

Self