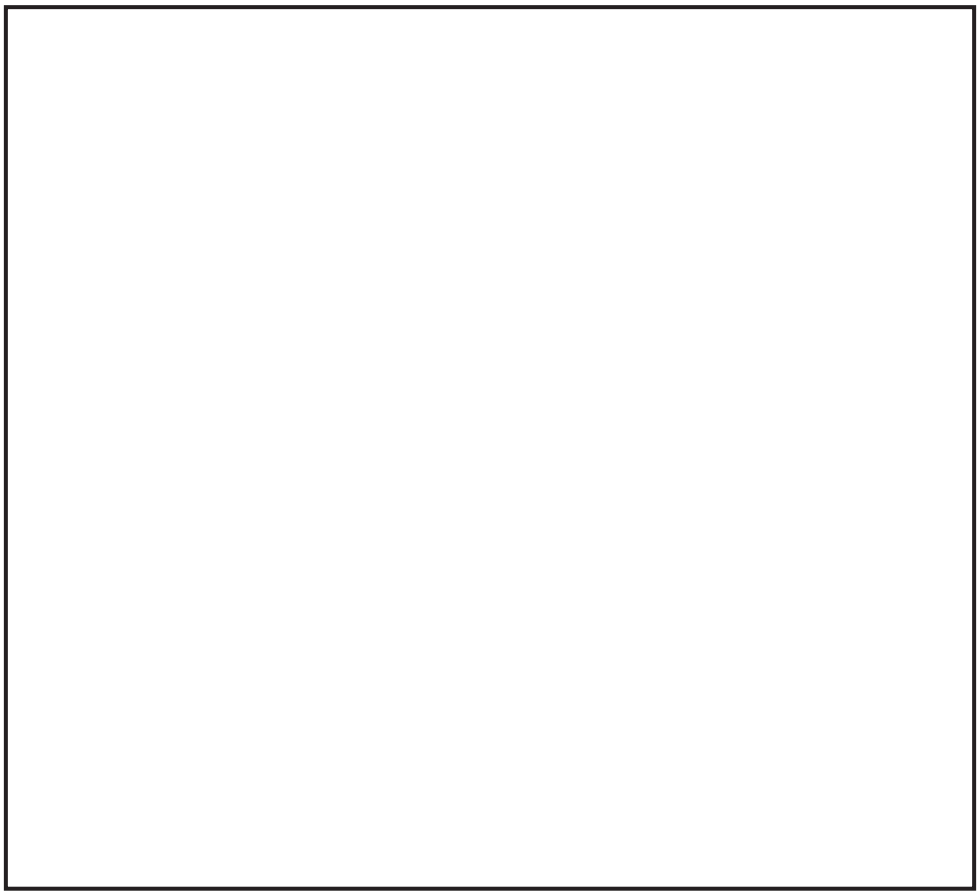


7.1 Abstract

Background: The purpose of this study was to evaluate the effect of a school-based intervention program to reduce overweight and improve fitness in primary schoolchildren.
Methods: The main components of the intervention, called Lekker Fit!, were the implementation of three physical education (PE) sessions a week by a professional PE teacher, additional sport and play activities outside school hours and an educational program. A cluster randomized controlled design was used to evaluate the effectiveness of the intervention over one school year with schools as unit of randomization. 20 schools and 2,622 children aged 6-12 years from multi-ethnic, low income inner-city neighbourhoods participated. Outcome measures were weight status, body mass index (BMI), waist circumference and different components of the Eurofit test.
Results: Significant positive intervention effects were found for percentage overweight children (OR 0.53; 95%CI 0.36-0.78), waist circumference (-1.29 cm; 95%CI -2.16- -0.42 cm) and 20m shuttle run test (0.57 laps; 95%CI 0.13-1.01 laps) among pupils of grades 3-5. Among pupils of grades 6-8 only an effect for standing broad jump (2.96 cm; 95%CI 0.44-5.48 cm) was found. The prevalence of overweight in grades 3-5 increased with 4.3% in the control group and with 1.3% in the intervention group. No significant effects were found for BMI, but increases in BMI between baseline and follow up among pupils of grades 3-5 in intervention schools as compared to control schools were lower for pupils with a BMI around the cut-offs for overweight.
Conclusion: Our results provide some evidence for the effectiveness of the multi-component intervention Lekker Fit!, targeting both behavioural and environmental determinants, to reduce overweight and improve aerobic fitness in primary school children in grades 3-5.

7.2 Introduction

In the last two decades many intervention programmes have been developed and evaluated in response to the worldwide increasing prevalence of childhood obesity.[72] It has been argued that prevention approaches instead of treatment are mostly needed. Reviews suggest that engagement in physical activity (PA) is one of the critical interventions in childhood obesity prevention and that the school is a critical setting[72, 73, 76, 80], but the number of well designed studies and the available evidence for effectiveness of school-based programs is still limited.
It is generally believed that PA levels of children have decreased in the last decades, although hard evidence is sparse because of lack of PA monitoring.[205] A decline in aerobic fitness in children worldwide has however been demonstrated.[206] Obesity and low aerobic fitness are both independent risk factors for cardiovascular health.[207] Increasing PA levels can therefore be expected to have a beneficial effect on both body composition as well as general health. [208]
Research has shown that PA in childhood tends to track into adolescence and adulthood, but

also that PA levels of children decline with age, especially in adolescents. [153, 209] The early establishment of a healthy PA pattern in children seems therefore warranted.
Several ways to target PA in the school setting already have been tried and evaluated in obesity prevention programmes for primary schoolchildren in various countries including increasing the amount of physical education (PE) lessons a week [193, 194, 203], altering the content of existing PE lessons [195, 196, 199-201, 204], increasing PA in the classroom [198], or during breaks [202] or outside school hours [210]. In a recent review of interventions to promote PA in children, 33 intervention studies in children were identified.[77] In 14 an increase in PA was indeed achieved. The authors concluded there was no evidence for effectiveness of interventions that used educational activities only, and limited evidence for an effect of interventions aiming at environmental changes to increase PA. Inclusion of environmental change interventions has also repeatedly been proposed based on studies that show environmental PA opportunities are associated with PA behaviours in youth.[57, 68] Following this proposed approach a school-based intervention was developed targeted at the reduction of overweight and improvement of fitness in elementary schoolchildren focusing on healthy lifestyles and on increasing PA in particular. The targeted population consisted of primary schoolchildren attending schools in more deprived inner-city areas with high proportions of immigrant children in the city of Rotterdam. This population group has been underserved thus far [72], while research has shown overweight and obesity as well as low PA are more prevalent among these groups. [9, 173]
The present paper reports on the cluster randomized controlled trial that was designed to evaluate the effectiveness of this intervention. Favourable intervention effects were expected on BMI, weight status, waist circumference and fitness.

7.3 Methods

The intervention

The intervention, called Lekker Fit!, focuses on the promotion of healthy eating and active living rather than the achievement of an ideal body weight. The most important component of the intervention constitutes of a structural change in the school environment by the implementation of three PE sessions a week by a professional PE teacher for grades 3 through 8 (6-12 years of age). The usual curriculum of primary schools in the Netherlands consists of two PE sessions of 45 minutes a week by the classroom teacher or a professional PE teacher, dependent on the school's policy. A second component of the intervention is the organisation of additional sport and play activities outside school hours which can be attended on a voluntary basis. A third component is the administration of the Eurofit test at the beginning and the end of the school year. The Eurofit test comprises of measurements of height, weight and nine different fitness test, measuring balance, endurance, flexibility, power, speed and strength.[178] Children receive a scorecard to take home with their test results. Parents of overweight children are offered individual counselling by the school nurse. The fourth component is classroom education on healthy nutrition, active living and

healthy lifestyle choices. A more detailed description of the intervention and study protocol (e.g. sample size calculation) are given elsewhere.[211]

Study design

A cluster randomized controlled study design was used to evaluate the effectiveness of Lekker Fit! with baseline measurements at the beginning and follow-up measurements at the end of the school year 2006/2007 among all children in grades 3 through 8 (6-12 years of age). The main outcome measures were BMI, weight status, waist circumference and fitness and were measured among all pupils of grade 3 through 8 by trained staff during PE class.

Population and procedure

Primary schools in inner-city areas of Rotterdam were free to apply for participation in the intervention, which was already implemented on 30 schools in the school year 2005/2006. A total of 27 schools spontaneously applied. All of the eligible 27 schools were paired according to size, proportion of migrants and neighbourhood into 13 comparable pairs. One school could not be paired and was excluded from the study. Randomization took place within each pair with the toss of a coin. After randomization 3 pairs were lost to the study, due to withdrawal of schools (1 pair) and implementation of the intervention components prior to the study (2 pairs), resulting in a total amount of twenty participating schools.
Parents received information on the study and supplied their consent through the schools.
The study was approved by the Medical Ethics Committee of Erasmus MC.

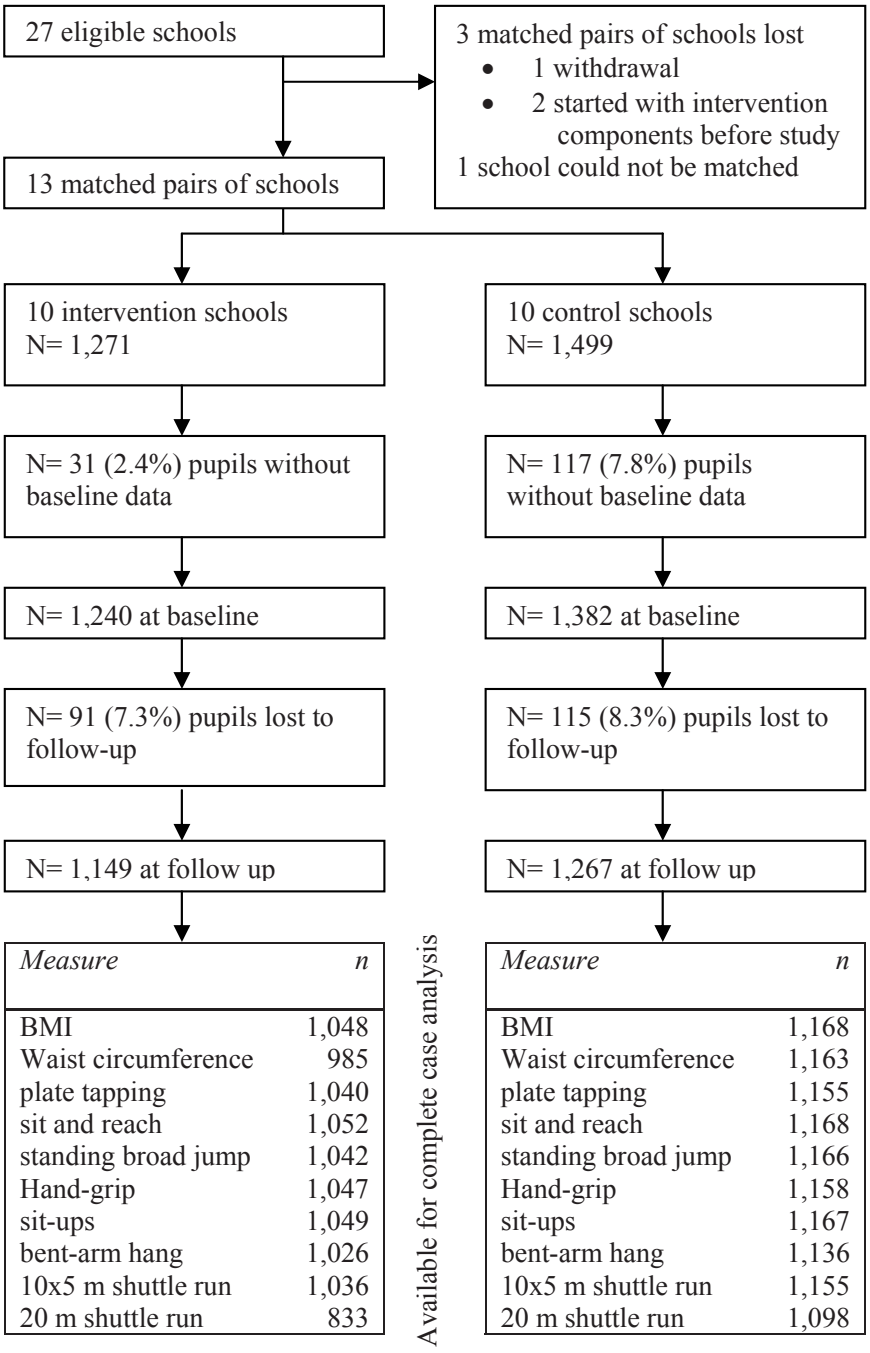
Anthropometric measures and fitness

Height was measured to the nearest 0.1 cm using a commercial mobile stadiometer, and weight was measured to the nearest 0.2 kg using a flat electronic weighing scale (SECA 8888) in light (sport) clothing. BMI was calculated and pupils were categorised as not overweight, overweight, or obese. Overweight and obesity were defined using the cut-offs published by the International Obesity Task Force.[95] BMI standardized deviation score (BMI SDS) using reference data for gender and age were also calculated.[212] Waist circumference was measured over the naked skin half-way between the lower rib and the top of the iliac crest at the end of a gentle expiration.
Fitness was assessed by the Eurofit test components plate tapping, sit and reach, standing broad jump, hand-grip, sit-ups, bent-arm hang, 10*5m shuttle run and 20m shuttle run.[178] The Flamingo balance test was not used, because of unreliable test results.
Socio-demographic characteristics

Socio-demographic characteristics included gender, age, ethnic background, determined by country of birth of the parents.

Data analysis

All outliers on anthropometric measures and Eurofit test scores were checked and implausible recordings were recoded as missing.
Missing value analyses were performed for children lost to follow up on all outcome measures and on single outcome measures as compared to children with follow up measurements, using logistic regression with as independents socio-demographic characteristics (gender, age and ethnicity), belonging to intervention or control group and baseline measurements. Subsequently, missing data were imputed using multiple imputation.
T-tests and Pearson chi-square tests were used to compare intervention and control groups at baseline.
For the evaluation of the effectiveness of the intervention, multilevel analyses were used to allow for the clustering of observations within schools.[192] Unmatched analyses were performed as their validity and efficiency have been demonstrated.[213] Multilevel linear regression analysis was used to evaluate the effects on BMI, waist circumference and fitness measures. In all analyses outcome variables measured at follow up were adjusted for baseline values, socio-demographic characteristics (gender, grade and ethnicity), weight status and time between measurements. Multilevel logistic regression analyses were used initially to evaluate the effects on weight status (not overweight versus overweight). But, because these analyses did not indicate the presence of random effects, generalized estimating equations (GEE) analyses were performed instead, adjusting for baseline weight status, socio-demographic characteristics and time between measurements as well as for clustering of observations within schools. Interaction effects with gender, grade (3-5 vs 6-8) and weight status (not overweight vs overweight) were checked. Gender and weight status appeared not to be effect modifiers, but interaction effects with grade appeared to be significant for all outcome variables with an intervention effect ($p<.05$). Therefore all analyses were performed separately for grades 3-5 and grades 6-8.
Results of complete case analyses were compared with results based on multiple imputation. Both methods yielded similar results. Results based on multiple imputation are reported.
Intra-cluster correlation coefficients were calculated for all outcome measures at follow up using complete case analysis without adjustment for covariates.
Analyses were performed using SPSS 15.0 and SAS 9.1 (multilevel logistic regression analysis and GEE).



Measure	*n*
BMI	1,048
Waist circumference	985
plate tapping	1,040
sit and reach	1,052
standing broad jump	1,042
Hand-grip	1,047
sit-ups	1,049
bent-arm hang	1,026
10x5 m shuttle run	1,036
20 m shuttle run	833

Measure	*n*
BMI	1,168
Waist circumference	1,163
plate tapping	1,155
sit and reach	1,168
standing broad jump	1,166
Hand-grip	1,158
sit-ups	1,167
bent-arm hang	1,136
10x5 m shuttle run	1,155
20 m shuttle run	1,098

Figure 7.1 Flow chart of pupils in study

7.4 Results

The flowchart of children in the study is presented in figure 7.1. Baseline measurements were available for 2.622 children; follow up measurements for 2.416 children (92.1%). The number of complete observations varied according to outcome measure (figure 7.1).
Due to organisational problems in data collection (illness of staff) all follow up measures on shuttle run were missing in one intervention school and follow up measures on waist circumference were lacking for the pupils in the highest grade of another intervention school.

Baseline characteristics and differences
Table 7.1 shows the socio-demographic characteristics and weight status at baseline for pupils in the intervention schools and control schools for grades 3-5 and grades 6-8 separately. The majority of pupils had a non-Dutch ethnic background. Overall prevalence of overweight was 24.4% among pupils of grades 3-5 and 31.2% among pupils of grades 6-8. Baseline characteristics differed between both groups for ethnic background and in grades 3-5 also for age.

Table 7.1 Characteristics at baseline in intervention and control group (n=2,622)

	Grades 3-5			Grades 6-8		
Variable	Intervention schools n=657	Control schools n=729	P value	Intervention schools n=583	Control schools n=653	P value
Gender			.85			.18
Male	49.5%	49.0%		47.2%	51.0%	
Female	50.5%	51.0%		52.8%	49.0%	
Ethnicity			.00			.00
Dutch	14.3%	6.9%		13.6%	8.0%	
Surinam	9.4%	11.0%		11.3%	12.7%	
Antillean	5.6%	4.1%		4.8%	2.8%	
Moroccan	26.8%	36.4%		22.1%	34.6%	
Turkish	21.9%	20.3%		23.7%	22.5%	
Capeverdean	4.0%	4.0%		5.1%	4.7%	
Other/missing	18.0%	17.4%		19.4%	14.7%	
Weight status			.55			.30
Not overweight	75.6%	75.5%		66.2%	71.0%	
Overweight	16.7%	18.5%		24.2%	21.0%	
Obese	7.6%	6.0%		9.7%	7.9%	
Age (mean in years)	7.7 (1.0)	7.8 (1.0)	.01	10.8 (1.0)	10.8 (1.0)	.69

Table 7.2 Anthropometric characteristics and fitness scores (mean values (SD)) at baseline (T0) and follow up (T1) in grades 3-5 and grades 6-8 in intervention and control schools, and the intervention effect (B (95%CI) between both groups (n=2,622) with significant effects in bold

Variable	Intervention schools		Control schools		Effect of interventionc	
	T0	T1	T0	T1	B	95%CI
Grade 3-5						
BMI	17.07 (2.76)	17.49 (3.00)	17.07 (2.79)	17.57 (3.08)	-0.10	-0.22 - 0.03
Waist circumference (cm)	59.07 (7.95)	60.09 (8.58)	58.66 (8.05)	60.79 (8.70)	**-1.29a**	**-2.16 - -0.42**
Plate tapping (sec)	20.62 (4.28)	17.52 (3.13)	20.20 (3.85)	17.49 (2.92)	-0.11	-0.44 - 0.22
sit and reach (cm)	26.67 (5.61)	26.49 (5.89)	27.22 (5.65)	26.96 (6.21)	-.07	-2.56 - 2.42
standing broad jump (cm)	113.1 (19.8)	122.5 (17.1)	115.1 (19.8)	122.9 (17.3)	0.44	-1.32 – 2.20
Hand-grip (kg)	12.38 (3.30)	13.29 (3.23)	12.66 (3.37)	13.77 (3.50)	-0.17	-0.69 - 0.35
sit-ups	13.66 (4.86)	16.16 (4.69)	15.09 (4.89)b	16.49 (4.73)	0.43	-0.23 - 1.08
Bent-arm hang (sec)	6.01 (5.57)	7.29 (6.32)	6.68 (6.21)b	7.67 (7.57)	-0.03	-0.84 - 0.77
10x5m shuttle run (sec)	24.30 (2.24)	23.11 (1.84)	23.67 (1.98)b	22.99 (1.98)	-0.07	-0.45 - 0.32
20 m shuttle run	4.33 (1.99)	5.61 (2.31)	5.59 (2.16)b	6.09 (2.37)	**0.57a**	**0.13 - 1.01**

Table 7.2 Anthropometric characteristics and fitness scores (mean values (SD)) at baseline (T0) and follow up (T1) in grades 3-5 and grades 6-8 in intervention and control schools, and the intervention effect (B (95%CI) between both groups (n=2,622) with significant effects in bold.(continued)

Variable	Intervention schools		Control schools		Effect of interventionc	
	T0	T1	T0	T1	B	95%CI
Grade 6-8						
BMI	19.60 (3.98)	20.36 (4.24)	19.06 (3.83)b	19.77 (4.09)	0.03	-0.12 - 0.17
Waist circumference (cm)	69.03 (10.87)	71.81 (11.29)	67.34 (10.73)b	70.77 (11.55)	-0.71	-1.72 - 0.29
Plate tapping (sec)	14.55 (2.17)	13.00 (1.70)	14.81 (2.32)b	13.35 (1.87)	-0.16	-0.41 - 0.09
sit and reach (cm)	25.00 (6.81)	25.12 (6.93)	25.75 (6.75)	25.80 (6.98)	-0.05	-0.84 - 0.73
Standing broad jump (cm)	133.2 (19.7)	139.5 (21.0)	133.4 (19.1)	136.6 (20.3)	**2.96a**	**0.44 - 5.48**
Hand-grip (kg)	19.45 (4.74)	20.92 (4.84)	18.98 (4.70)	20.50 (4.88)	0.01	-0.57 - 0.59
sit-ups	17.99 (5.02)	19.40 (4.70)	18.24 (5.21)	19.47 (4.72)	0.21	-0.27 - 0.68
Bent-arm hang (sec)	7.05 (7.17)	6.82 (7.06)	7.45 (6.89)	7.70 (7.27)	-0.47	-1.09 - 0.16
10x5m shuttle run (sec)	22.09 (2.24)	21.65 (1.67)	21.90 (1.57)b	21.58 (1.62)	0.01	-0.29 - 0.31
20 m shuttle run	5.87 (2.62)	6.72 (2.61)	7.14 (2.56)b	7.76 (2.57)	0.04	-0.45 - 0.53

a = in favour of intervention group
b = difference ($p<.05$) between intervention and control group at T0 (t-test)
c = regression coefficients of the fully adjusted models

Baseline measures on BMI, waist circumference and fitness scores are reported in table 7.2. In grades 3-5 intervention schools scored less favourable on four fit-tests as compared to control schools at baseline. In grades 6-8 intervention schools scored less favourable at baseline on BMI, waist circumference and three fit-tests.

Effects on BMI, waist circumference and fitness
Table 7.2 shows the means for BMI, waist circumference and fitness at baseline and follow up and the results of the multilevel analyses for grades 3-5 and grades 6-8 separately.
For grades 3-5 the increase in BMI and waist circumference during the school year was smaller in the intervention group as compared to the control group. This difference was statistically significant for waist circumference (1.29 cm; 95%CI 0.42-2.16). The improvement in mean fitness scores was larger in the intervention group as compared to the control group for five of the eight fit-tests, but reached statistical significance only for the 20m shuttle run test (0.57 laps; 95%CI 0.13-1.01).
For grades 6-8 the increase in BMI was higher in the intervention group as compared to the control group, while the increase in waist circumference was less in the intervention group as compared to the control group. Both measures did not reach statistical significance. The improvement in mean fitness scores was higher in the intervention group as compared to the control group for six of the eight fit-tests, but reached significance only for the broad standing jump (2.96 cm; 95%CI 0.44-5.48).

Intra-cluster correlation coefficients were below 0.010 for BMI, plate tapping, sit and reach, standing broad jump, hand-grip and bend arm hang, 0.014 for waist circumference, 0.027 for sit-ups, 0.030 for 10x5m shuttle run and 0.166 for 20m shuttle run.

Effect on weight status
In grades 3-5 the prevalence of overweight increased from 24.4% to 25.7% (incidence 3.7%, remission 2.4%) in the intervention group and from 24.4% to 28.7% (incidence 5.4%, remission 1.1%) in the control group. GEE analyses revealed a statistically significant intervention effect for the prevalence of overweight (OR 0.53; 95%CI 0.36-0.78).
In grades 6-8 the prevalence of overweight increased from 33.8% to 36.3% (incidence 4.1%, remission 1.6%) in the intervention group and from 28.9% to 31.1% (incidence 4.3%, remission 2.2%) in the control group. No significant intervention effect was found.
Because a significant intervention effect was found for weight status but not for BMI, it was expected that the intervention effect differed according to BMI SDS at baseline. Figure 7.2 shows that in the intervention group mean change in BMI between baseline and follow up in grades 3-5 was lower in comparison with the control group for BMI SDS categories 0.5-1.0 and 1.0-1.5. These two BMI SDS categories represent the children that are just below and just above the cut off for overweight.

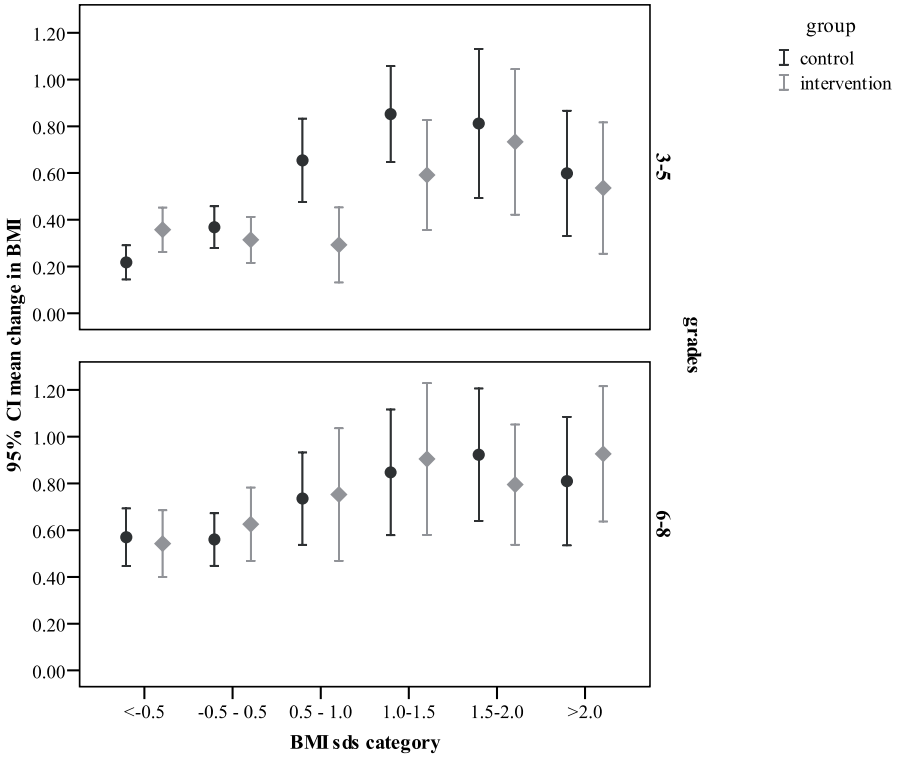


Figure 7.2 Mean change in BMI (95%CI) from baseline to follow up in intervention group and control group according to BMI SDS category at baseline for grades 3-5 and grades 6-8 separately

7.5 Discussion

The intervention Lekker Fit! was developed as a multi-component intervention in the school setting targeting both behavioral and environmental determinants of overweight, mainly focusing on the increase of the daily amount of physical activity of primary school children. At the end of one school year positive and statistically significant intervention effects were found on the prevalence of overweight, waist circumference and aerobic fitness of children in grades 3-5 of primary school (6-9 year olds), but not in grades 6-8 (9-12 year olds).

Although the prevalence in overweight in grades 3-5 of our intervention group did not increase as strongly as in the control group, a reduction in the prevalence of overweight was not achieved, but merely a reduction in the rising trend. The effects on waist circumference and 20m shuttle run were, however, favourable, since both abdominal obesity and aerobic fitness are associated with cardiovascular disease risk factors in children.[188, 214]

No effect on BMI was found, but when children were categorized according to BMI SDS group at baseline the intervention effect on BMI among children in grades 3-5 appeared to be the largest in children around the cut-off for overweight at baseline. This suggests that the effects found were indeed based on prevention of overweight rather than on weight loss among children who were overweight at baseline. Although a lack of effect on BMI in combination with an effect on the prevalence of overweight has been found before in other evaluation studies[195, 210], our study is – to our knowledge – the first to further investigate this finding.
The use of BMI as the primary measure for overweight in children is criticized because BMI does not discriminate between increases in fat mass and fat-free mass[127], which constitutes a possible explanation for the lack of an intervention effect we found for BMI in the intervention group as a whole. Furthermore, BMI is a measure of general adiposity and does not give information on fat distribution, which is related to cardiovascular disease risk factors in children as well as in adults.[188] The lower increase in waist circumference in the intervention group, which reached significance in grades 3-5, indicates children in the intervention group became relatively leaner in comparison with the controls.

It is not clear why the intervention had no effect in the higher grades. Possibly the intervention components had less impact on or were less appealing to older pupils. To our knowledge there are no other studies reporting effect modification by age.

Our results are comparable to the results of the El Paso Catch study in Texas. [195] In this study a minimum of three PE lessons a week was provided to 8-9 year olds, as well as a classroom curriculum on multiple health behaviours. Effects after two years of intervention, as compared to matched control schools were found on percentage of overweight and fitness, but not on BMI.
Our results are also comparable to a daily after school program consisting of academic enrichment, a healthy snack, as well as PA, in which after one year of intervention an effect was found on fitness and percentage of body fat but not on BMI or waist circumference in children that participated in at least 40% of the program.[210]
The intervention Healthy Schools in Chile[193] consisting of comparable components - 90 minutes additional PE per week and active recess activities for the children, nutrition education for children and parents, – and targeting a population comparable to our population, resulted in a significant favourable intervention effect on fitness at six month follow-up, comparable with our results, and additionally in an effect on BMI and waist circumference among boys. Also in the Greek adaptation of the Know Your Body program, in where health education was combined with fitness oriented PE sessions led by a PE teacher an effect on BMI, fitness and biochemical indices was demonstrated as compared to the same scheme led by the regular classroom teacher.[201]
According to recommendations, the intervention in the present study consisted of several components. However, with a multi-component intervention approach, it remains unclear which components are crucial for the observed effects. Reviews of the literature suggest

that program delivery by a PE teacher as compared to a classroom teacher[215], inclusion of additional PE sessions[203], and inclusion of after school PA opportunities[185], may all contribute to effective school-based PA promotion programs. In a recent systematic review a synthesis of controlled trial results pointed to compulsory PA rather than voluntary PA as the main factor distinguishing effective from ineffective trials.[78] This is supported by our results.

Additional research is needed to elucidate which combination of the components is responsible for the effects of the intervention in grades 3-5 and to assess a dose response relationship between received amount of the different components of the intervention and effects. Further research would also be necessary to establish longer term effects of the intervention.

Because the sizes of the random intercepts in the multilevel logistic regression analyses were too small to be meaningfully detected, the fitting of these models failed. We used GEE analyses with correction for the dependency of measurements within schools instead. Interpretations of both methods differ, since GEE analyses result in population averaged estimates, and random effect analyses in subject specific estimates. However, since intra-cluster correlations were rather low (ICC of BMI below 0.01) only small deviations between both methods seem probable.[216]

Although the present study provides evidence that the Lekker Fit! intervention can contribute to prevention of overweight, the intervention did not succeed in reducing the prevalence of overweight. This suggests that further intensification of or additions to the intervention program Lekker Fit! are necessary to curb the obesity epidemic among primary school children. Furthermore, generalizability might be limited to primary schoolchildren in more deprived metropolitan areas where prevalence rates of overweight and inactivity are high.

In conclusion, our results provide some evidence for the effectiveness of the Lekker Fit! intervention program in primary school children of grades 3-5 and are supportive to recommendations to target both behavioural and environmental determinants of overweight.

8
General discussion

8.1 Introduction

Childhood overweight has become a major public health issue worldwide, urging national and local governments to take action. Following the Public Health Act, municipalities in the Netherlands have an important task in providing insight into the local childhood overweight problem and taking or promoting preventive measures at the individual and population level.
The model for Planned Health Education and Promotion[27] enables a careful evidence-based approach to childhood overweight prevention in a municipal setting. The model identifies the following steps: 1) analysis of health and quality of life, 2) analysis of behavioural and environmental risk factors, 3) analysis of determinants of exposure to these risk factors, 4) intervention mapping, and 5) intervention implementation and evaluation.
The studies described in this thesis aim to contribute to insight in the childhood overweight problem, its risk factors and determinants and the effectiveness of a municipal childhood obesity prevention program, in particular in the city of Rotterdam.
In this final chapter the main findings are discussed and interpreted following the steps of the model for Planned Health Education and Promotion. Strengths and weaknesses in the methodology are addressed, and implications for future research and public health practice are discussed. At the end of this chapter the general conclusions are outlined.

8.2 Main findings

Step 1. Analysis of health and quality of life

Research question 1. Do 12-13 year olds provide valid self-reported height and weight data? Is validity associated with socio-demographic characteristics? Can correction factors be applied to adjust these self-reported data?

Our main finding was that self-reported height and weight data produced a considerable underestimation of the prevalence of childhood overweight. Under-reporting of BMI was higher among pupils who were of non-Dutch origin and who were in lower levels of education. Furthermore, under-reporting of BMI was higher in pupils who regarded themselves as being more overweight. A more accurate estimate of BMI was achieved when self-reported data were corrected for socio-demographic variables and body image. However, although the sensitivity improved substantially when self-reported data were corrected, about one fourth of all overweight subjects would still not be identified as such (based on self-reports) even after applying the correction formula.

Our finding that self-reported height and weight data produce an underestimation of weight and BMI confirms results of other studies on the validity of self-reported height and weight data.[38-41, 84-86, 88-90, 93, 94, 96, 217] However, the extent of underestimation in our

study (6.1 kg for weight and 1.5 kg/m^2 for BMI) was larger than in other studies. Therefore, we cannot confirm the positive conclusions about the validity of self-reported height and weight data that were proposed in some of these studies.[38, 86, 90, 93, 94, 217]Possible explanations for the relatively large underestimation in the Rotterdam study population are the relatively large prevalence of (measured) overweight in our sample (33%) and the differences in data collection compared with some other validation studies. In our study confidential classroom questionnaires were used, while in some other studies [38, 39, 41, 90, 93] pupils were aware of later actual measurement of height and weight.
The relative young age of our sample could be another explanation. However, self-reported height and weight in third grade pupils (14-15 year olds) of secondary school in Rotterdam resulted in an overweight prevalence rate of 15% (see figure 1.2 in the general introduction of this thesis)[218]. This is almost equal to the measured rate found among first grade pupils of secondary school. Therefore, the prevalence rate among third grade pupils of secondary school is probably also a considerable underestimation.

Our estimate of the prevalence of overweight based on corrected self-reported height and weight data was much higher than the 'crude' prevalence rate using self-reported height and weight data (22.8% versus 12.5%, respectively). This much higher rate has recently been supported by measurements of height and weight conducted in the ENvironmental Determinants of Obesity in Rotterdam StudEnt (ENDORSE) study[49] among a similar population group of the same age in the same municipality. Based on measured height and weight, a 22.2% overweight prevalence among 12-13 year olds was found.[219]

The HBSC study[6] reported prevalence rates on overweight based on self-reports among a Dutch representative sample of 13 and 15 year old boys and girls in 2001-2002 (see table 1.1 in the general introduction) ranging from 4.5% to 9.8%. TNO Prevention and Health[220] reported prevalence rates for overweight among the same age groups based on measured data among a weighted representative sample in 2003 ranging from 15.2 % to 20.1%. The relative large difference between the findings of both studies, should raise questions on the validity of self-reports in other Dutch samples as well.

Research quesion 2. Are psychosocial well-being and weight status associated among 9-10 year olds and 12-13 year olds cross-sectionally and longitudinally? Is the association dependent on socio-demographic characteristics, body image or indicators of weight?

In our cross-sectional sample of sixth grade primary school pupils, obese boys reported more favourable social anxiety scores regarding their physical appearance than non-overweight boys. In our cross-sectional sample of first grade secondary school pupils, no association between measured weight status and psychosocial well-being was found. The association between self-reported weight status and mental health indicators appeared to be attributable to body weight perception rather than to weight status.
No longitudinal associations were found between weight status and psychosocial well-being

among pupils in sixth grade of primary school and, again, in the first grade of secondary school.

Childhood obesity is related to stigmatization and diminished chances of social and economic performance in later life.[15, 221] Stigmatization may therefore affect a child's self-esteem and overall psychological well-being. However, the empirical evidence for this assumption is not conclusive - as was shown in two consecutive reviews.[42, 43] In fact, the reviewed longitudinal studies provided more evidence for the opposite causal relationship (i.e. psychological well-being predicting future weight status).[43] The lack of association between mental health indicators and overweight that was found in our study confirms results found in the majority of earlier cross-sectional studies discussed in these reviews. In contrast to most of the reviewed longitudinal studies, we did not find that earlier psychosocial well-being predicts later overweight or obesity.[44, 99-108]

A possible explanation for the lack of association between psychological well-being and obesity found in a few studies, is the mediating effect of body weight perception.[45, 46, 110, 124] Our findings confirm these results. *Feeling* overweight rather than *being* overweight was found to be associated with psychosocial well-being.

Body perception might be subject to time trends. Research in Finland demonstrated that increasing prevalence rates of overweight coincided with decreasing trends in feeling fat.[122] If this finding can be generalized to other parts of the world and body perception indeed acts as a moderator for the association between overweight status and psychological well-being, a weaker association between obesity and psychological well-being can be expected among the population at large.

Step 2 and 3. Analysis of behavioural and environmental risk factors and its determinants

Research question 3. What is the prevalence of overweight, unhealthy key energy-balance related behaviours and intentions among 9-12 year olds. Are differences related to socio-demographic characteristics and weight status?

Our main finding was that the prevalence of overweight in 9 to12-year-old Dutch inner-city children was high (30%). For all energy-balance behaviours that were studied (skipping breakfast, screen behaviour, consumption of sugar-containing drinks, active commuting, playing outdoors and doing sports) there was room for improvement. Only 13% of the children reported favourable answers on all energy-balance related behaviours. Most of the children expressed the intention to (continue) doing sports and having breakfast, while less than half of the children intended to reduce television and computer time.

Socio-demographic characteristics were not associated with being overweight and few with being obese. However, gender, ethnicity and age were associated with engagement in some of the energy-balance related behaviours and intentions. Neighbourhood income level (as measure of socio-economic status) was not associated with most behaviours and intentions. Skipping breakfast and the sum of healthy behaviours were associated with being overweight; skipping breakfast and not doing sports at least twice a week was associated with being

obese. Overweight children were more likely to report positive intentions towards outdoor play and doing sports, but less likely to report positive intentions towards having breakfast in comparison with normal weight children.

Although the association between risk behaviours and weight status has been investigated in many earlier studies, few studies reported on the prevalence or clustering of obesogenic behaviours in primary school children or the role of socio-demographic characteristics on these behaviours. Data on the prevalence of risk behaviours for overweight in Dutch primary schoolchildren are largely lacking. Research on intentions to healthy behaviours (an important potential determinant of future behaviour according to the Theory of Planned Behaviour[58]) in primary schoolchildren is even more limited. The need for these data and the monitoring of these behaviours and their determinants is high, since such data are needed to carefully plan future interventions and to evaluate if present-day interventions are well-targeted towards the right behaviours and behavioural determinants. At present, preventive youth health care is implementing the Minimum Intervention Strategy that aims to tackle a number of possible risk behaviours guided by the stages-of-change theory, without proper insight in whether these behaviours and determinants are the most important.[51]

Although the association between risk behaviours and weight status has been investigated, few studies reported on the prevalence or clustering of obesogenic behaviours in primary schoolchildren or the role of socio-demographic characteristics on these behaviours. Data on the prevalence of risk behaviours for overweight in Dutch primary schoolchildren are largely lacking. Research on intentions towards healthy behaviours (an important potential determinant of future behaviour according to the Theory of Planned Behaviour [58]) in primary schoolchildren is even more limited. The need for these data and the monitoring of these behaviours and their determinants is high, since such data are needed to carefully plan future interventions and to evaluate if present-day interventions are well-targeted towards the right behaviours and behavioural determinants. At present, preventive youth health care is implementing the Minimum Intervention Strategy that aims to tackle a number of possible risk behaviours guided by the stages-of-change theory, without proper insight into whether these behaviours and determinants are the most important.[51]
Although some differences based on socio-demographic characteristics on energy-balance related behaviours were found (primarily between boys and girls), our results indicate that a general approach is needed for obesity prevention among inner-city primary schoolchildren. Our results do not contribute to the explanation of the higher prevalence rates of overweight found in children from Turkish and Moroccan ethnicity in the Netherlands as a whole.[9]
We were able to compare our data on television screen time and breakfast skipping with that from earlier studies. Compared with the Dutch sample in the Pro-Children study [154] television screen time appeared to be somewhat lower in the present study, but seasonal variation and differences in the measurement instrument could have contributed to these differences. Comparison of data on skipping breakfast from an older study [159] showed that the present study had a somewhat higher rate.

To our knowledge no comparable data on Dutch samples of primary school children are available for active commuting to school, outdoor play, engaging in sports, and sugar-containing drinks.
Despite earlier evidence suggesting a range of energy-balance related behaviours among youth [47, 48, 50, 52-54, 74, 98, 130, 131, 222-225], in the present study only skipping breakfast was found to be associated with being overweight. Skipping breakfast was reported to be associated with overweight in two other large cross-sectional studies among Dutch secondary schoolchildren.[226, 227] However, it is still not clear whether skipping breakfast is a predictor or a partial cause of unnecessary weight gain. Perhaps people who are overweight start skipping breakfast, or perhaps skipping breakfast is an indicator of a more general unstructured eating pattern.
The lack of association with other energy-balance related behaviours should not be regarded as evidence that these behaviours are not important. Some of our study limitations may well have contributed to the lack of associations found. For example, the cross-sectional design of the study, and the crude measures used for behavioural assessment, are two important limitations. It is, however, noteworthy that good quality research on potential energy-balance behaviours among school-aged children is sparse, especially among a multi-ethnic population such as in Rotterdam; such research is urgently needed to further guide prevention efforts.

Research question 4. Do parents recognize overweight in their child and are socio-demographic characteristics associated with this ability?

Our main finding was that more than half of the parents of overweight children did not rate their child as being overweight. This observed unawareness of, or tendency to decline the overweight status did not differ according to parental level of education, parental occupational status, ethnic background or gender of the child. However, compared with parents of overweight children, the awareness was higher in parents of obese children.

Other studies investigating the awareness of parents about the weight status of their child have been conducted in the USA, Australia and the UK [63, 64, 166-168, 228-236]. The proportions of parents of overweight children that reported to be aware of this ranged from 2% up to 68%. Differences in the definitions of overweight, prevalence of overweight, cultural differences, and other differences between study populations may contribute to the differences between the reported proportions. Weight status or BMI [64, 168, 228], age (more aware about older children) [64, 233] and reporting parent (mother more aware than father) [168] have been found to be associated with awareness in parents. Ethnic background was not found to be associated [166], and mixed results have been reported for gender of the child [63, 64, 166-168, 228, 233], socio-economic status [63, 64, 166-168, 228] as well as parental obesity status.[64, 166-168]

To our knowledge no other studies have been conducted on awareness of parents in the

Netherlands. It appears that parents in Rotterdam are more aware of overweight in their children (50%) than parents of children of a similar age range in the UK (39%) [237], Australia (37%) [236], and the USA (36%).[235]

Step 5. Intervention implementation and evaluation

Research question 5. Is the intervention Lekker Fit! effective in reducing overweight and improving fitness levels in primary schoolchildren?

Favourable and significant intervention effects for Lekker Fit! were found on the prevalence of overweight, waist circumference and aerobic fitness of children in grades 3-5 of primary school (6-9 year olds), but not in grades 6-8 (9-12 year olds).
No significant effect based on mean BMI was found.

The latest Cochrane review on obesity prevention programs for children concluded that no evidence-based programs are available to date.[76] This is also the case for the Netherlands, where some research has been done and is ongoing on the effectiveness of obesity prevention programs for secondary schoolchildren [238-241], and to a limited extent for primary schoolchildren.[198]
An energy-balance approach, including diet and physical activity, and focusing on individual as well as environmental potential determinants of these behaviours, has been recommended by several experts in the field of childhood obesity prevention.[68-70, 172, 174] This approach was also chosen in the Lekker Fit! Program, although the main focus was on physical activity.[3, 72-75, 78] The school has also emerged as a critical setting for successful obesity prevention programs.[79, 80]
Our results are comparable to those of the El Paso Catch program [195], the Medical College of Georgia Fitkid program [210], Healthy schools [193], and the Greek adaptation of the Know Your Body program [215]. All of these interventions comprise elements that resemble the Lekker Fit! program and all reported similar modest but significant results.
Our findings also support the conclusions of a recent review by Connelly et al. [78]; this review found obligatory physical activity to be crucial for successful obesity prevention. More obligatory physical activity is also one of the elements of the Lekker Fit! program. However, since Lekker Fit! is a multi-component intervention, no conclusions can be drawn on the effectiveness of the individual components.

The effects of the Lekker Fit! intervention were favourable for grades 3-5, but no effects were found for grades 6-8. Furthermore, the prevalence of overweight in grades 3-5 did not decrease in the intervention schools but merely showed less increase compared with control schools.

8.3 Methodological considerations

In the interpretation of our study findings several strengths and weaknesses need to be acknowledged; these are related to the study designs, study populations, sampling, response, measurement issues and external validity. Each of these issues is discussed hereafter.

Designs

In our studies we used different research designs: a cross-sectional design for research questions 1, 2, 3 and 4; combined with a longitudinal design for research question 2; and a cluster randomized controlled design for research question 5.
The major drawback of a cross-sectional design is that no conclusions can be drawn on prediction or causality. In case associations are found, the causal direction remains unclear, and in case no associations are found a causal relation still cannot be excluded. Cross-sectional designs offer rapid preliminary and exploratory results and are suitable to assess the health status and risk groups in a population - as was done in Chapters 2, 4 and 5 of this thesis.
The strength of a longitudinal design is that it allows to explore prediction. However, because a major problem in longitudinal research is selective drop-out, missing data analysis was carefully performed for research question 2 to exclude the possibility of selective drop-out.
A cluster randomized controlled design can be regarded as an optimal design for group-based interventions, and is a major strength in our study on the effectiveness of the intervention Lekker Fit! However, some concessions were made to the most optimal design. We were unable to conduct the study 'double-blinded' because the intervention consisted of such a combination of obvious changes and activities that the data collection staff (as well as the pupils and teachers) would certainly be aware of which person or school was in which study condition. Also, randomization after the baseline measurements was not possible. We wanted to make baseline measurements immediately before the actual start of the intervention. Because schools had to prepare the intervention implementation, they were informed about the study condition they were in well before the measurements took place. Baseline and follow-up measurements took place at the beginning and the end of one school year without further follow-up measurements. Additional follow-up measurements would have provided valuable information about the sustainability of the intervention and its effects; however, because all schools were enthusiastic about obesity prevention and physical activity promotion activities, keeping control schools longer than one school year on the waiting list for participation in the intervention was not considered feasible. A cross-over design was also not an option, since the intervention Lekker Fit! has a duration of at least two years and schools had committed themselves to continuation thereafter.

Study populations, sampling and response

All of our samples were drawn from populations of school-aged children, adolescents, or

schools within a large municipality. Compared to the national population, socio-economic status and education levels are lower in larger Dutch cities and the proportion of youth from foreign ethnic backgrounds is higher. While at the national level children with a foreign background constitute 23% [242] of the population of 0-25 year olds, in our samples their proportion ranged from 52% to 89%. These specific population characteristics may hamper the generalisability of our results, even though we controlled for socio-demographic characteristics in all of our studies. Nevertheless, youth from larger city areas differ from the general youth population in many ways and we may not have been able to adjust for all such differences; therefore, the present results should certainly not be regarded as valid for the Dutch population at large.

For research questions 1, 2 and 4 our study samples were derived from routine health surveys and routine health examinations of preventive youth health care for which entire age groups are invited to participate. The response rate of these types of surveys and examinations is usually high for children from Dutch as well as non-Dutch backgrounds. [120, 243, 244] Because high response rates were also achieved in our other studies, we believe that selection bias is of relatively low concern here. This can be regarded as a strength, and we believe that the results of these studies are representative for the relevant Rotterdam populations at large.

For research questions 3 and 5 study samples were derived from schools participating in an intervention trial. Schools with a high proportion of children from foreign ethnic backgrounds and low educated parents (mainly situated in inner-city neighbourhoods of Rotterdam) were free to apply for participation in the intervention. The intervention had already been implemented in 30 schools before the trial started. Spontaneous applications made further recruitment unnecessary. The fact that schools applied spontaneously might have introduced a selection bias. Participating schools might have been more interested or motivated for this type of intervention and might therefore not be representative of all schools in inner-city neighbourhoods.
Since free applications were still possible and continued after the trial, and the final target to implement Lekker Fit! in 50% of all primary schools in Rotterdam is expected to be reached by 2009 based on free applications only [245], this possible selection bias appears to be not substantial, at least for the Rotterdam area.

Measures

Another strength of our studies is that in most samples anthropometric measures were based on measurements by trained staff using protocols and not on self-reports. The analyses presented in this thesis clearly show that self-reports lead to underestimations of the overweight and obesity issues in Rotterdam. In case we had to use self-report measures for overweight and obesity, we were able to compare these with measured data.
The measurement of fitness (research question 5) was based on the Eurofit test battery, an

established measure consisting of several fit tests (including the widely used shuttle run test) to measure aerobic fitness.[178]
In our studies, measures of energy-balance related behaviours and their determinants, as well as measures of psychological well-being, were based on self-reports. Using self-reports has certain drawbacks. Self-reported data can be susceptible to reporting bias, recall bias and social desirability.[163, 246] Under or over-reporting might be dependent on socio-demographic characteristics or weight status, which remains undetected in our data. For mental health measures validated questionnaires were used.[114, 116, 117] For energy-balance related behaviours validated Dutch questionnaires were not available. We largely based our questionnaire on the questionnaire that was developed in the ENDORSE study [49], which is based on expert and face validity, but no tests for relative validity have been conducted.

External validity of findings on Lekker Fit!

The external validity of an RCT is important since it refers to the generalisability of the intervention effects to other populations. The external validity might be hampered if interventions involve causal pathways that are complex or intervention-outcome associations are affected by specific characteristics of the population, health system, or environment.[247] The fact that our school and study sample has specific characteristics has been discussed already above, and obviously is of importance for the external validity. Two other types of threats to external validity need to be considered: a) the actual dose of the intervention delivered to the target population might depend on institutional, provider and recipient behaviours; and b) the dose–response relationship between the intervention and the outcome might depend on the presence of specific characteristics.

With regard to the first threat the question needs to be addressed whether the actual dose of the intervention achieved in the study population can be achieved in other populations during routine implementation. The intervention Lekker Fit! was designed and implemented by the sport and recreation department of the city of Rotterdam in cooperation with the education department and the public health service. The role of this strong cooperation between municipal services in a successful implementation of Lekker Fit! is unclear. If it was of great importance for implementation, this might limit the external validity. This is also the case for the free appointment of a PE teacher for two years financed by the municipality of Rotterdam and supervised by the sport and recreation department and the appointment of eurofit test teams. It remains unclear how this influenced the decision to adopt the intervention and whether it is crucial for successful adoption, implementation and continuation of the intervention.

With regard to the second threat the question needs to be addressed whether the dose – response relationship might be dependent on specific characteristics of the study population or setting. Some of the specific characteristics of our school and study sample have already

been mentioned above. Additionally, compared with national data overweight prevalence in the participating schools was relatively high and membership of sport clubs and probably accompanying sports participation was relatively low.[8, 248] PE teachers were not present in many of the participating schools before implementation of Lekker Fit!.
It is unclear whether the effects of Lekker Fit! can be replicated in populations with lower prevalence rates of overweight, higher sports participation or more favourable school conditions.

8.4 Implications for future research

The following implications for future research have emerged.

Analysis of health and quality of life

Continued monitoring of childhood overweight and obesity in the population as a whole, and in known risk groups, is necessary to determine trends in prevalence data. The same applies to the accompanying health consequences of childhood overweight, which until now have received little attention in the Netherlands.

Analysis of risk factors and determinants

Information on risk factors and their determinants is essential for the development of successful intervention programs for the prevention of overweight in the Netherlands and elsewhere. Only a few comprehensive studies have been conducted so far in the Netherlands, and very few among pre-school and primary school children.

Longitudinal research is needed on the relative contribution of the energy-balance related behaviours targeted in the Dutch minimum intervention strategy and of other energy-balance related behaviours, to the aetiology of overweight in Dutch children and high-risk subpopulations.
Also, more research is needed on the personal and environmental determinants of energy-balance related behaviours, especially in primary schoolchildren. Theoretical models, like the theory of planned behaviour and social-ecological models, should be the starting point. Some of the research questions that have received (limited) attention so far include: Do cognitive mediators, like behavioural intentions, predict behaviour change in primary schoolchildren? Which abilities and opportunities are needed to bridge the gap between intention and actual behaviour change in primary school children? What is the relative contribution of parents, schools and neighbourhoods on behavioural intentions and actual behaviour change among primary schoolchildren? We also need to explore why some overweight children consider themselves as being overweight whereas others do not, and whether this is a prerequisite for behaviour change in overweight youth.

Theoretical models for children should probably be expanded to reflect the role of parental behaviour and parenting on children's energy-balance related behaviours. Because parents play an important role in the development of a healthy lifestyle in their children, their involvement in preventive interventions is very important. Which determinants, apart from awareness of the weight status of their child, play a role in the successful involvement of parents in preventive interventions also needs to be explored in more detail.
The prevalence rates of childhood overweight in the Netherlands are much higher in large cities compared with national data; moreover, in Rotterdam (and probably in other large cities) the rates vary substantially depending on the neighbourhood. Apart from personal determinants and specific population characteristics, physical and socio-cultural environmental determinants are probably important 'upstream' factors explaining these differences. Research on environmental determinants is needed to understand differences in childhood overweight prevalence between inner-city neighbourhoods, large cities, and national representative populations and to contribute to diminishing these differences.

Intervention mapping and implementation

Further intervention mapping based on sound research is needed to successfully intensify the intervention Lekker Fit! especially for children in grades 6-8. We still need to establish which methods, strategies and intervention tools are best suited to reach intervention goals and change the targeted determinants of energy-balance behaviours.

Evaluation

More studies are needed on the long-term effects of Lekker Fit! Questions still to be addressed include: Is the intervention program more effective after more years of intervention? and Do the effects of the intervention program persist into adolescence and beyond? Answers to these type of questions are lacking for most of the interventions that have shown intervention effects so far, while these answers are highly relevant for decisions on the allocation of community resources. In addition, we need to elucidate the relative contribution of the different components of Lekker Fit! to its effectiveness. This also applies to other multi-component interventions showing favourable intervention effects. If effective components can be identified, more efficient and cost-effective intervention programs can be designed.
The cost-effectiveness of Lekker Fit! needs more attention. To our knowledge, little is known about the cost-effectiveness of obesity prevention programs in youth; the need for this information will increase as more effective programs become available. Finally, research is needed on the determinants of successful adoption, implementation and continued use of effective interventions like Lekker Fit! in the school setting. The role of decision-makers outside the school setting needs to be included in these studies.

8.5 Implications for public health practice

For public health practice the following items require attention.

Analysis of health and quality of life

Relying on self-report data of height and weight from 12-13 year old pupils will not result in reliable estimates of the prevalence of overweight in a given population. Application of correction formulas based on regularly acquired data from sub-samples with measured height and weight data is necessary and will lead to more reliable estimates.
Using self-reported height and weight data to calculate weight status among 12-13 year olds for screening purposes and tailored interventions on an individual level, is questionable. Overweight status based on self-reported height and weight has a low sensitivity and does not sufficiently improve by applying correction formulas. In adolescents, for screening purposes measured height and weight data are therefore recommended.

Our results indicate that, in young adolescents, feeling overweight rather than being overweight may be associated with psychological well-being. This should be kept in mind by professionals involved with the physical and mental health of children and adolescents.

Analysis of risks factors and determinants

Health professionals addressing the parent of an overweight or obese child should also realise that many parents are unaware of, or deny, the overweight of their child. Therefore, raising awareness should be given priority before making recommendations for changes in energy-balance related behaviours. This is the case irrespective of the parental level of education, ethnicity, or occupational status.
Raising awareness in parents might also be a prerequisite to successfully involve parents in school-based interventions.

There is still considerable room for improvement in energy-balance related behaviours targeted in the Dutch minimum intervention strategy among inner-city primary schoolchildren. Some differences based on gender, ethnic background and age should probably be taken into account. For example, among girls there is more room for improvement of physical active behaviours than among boys, and in older children there is more room for improvement than in younger children. Overall, however, our results indicate that a general approach is needed for obesity prevention among inner-city primary schoolchildren.

The most promising target behaviour for interventions in inner-city primary school children is probably physical activity, since it connects best with the intentions most children express towards doing sports. The hardest target behaviour for interventions is probably reducing television and computer time, since most children express low intentions towards changing these behaviours.

Intervention mapping and implementation

Since positive intervention effects of Lekker Fit! were found for grades 3-5, further implementation of the intervention is recommended. Furthermore, intensification of the intervention Lekker Fit! (especially for grades 6-8) is recommended.

The high prevalence rates of overweight in inner-city primary schoolchildren in grades 3-5 call for preventive interventions in younger age groups. The development and implementation of preventive interventions targeted at younger age groups using a carefully planned approach is recommended.

Evaluation

Practitioners and local decision-makers need preventive interventions to combat and solve public health problems like childhood overweight. To ensure that community resources are spent well, these interventions should be evidence-based. In case evidence-based interventions are not available, which is the case for childhood overweight, interventions need to be theory-based and evaluation studies need to be planned and incorporated into preventive interventions programs.
The knowledge that is generated by these studies needs to be shared and put into practice to ensure that future public health policy will be evidence-based and community resources will be spent in the most efficient and effective way.
Municipal Public Health Services in cooperation with the Academic Collaborative Centres for Public Health have an important role to play in this aim.

8.6 General conclusions

Compared with national figures, the prevalence of childhood overweight in the Rotterdam area is high, especially among inner-city children. Preventive actions are urgently needed. No evidence was found for adverse effects of overweight on psychosocial well-being of young adolescents.
Concerning the risk behaviours targeted in the Dutch minimum intervention strategy, a general approach is warranted for obesity prevention among inner-city primary schoolchildren, since differences based on socio-demographic characteristics are small. There is considerable room for improvement of these targeted behaviours, although more

research is needed on their relative contribution to the aetiology of childhood overweight and on their personal and environmental determinants. Raising physical activity connects best with behaviour intentions of children, and decreasing screen time (TV and computer) the least.

Awareness of parents that their child is overweight is lacking in about half of the parents of overweight children, regardless of their educational level, gender or ethnic background of their child, and might hamper successful involvement of parents in preventive interventions.

Lekker Fit!, a multi-component intervention aiming to reduce overweight and improve fitness in primary schoolchildren, has some positive short-term effects on overweight prevalence, waist circumference and aerobic fitness of grade 3-5 primary school pupils. No effects were found for grade 6-8 primary school pupils. Although Lekker Fit! had favourable effects, it was unable to reduce the prevalence of overweight in the short term. Therefore, more effort is needed to enhance the Lekker Fit! intervention. Such innovations should be developed and continuously tested during the further implementation of the Lekker Fit! intervention.

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Summary

This thesis presents studies on the prevention of childhood overweight. Childhood overweight has become a major public health issue in the Netherlands as well as worldwide. The Dutch government has set itself the task to reverse the trend of overweight in children; in the prevention of childhood overweight an important role has been given to local authorities. The theory of 'planned health education and promotion' offers local authorities a structured approach to the childhood overweight problem.
Five steps are distinguished:

- Analysis of health and quality of life
- Analysis of behaviour and environmental risk factors
- Analysis of determinants of risk behaviours
- Intervention mapping
- Intervention implementation and evaluation

This thesis aims to contribute to the careful evidence-based planning and evaluation of childhood overweight prevention in a municipal setting, in particular in the city of Rotterdam. Following the steps of this theory, the following research questions are addressed:

Step 1

1. *Do 12-13 year olds provide valid self-reported height and weight data? Is validity associated with socio-demographic characteristics? Can correction factors be applied to adjust these self-reported data? (Chapter two)*
2. *Are psychosocial well-being and weight status associated among 9-10 year olds and 12-13 year olds cross-sectionally and longitudinally? Is the association dependent on socio-demographic characteristics, body image or indicator of weight status (determined by self-reported versus measured height and weight) (Chapter three)*

Steps 2 and 3

3. *What is the prevalence of overweight and unhealthy key energy balance related behaviours and intentions among 9-12 year olds. Are differences related to socio-demographic characteristics and weight status? (Chapter four)*
4. *Do parents recognize overweight in their child and are socio-demographic characteristics associated with this ability? (Chapter five)*

Step 5

5. *Is the intervention Lekker Fit! effective in reducing overweight and improving fitness levels in primary schoolchildren? (Chapter seven)*

Step 1. Analysis of health and quality of life

Monitoring overweight prevalence and its trends in Dutch youth is frequently based on self-reported data. The validity of self-reported data, especially in young adolescents, is not sufficiently known. **Chapter 2** of this thesis describes our study on the validity of self-

reported height and weight in 12-13 year olds. We explored the role of socio-demographic correlates on the validity of self-reported height and weight, and investigated whether correction factors can be developed to estimate the prevalence of overweight in youth. We used data gathered through routine health surveys (Youth Health Monitor Rotterdam) on health topics, including self-reported height and weight among 12-13 year old pupils in the Rotterdam area. In a sub-sample both self-reported and measured height and weight were available. Our main findings were that the use of self-reported data led to a considerable underestimation of the body mass index (BMI) and consequently the prevalence of overweight. Underestimation was higher in pupils who regarded themselves as more fat, were from non-Dutch origin, and in lower education levels. A more accurate estimate of BMI was possible when self-reported data were corrected for socio-demographic variables and body image. The sensitivity improved to a great extent when self-reported data were corrected; nevertheless, about 25% of all overweight subjects would still not be identified after applying the correction formula. Using self-reported height and weight data the adjusted prevalence rate was considerably higher than the crude prevalence rate (22.8% versus 12.5%, respectively). We concluded that self-reported height and weight are inappropriate to estimate the overweight prevalence in 12-13 year olds, unless they are adjusted using proper correction formulas. Furthermore, we concluded that using self-reported BMI for screening purposes on an individual level is questionable.

Childhood obesity is related to stigmatization and a diminished chance of social and economic performance in later life. This is believed to affect a child's self-esteem and overall psychological well-being; however, the empirical evidence for this assumption is not conclusive. Longitudinal studies even provide more evidence for an inverse causal relationship (i.e. psychological well-being predicting future weight status). A possible explanation for the lack of association between psychological well-being and obesity found in some studies is the mediating effect of body perception. **Chapter 3** presents a study in which we explored the association of psychosocial well-being with overweight and weight perception among young Dutch adolescents. Data from the Youth Health Monitor Rotterdam were used for 9-10 year olds and 12-13 year olds. The association of mental health indicators with weight status based on self-report, and on measured height and weight, was studied in both age groups cross-sectionally. Additional longitudinal analyses were conducted among the pupils for whom follow-up data were available. Interactions with gender and ethnic background were explored. Among the 12-13 year olds the role of weight perception was also studied. Our main findings were that 9-10 year old obese boys scored more favourably on social anxiety than non-overweight boys. Among 12-13 year olds body weight perception, rather than self-reported or measured weight status, was associated with mental health indicators. Mental health indicators at age 9-10 years did not predict self-reported weight status at age 12-13 or change in weight status between 9-10 and 12-13 years, nor did weight status at age 9-10 predict later mental health indicators or change in these indicators. We concluded that our study provides no evidence for an association of overweight with less favourable psychological well-being in young adolescents. In 12-13

year olds *feeling* overweight appears to be important, rather than *being* overweight.

Step 2 and 3. Analysis of risk factors and determinants

Promoting four energy-balance behaviours ('increasing physical activity', 'reducing sedentary behaviour', 'reducing sugar-sweetened drinks', 'not skipping breakfast') has been adopted by youth health care in the Netherlands for prevention of obesity among primary schoolchildren as part of the Dutch minimum intervention strategy. However, data on the prevalence of these behaviours and intentions to engage in these behaviours among primary school children in the Netherlands (and elsewhere) is limited, especially for multi-ethnic inner-city populations. **Chapter 4** describes a study on these behaviours and intentions using baseline data of our cluster randomized controlled trial (see Chapters 6 and 7) among grade 6-8 pupils of primary schools in inner-city neighbourhoods. Data were collected using classroom questionnaires. Height and weight were measured by trained staff.
Our main findings were that the prevalence of overweight and obesity were 30% and 9%, respectively. Few significant associations were found between socio-demographic characteristics and weight status. Engagement in energy-balance behaviours ranged from 59% for outdoor play (>1 hour the previous day) to 86% for active transportation to school (day of survey). Only 13% of the children reported favourable answers on all energy-balance related behaviours. The highest positive intentions were reported for engaging in sports (84%), the lowest for reducing computer time (41%). Some significant differences in behaviours and intentions according to gender, age and ethnicity were found. Skipping breakfast and total number of favourable energy-balance behaviours were associated with overweight. Overweight children reported more positive intentions towards doing sports and less positive intentions towards having breakfast than normal weight children. We concluded that the prevalence of overweight among inner-city schoolchildren in the Netherlands is high, that engagement in energy-balance behaviours can be improved, and that a general approach targeting all children appears to be the best.

To successfully involve parents in the treatment of overweight in their child, they first need to be aware of the problem and its accompanying health risks. **Chapter 5** presents our study on parents' awareness of the weight status of their child. Data on 9-10 year olds from the Youth Health Monitor Rotterdam were used. The main finding was that in overweight children 50% of the parents do not recognize that their child is overweight. Except for age, none of the investigated socio-demographic characteristics, including ethnicity of the child and parental educational level, were associated with awareness. Parents of obese children showed greater awareness than parents of overweight children.

Step 5 intervention implementation and evaluation

Effective interventions to prevent overweight and obesity in children are urgently needed, especially in inner-city neighbourhoods where prevalence of overweight and inactivity

among primary school children is high. **Chapter 6** describes a school-based intervention called Lekker Fit! which aims to reduce overweight and improve fitness in primary schoolchildren. The main components of the intervention are the re-establishment of a professional physical education (PE) teacher; three (instead of two) PE classes per week; additional sport and play activities outside school hours; fitness testing; classroom education on healthy nutrition, active living and healthy lifestyle choices; and the involvement of parents. With these components Lekker Fit! combines a behavioural approach with an environmental approach, as recommended by several experts. Chapter 6 also describes the study protocol that was used to evaluate the effectiveness of the intervention. A cluster randomized controlled design was used in 20 primary schools among grades 3 through 8 (6-12 year olds). Primary outcome measures were prevalence of overweight, BMI, waist circumference and fitness. Multilevel regression analyses were used to study differences in outcomes between children in the intervention schools and in control schools, taking clustering of children within schools into account.
Chapter 7 presents the results of this trial. Significant positive intervention effects were found for percentage overweight, waist circumference and 20-m shuttle run among pupils of grades 3-5. Among pupils of grades 6-8 only an effect for standing broad jump was found. The prevalence of overweight in grades 3-5 increased by 4.3% in the control group and by 1.3% in the intervention group.
No significant effects were found for BMI, but increases in BMI between baseline and follow-up among pupils of grades 3-5 in intervention schools as compared to control schools were lower for pupils with a BMI around the cut-offs for overweight. We concluded that our results provide evidence for the effectiveness of Lekker Fit! and recommended its implementation as well as further intensification.

A general discussion of the main findings is provided in **Chapter 8**, together with implications for further research and public health practice.

The **main conclusions** of the thesis are:

Compared with national figures, the prevalence of childhood overweight in the Rotterdam area is high, especially among inner-city children. Preventive actions are urgently needed. Self-reported height and weight data of 12-13 year olds result in an underestimation of the overweight prevalence. No evidence was found for adverse effects of overweight on psychosocial well-being of young adolescents.
Concerning the risk behaviours targeted in the Dutch minimum intervention strategy, a general approach is warranted for obesity prevention among inner-city primary schoolchildren, since differences based on socio-demographic characteristics are small. There is considerable room for improvement of these targeted behaviours, although more research is needed on their relative contribution to the aetiology of childhood overweight and on their personal and environmental determinants. Raising physical activity connects best with behaviour intentions of children, and decreasing screen time (TV and computer)

the least.
Awareness of parents that their child is overweight is lacking in about half of the parents of overweight children, regardless of their educational level, gender or ethnic background of their child, and might hamper successful involvement of parents in preventive interventions. Lekker Fit!, a multi-component intervention aiming to reduce overweight and improve fitness in primary schoolchildren, has some positive short-term effects on overweight prevalence, waist circumference and aerobic fitness of grade 3-5 primary school pupils. No effects were found for grade 6-8 primary school pupils. Although Lekker Fit! had favourable effects, it was unable to reduce the prevalence of overweight in the short term. Therefore, more effort is needed to enhance the Lekker Fit! intervention. Such innovations should be developed and continuously tested during the further implementation of the Lekker Fit! intervention.

Samenvatting

In dit proefschrift worden verschillende studies beschreven over (preventie van) overgewicht bij de jeugd. Zowel in Nederland als wereldwijd is overgewicht bij de jeugd een groot maatschappelijk gezondheidsprobleem geworden. De Nederlandse overheid heeft zichzelf tot taak gesteld het toenemende percentage jeugdigen met overgewicht te stoppen en de trend om te buigen. Daarbij heeft de landelijke overheid een belangrijke rol neergelegd bij lokale overheden. Het model voor planmatige gezondheidsvoorlichting en gezondheidsbevordering biedt lokale overheden handvatten voor een planmatige benadering van de preventie van overgewicht bij de jeugd. In het model worden vijf stappen onderscheiden:

- Analyse van de gezondheid en kwaliteit van leven.
- Analyse van risicofactoren in het gedrag en de omgeving
- Analyse van determinanten van risicofactoren
- 'Intervention mapping'
- Implementatie van interventies en evaluatie

Dit proefschrift beoogt bij te dragen aan een zorgvuldige, planmatige benadering van de preventie van overgewicht bij de jeugd, meer specifiek in Rotterdam. Bovenstaande stappen volgend, komen de volgende onderzoeksvragen aan de orde:

Stap 1

1. *Zijn zelfgerapporteerde lengte en gewicht gegevens van brugklassers valide? Is de validiteit van deze gegevens gerelateerd aan socio-demografische kenmerken? Kan een correctie-factor worden toegepast om zelfgerapporteerde gegevens te corrigeren? (hoofdstuk 2)*
2. *Is psychosociale gezondheid gerelateerd aan gewichtstatus bij groep 6 leerlingen en brugklassers, cross-sectioneel en longitudinaal gezien,? Is deze relatie afhankelijk van socio-demografische kenmerken, lichaamsbeleving of wijze waarop gewichtstatus is bepaald (op basis van zelfgerapporteerde of gemeten lengte en gewicht)? (hoofdstuk 3)*

Stap 2 en 3

3. *Wat is de prevalentie van een ongezonde leefstijl en bijbehorende gedragsintenties bij 9-12 jarigen? Zijn er verschillen naar socio-demografische kenmerken en gewichtstatus? (hoofdstuk 4)*
4. *Herkennen ouders overgewicht bij hun kind en zijn hierin verschillen naar socio-demografische kenmerken? (hoofdstuk 5)*

Stap 5

5. *Is de interventie Lekker Fit! effectief in het terugdringen van overgewicht en het verbeteren van fitheid van basisschoolleerlingen? (hoofdstuk 7)*

Stap 1 Analyse van gezondheid en kwaliteit van leven

Het monitoren van overgewicht onder de jeugd wordt vaak gebaseerd op zelfgerapporteerde lengte en gewicht gegevens. De validiteit van deze gegevens, vooral onder jonge adolescenten is onvoldoende bekend. In **hoofdstuk 2** van dit proefschrift wordt een studie beschreven naar de validiteit van zelfgerapporteerde lengte en gewicht gegevens bij brugklassers (12-13 jarigen). We hebben onderzocht wat de rol van socio-demografische kenmerken op de validiteit van zelfgerapporteerde lengte en gewicht gegevens is. Ook is onderzocht of met een correctiefactor de prevalentie van overgewicht geschat kan worden op basis van zelfgerapporteerde gegevens. We hebben gegevens gebruikt uit de Jeugdmonitor Rotterdam verzameld bij brugklassers. Bij een deel van deze populatie waren ook gemeten lengte en gewicht gegevens beschikbaar. Onze belangrijkste bevinding was dat zelfgerapporteerde lengte en gewicht gegevens resulteren in een forse onderschatting van de body mass index (BMI) en de daaruit afgeleide prevalentie van overgewicht. De onderschatting was groter bij leerlingen die zichzelf dik voelen, bij allochtone leerlingen en in lagere onderwijsniveaus. Een preciezere schatting van de BMI was mogelijk wanneer zelfgerapporteerde gegevens werden gecorrigeerd voor deze factoren. Alhoewel de sensitiviteit van de zelfgerapporteerde gegevens na correctie verbeterde, toch zou nog ongeveer 25% van de leerlingen met overgewicht niet geïdentificeerd worden. De prevalentie van overgewicht gebaseerd op gecorrigeerde gegevens was aanzienlijk hoger dan gebaseerd op de ruwe gegevens (22,8% versus 12,5%). Onze conclusie is dat zelfgerapporteerde lengte en gewicht gegevens ongeschikt zijn voor het bepalen van de prevalentie van overgewicht bij 12-13 jarigen, tenzij ze gecorrigeerd worden. Bovendien concluderen we dat het gebruik van zelfgerapporteerde lengte en gewicht gegevens voor individuele screenings doeleinden twijfelachtig is.

Stap 2 en 3. Analyse van risicofactoren en determinanten

Obesitas bij kinderen hangt samen met stigmatisering en verminderde kansen op maatschappelijk succes in het latere leven. Aangenomen wordt dat dit invloed heeft op het zelfvertrouwen en psychisch welbevinden van kinderen met overgewicht, maar het wetenschappelijk bewijs hiervoor is niet eenduidig. Longitudinaal onderzoek levert zelfs meer bewijs op voor een omgekeerd verband (i.e. dat psychisch welbevinden de latere gewichtstatus voorspelt). Een mogelijke verklaring voor het gebrek aan samenhang tussen psychisch welbevinden en gewichtstatus dat in sommige studies gevonden is, is het verstorende effect van lichaamsbeleving. In **hoofdstuk 3** beschrijven we een studie naar de samenhang tussen psychisch welbevinden, gewichtstatus en lichaamsbeleving onder jonge adolescenten. De onderzoeksgegevens waren afkomstig van de Jeugdmonitor Rotterdam en hadden betrekking op groep 6 leerlingen en brugklassers. De samenhang tussen psychisch welbevinden en gewichtstatus gebaseerd op zelfgerapporteerde en gemeten lengte en gewicht gegevens zijn cross-sectioneel bestudeerd. Aanvullende longitudinale analyses zijn uitgevoerd bij leerlingen met metingen op beide leeftijden. Interacties met geslacht en etnische herkomst werden geëxploreerd. Bij brugklassers werd de rol van lichaamsbeleving

meegenomen.
Onze belangrijkste bevindingen waren dat obese jongens in groep 6 gunstiger scoren op sociale angst dan jongens zonder overgewicht. Bij brugklassers hing niet de zelfgerapporteerde gewichtstatus, maar de lichaamsbeleving samen met psychisch welbevinden. Psychisch welbevinden bij groep 6 leerlingen hing niet samen met later als brugklassers zelf gerapporteerd overgewicht of met een verandering in gewichtstatus tussen beide metingen. Ook hing gewichtstatus bij groep 6 leerlingen niet samen met later psychisch welbevinden in de brugklas of met een verandering in psychisch welbevinden. Onze conclusie luidt dat onze studie geen bewijs levert voor een verband tussen overgewicht en minder gunstig psychisch welbevinden bij jonge adolescenten. Bij brugklassers blijkt zich dik voelen belangrijker voor psychisch welbevinden, dan daadwerkelijk overgewicht hebben.

De Nederlandse preventieve jeugdgezondheidszorg zet met het overbruggingsprotocol in op het stimuleren van vier typen gezond gedrag ('meer fysieke activiteit', 'minder zittend gedrag', 'minder gezoete dranken', 'dagelijks ontbijten') voor de preventie van overgewicht bij schoolkinderen. Over de prevalentie van deze gedragingen en bijbehorende gedragsintenties bij basisschoolleerlingen in Nederland en elders is weinig bekend. Dit geldt met name voor multi-etnische jeugd in grote steden. In **hoofdstuk 4** wordt een studie beschreven naar deze gedragingen en gedragsintenties bij groep 6-8 leerlingen uit binnenwijken van Rotterdam, gebaseerd op gegevens van de nulmeting uit het in hoofdstuk 6 en 7 beschreven cluster gerandomiseerde onderzoek. De gegevens werden verzameld met behulp van klassikaal afgenomen vragenlijsten. Lengte en gewicht werden gemeten door getraind personeel.
Onze belangrijkste bevindingen waren dat overgewicht en obesitas bij respectievelijk 30% en 9% van de kinderen voorkwamen. Er werden weinig significante verbanden gevonden tussen gewichtstatus en socio-demografische kenmerken. Gezond gedrag varieerde van 59% voor buitenspelen (> 1 uur op voorgaande dag) tot 86% voor lopen of fietsen naar school (dag van vragenlijstonderzoek). Slechts 13% van de leerlingen rapporteerde gunstig op alle typen gezond gedrag. De gunstigste gedragsintenties werden gerapporteerd voor sporten (door 84%), de ongunstigste voor verminderen van computer tijd (door 41%). Er werden een paar significante verschillen gevonden naar geslacht, etnische herkomst en leeftijd. Overgewicht hing samen met het vaker overslaan van het ontbijt en een lager totaal aantal typen gezond gedrag. We concludeerden dat de prevalentie van overgewicht bij kinderen in de binnensteden hoog is, dat er verbetering mogelijk is in de leefstijlaspecten uit het overbruggingsplan en dat een algemene aanpak gericht op alle kinderen het beste is.

Om ouders succesvol bij de behandeling van overgewicht bij hun kind te betrekken, moeten zij zich op de eerste plaats bewust zijn van het gezondheidsprobleem van hun kind. In **hoofdstuk 5** beschrijven wij een studie naar herkenning van overgewicht bij hun kind door ouders. Gegevens van groep 6 leerlingen uit de Jeugdmonitor Rotterdam zijn hiervoor gebruikt. De belangrijkste bevinding was dat 50% van de ouders het overgewicht bij hun kind niet herkend. Behalve leeftijd blijkt geen van de onderzochte socio-demografische

kenmerken, waaronder etnische herkomst van het kind en ouderlijk opleidingsniveau, samen te hangen met het vermogen van de ouders om overgewicht te herkennen bij hun kind. Ouders van obese kinderen herkennen overgewicht beter dan ouders van niet obese kinderen, die wel overgewicht hebben.

Stap 5 Implementatie van interventies en evaluatie

Er is een grote behoefte aan effectieve preventieve interventies voor overgewicht bij kinderen, vooral in binnensteden waar de prevalentie van overgewicht en bewegingsarmoede hoog is. In **hoofdstuk 6** wordt een interventie beschreven met de naam "Lekker Fit!", gericht op het verminderen van overgewicht en verbeteren van fitheid bij basisschoolleerlingen. De belangrijkste componenten in deze interventie zijn het herintroduceren van de vakdocent gymnastiek; drie in plaats van twee gymlessen per week; buitenschoolse beweegactiviteiten; fitheids testen; een lespakket over gezonde beweging, gezonde voeding en gezonde keuzes; en oudervoorlichting. Met deze componenten wordt gekozen voor een aanpak van zowel individueel gedrag als van de omgeving, zoals wordt aangeraden door verschillende experts. In hoofdstuk 6 wordt ook het onderzoeksprotocol beschreven, dat is gebruikt om de effectiviteit van deze interventie te evalueren. Hiervoor is een cluster gerandomiseerde, gecontroleerde onderzoeksopzet gebruikt bij twintig basisscholen in de groepen 3 tot en met 8 (6-12 jarigen). De primaire uitkomstmaten waren prevalentie van overgewicht, BMI, middelomvang en fitheid. Multilevel regressie analyses zijn gebruikt om verschillen in uitkomstmaten tussen leerlingen van interventiescholen en controlescholen te bepalen, waarbij werd gecorrigeerd voor het clusteren van leerlingen binnen scholen.
In **hoofdstuk 7** worden de resultaten van deze effectstudie beschreven. Er werden significante gunstige interventie effecten gevonden voor prevalentie van overgewicht, middelomtrek en 20m shuttle run bij leerlingen in de middenbouw (groep 3-5). Bij leerlingen in de bovenbouw (groep 6-8) werd alleen een gunstig interventie effect gevonden op verspringen-uit-stand. De prevalentie van overgewicht in de groepen 3-5 nam bij de controlescholen toe met 4,3% en bij de interventiescholen met 1,3%.
Er werd geen significant effect gevonden op BMI. De toename van BMI tussen voormeting en nameting was bij middenbouw-leerlingen op interventiescholen in vergelijking met controlescholen lager voor leerlingen met een BMI rondom het afkappunt voor overgewicht. We concludeerden dat onze resultaten bewijs leveren voor de effectiviteit van Lekker Fit!, en bevelen verdere implementatie en intensivering van Lekker Fit! aan.

Een algemene bespreking van de belangrijkste bevindingen wordt gegeven in **hoofdstuk 8**, samen met implicaties voor verder onderzoek en praktijk.

De belangrijkste conclusies van dit proefschrift luiden:

In vergelijking met landelijke cijfers, is de prevalentie van overgewicht in Rotterdam hoog, vooral onder kinderen in de oudere stadswijken. Preventieve interventies zijn dan ook

hard nodig. Zelfgerapporteerde lengte en gewicht gegevens van brugklassers resulteren in een onderschatting van de prevalentie van overgewicht. Er is geen bewijs gevonden voor negatieve effecten van gewichtstatus op psychisch welbevinden van jonge adolescenten.
Wat de leefstijlaspecten betreft waarop het landelijke overbruggingsprotocol zich richt, zijn er aanzienlijke verbeteringen mogelijk. Aangezien de verschillen naar sociodemografische achtergrondkenmerken klein zijn, is daarbij voor preventieve interventies een generieke benadering wenselijk bij kinderen in oudere stadswijken. Het stimuleren van fysieke activiteit sluit het beste aan bij de gedragsintenties van kinderen, het ontmoedigen van beeldschermtijd (TV en computer) het minste.
Ongeveer de helft van de ouders van een kind met overgewicht (h)erkent dit overgewicht niet bij hun kind. Deze bevinding hangt niet samen met het opleidingsniveau van de ouders, het geslacht of de etnische herkomst van het kind.
Lekker Fit!, een interventie bestaande uit meerdere componenten, gericht op de reductie van overgewicht en toename van fitheid bij basisscholieren, heeft gunstige korte termijn effecten op de prevalentie van overgewicht, middelomtrek en uithoudingsvermogen bij middenbouw leerlingen (groep 3-5). Dergelijke effecten werden niet gevonden voor bovenbouw leerlingen (groep 6-8). Alhoewel Lekker Fit! gunstige effecten had op de prevalentie van overgewicht, nam de prevalentie niet af. Daarom, is verdere intensivering van de interventie nodig. Bij de verdere intensivering en implementatie van Lekker Fit! is nader evaluatie onderzoek gewenst.

Dankwoord

De afgelopen jaren heb ik met veel plezier en vol overgave gewerkt aan de tot stand koming van dit proefschrift. Het werken in een academische werkplaats met één been in de praktijk en één been in de wetenschap is me zeer goed bevallen.

De plannen om te promoveren waren al langer aanwezig. Met professor Ferd Sturmans, onze 'oude' GGD-directeur, had ik ze al besproken. Promoveren op een vraagstelling vanuit de jeugdgezondheidszorg lag in mijn beginjaren bij de GGD voor de hand. Alice Hazebroek-Kampschreur, mijn coach in die tijd, ging mij daarin voor.

De plannen zijn door allerlei omstandigheden in de ijskast beland. In 2004 was de tijd rijp. Door de vorming van de academische werkplaats Cephir (Centre for Effective Public Health In the larger Rotterdam area) tussen de GGD Rotterdam e.o. en de afdeling Maatschappelijke gezondheidszorg van het Erasmus MC kwam er ruimte om te promoveren. Een klein aantal GGD-medewerkers kon hier één dag in de week aan gaan besteden. Dat ik tot dit selecte gezelschap behoorde, heb ik te danken aan Erik Jan de Wilde, mijn toenmalige afdelingshoofd.

De keuze voor het onderwerp en de vraagstellingen waren niet moeilijk. Uit onderzoek van de jeugdarts Ellen Bergkamp-Hoogestein in het kader van haar opleiding tot sociaal geneeskundige bleek dat overgewicht bij 9-10 jarigen in Rotterdam bij een kwart van de kinderen voorkwam. Dit was veel hoger dan landelijk. En landelijk was men al verontrust door de stijgende trend. De keuze voor het onderwerp 'preventie van overgewicht bij kinderen' zou me bovendien terugbrengen bij mijn studie-'roots': Voeding aan de Landbouw Universiteit.

Eind 2004 ging ik met mijn Jeugdmonitor data onder de arm aan de slag bij MGZ in de hoogbouw van het Erasmus MC. Later diende de onderzoeksvraag zich aan naar de effectiviteit van Lekker Fit!, een belangrijk project binnen het actieprogramma Voeding en Beweging van de gemeente Rotterdam. Het lag voor de hand om voor de beantwoording van deze vraag de deskundigheid van de academische werkplaats te benutten. De onderzoeksvraag paste bovendien perfect in de doelstelling van Cephir om wetenschappelijk bewijs voor beleid en praktijk van de maatschappelijke gezondheidszorg te versterken.

Zo is het dus zo'n beetje verlopen, ook al zijn er gedurende de rit wel wat veranderingen geweest. Veranderingen in begeleiding, waarin Hans Brug gelukkig de rode draad bleef en in samenwerkingspartners bij de GGD en S en R.

Na deze achtergrondschets, waarin ik al wel wat mensen heb genoemd, ga ik nu maar over tot het echte bedanken.
Bedankt:

- Ferd Sturmans en Alice Hazebroek-Kampschreur, voor het planten van het zaadje: het idee om vanuit het werkveld van de GGD te promoveren.
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- Ivo Reuvers, Ron van Walsem, Annemarie Wulffraat, Remon Bahnert, de medewerkers van het onvermoeibare Eurofit testteam en alle andere medewerkers van Sport en Recreatie voor de zeer gewaardeerde samenwerking.
- De leerkrachten en scholen, voor hun medewerking aan de effectstudie naar Lekker Fit!
- De kinderen uit de groepen 6 tot en met 8 van deze scholen, voor het invullen van de vragenlijsten en voor hun reacties op de laatste bladzijde van de vragenlijst. Sommigen vond ik zo mooi, raak, humoristisch, ontwapenend of ontroerend, dat ik ze wel in mijn proefschrift moest opnemen.
- Frouwkje de Waart, voor alle facilitering en stimulansen.
- De collega-onderzoekers bij de GGD, voor het begrip en de collegialiteit. Eén dag in de week academische werkplaats betekende één dag in de week minder tijd voor mijn andere werkzaamheden, zonder dat daar eigenlijk veel vanaf ging. Dat had

consequenties voor iedereen.
- Lonneke Braak-Jansen, voor 160 pagina's punten en komma's.
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- De leden van de kleine en grote commissie, voor het lezen van mijn proefschrift en het meewerken aan mijn promotie. Ik voel me vereerd door het illustere gezelschap dat deze commissie vormt.
- En verder iedereen, die ik hierboven niet expliciet genoemd heb, maar die in welke vorm dan ook bijgedragen hebben aan de tot stand koming van dit proefschrift.

Tenslotte, het thuisfront.
Promoveren in één dag in de week in ruim vier jaar is mogelijk, maar niet zonder heel veel werk mee naar huis te nemen. De tijd die nodig was voor het schrijven van dit proefschrift komt ook uit avonduren, weekenden en vakanties. Hierover is thuis nooit een klacht geuit. Als ik in mijn vrije tijd wilde werken, was dat mijn keuze, ook al leverde me dat wel het etiket 'work-aholic'op. Het sterkste staaltje was wel om een vaste pc (zo'n best nog aardige afdanker van MGZ) in de auto mee te nemen (inclusief computertafel) naar onze vakantiebestemming dwars door Europa heen ruim 3000 km verderop om er daar achter te komen dat de configuratie niet goed is ingesteld. Een hilarische herinnering voor de één, een uiterst gênante voor de ander. Het werk relativeren, wordt met een thuisfront dat je niet altijd serieus neemt, ook stukken gemakkelijker. Ik prijs mij gelukkig met een dergelijk thuisfront en hoop dat ik ze de afgelopen jaren niet tekort heb gedaan. Een aantal excuses hebben nu wel hun langste tijd gehad, zoals het excuus voor mijn geringe vorderingen in de Turkse taal. Mijn warme, meelevende 'schoonfamilie' gaat het vanaf de volgende vakantie misschien wel meemaken, dat ik iets meer kan zeggen dan *teşekkür ederim* (bedankt).
Ook mijn lieve, hulpvaardige schatten van ouders wil ik noemen, die altijd voor hun kinderen klaar staan en bijspringen als het huishouden niet op rolletjes loopt en extra handen ongevraagd toch goed van pas komen.
Lieve Mustafa, Soraya, Ayhan, Deniz, pa en ma, ik houd van jullie en ben jullie dankbaar voor alle steun en liefde in dit promotie-traject.

Het is tijd voor een feestje!

Over de auteur

Wilma Jansen is 12 februari 1962 geboren te Ridderkerk. Zij volgde haar middelbare schoolopleiding aan het Marnix gymnasium te Rotterdam en behaalde haar diploma in 1980. Zij vervolgde haar opleiding aan de Landbouw Universiteit te Wageningen, studierichting Voeding, met als doctoraal vakken Voeding en Ontwikkelingseconomie. Als onderdeel van deze studie evalueerde zij een schoolvoedselprogramma van het World Food Program in Senegal. In 1988 rondde zij haar studie af.

Na een tijdelijke aanstelling, is zij in 1991 in vaste dienst getreden bij de GGD Rotterdam-Rijnmond. Zij werkte achtereenvolgens als junior-onderzoeker, onderzoeker en senior-onderzoeker op het terrein van de jeugdgezondheidszorg.

Sinds 1996 is zij betrokken bij de ontwikkeling en implementatie van de Jeugdmonitor Rotterdam, waarbij vroegtijdige signalering van lichamelijke, emotionele en gedragsproblemen op zowel individueel als collectief niveau centraal staan. Als senior-onderzoeker is zij verantwoordelijk voor de Jeugdmonitor tussen 0 en 12 jaar. Hierbij ligt de nadruk op coördinatie van werkzaamheden, verdere instrumentontwikkeling, uitbreiding naar regiogemeenten en samenwerking met ouder- en kindzorg instellingen in de regio. Een voorbeeld van verdere instrumentontwikkeling is de validatiestudie van de Strengths and Difficulties Questionnaire (SDQ) bij 5-6 jarigen, waarvan zij projectleider is.

Toen uit gegevens van de jeugdgezondheidszorg bleek dat 25% van de Rotterdamse 9-10 jarigen overgewicht had, is zij betrokken geraakt bij het Rotterdamse actieprogramma Voeding en Beweging en de evaluatie van verschillende interventies hieruit. Preventie van overgewicht bij de Rotterdamse jeugd is ook het onderwerp waarop Wilma Jansen in het kader van de academische werkplaats Cephir (Centre for Effective Public Health In the larger Rotterdam area) in december 2004 haar promotie-traject startte.

Publikaties

Jansen, W., Raat, H., Joosten-van Zwanenburg, E.J., Reuvers, I., van Walsem, R., Brug, J. (2008) A school-based intervention to reduce overweight and inactivity in children aged 6-12 years: study design of a randomized controlled trial. *BMC Public Health.* **8,** 257.

Jansen, W., van de Looij-Jansen, P.M., de Wilde, E.J., Brug, J. (2008) Feeling fat rather than being fat may be associated with psychological well-being in young dutch adolescents. *J Adolesc Health.* **42,** 128-136.

Jansen, W., Brug, J. (2006) Parents often do not recognize overweight in their child, regardless of their socio-demographic background. *Eur J Public Health.* **16,** 645-647.

Jansen, W., van de Looij-Jansen, P.M., Ferreira, I., de Wilde, E.J., Brug, J. (2006) Differences in measured and self-reported height and weight in Dutch adolescents. *Ann Nutr Metab.* **50,** 339-346.

Jansen, W., Borsboom, G., Meima, A., Joosten-van Zwanenburg, E., Mackenbach, J.P., Raat, H., Brug, J. (2008) School-based intervention to reduce overweight and improve fitness in primary schoolchildren: a cluster randomized trial [ISRCTN84383524]. *submitted.*

Jansen, W., Mackenbach, J.P., Joosten-van Zwanenburg, E., Brug, J. (2008) Weight status, energy-balance behaviours and intentions in 9 to 12-year-old inner-city children. *submitted.*

Van de Looij-Jansen, P.M., Jansen, W., de Wilde, E.J., Donker, M.C.H., Verhulst, F.C. Discrepancies between parent-child reports of emotional problems among preadolescent children and how this relates with ethnic background and future emotional problems. *submitted.*

Jansen, W., Van Wijngaarden-Versteeg, R., Bleeker, J.K., Bergkamp-Hoogenstein, E.H.M. (2004) De relatie tussen overgewicht en psychische gezondheid bij 9- en 10-jarigen in Rotterdam. *TSG.* **82,** 426-434.

Reelick, N.F., Jansen, W. (2001) De Rotterdamse jeugdmonitor en het Rotterdamse jeugdbeleid. In: Gerris, J.R.M., editor. Jeugdzorg en jeugdbeleid naar integraal welzijn. Assen: Koninklijke Van Gorcum BV.

Jansen, W., Hazebroek-Kampschreur, A.A. (1997) Differences in height and weight between children living in neighbourhoods of different socioeconomic status. *Acta Paediatr.* **86,** 224-225.

PhD Portfolio Summary

Summary of PhD training and teaching activities

Name PhD student: Wilma Jansen Erasmus MC Department: Public Health Research School:	PhD period: dec 2004-sept 2009 Promotor(s): J. Brug & J.P. Mackenbach Supervisor: H. Raat

1. PhD training

	Year	Workload (Hours/ ECTS)
General academic skills		
Research skills - Statistics : Multilevel analyse met SPSS	2006	8 hours
In-depth courses (e.g. Research school, Medical Training)		
Presentations - "Onderrapportage van overgewicht bij Rotterdamse jeugd" Cephir seminar 11 februari 2005 - NCVGZ 2005 "Validiteit van zelfgerapporteerde lengte en gewicht gegevens van brugklassers" - "Effectevaluatie project Lekker Fit!" Cephir seminar 25 mei 2007 - Poster presentation ISBNPA 2007 "Determinants of overweight in 9-12 year old inner city children: differences according to gender and ethnicity" - NCVGZ 2009 "Een schoolgerichte interventie ter bestrijding van overgewicht en bewegingsarmoede: resultaten van een rct" - Poster presentation ISBNPA 2009 "Effectiveness of a school-based intervention to reduce overweight and improve fitness in primary schoolchildren [ISRCTN84383524]"	2005 2005 2007 2007 2009 2009	12 hours 20 hours 12 hours 20 hours 20 hours 20 hours
International conferences - Sixth annual conference of the International Society of Behavioral Nutrition and Physical Activity (ISBNPA) - Eighth annual conference of the International Society of Behavioral Nutrition and Physical Activity (ISBNPA)	2007 2009	24 hours 24 hours
Seminars and workshops		
Didactic skills		

Other		
2. Teaching activities		
	Year	**Workload (Hours/ECTS)**
Lecturing		
Supervising practicals and excursions		
Supervising Master's theses		
Other		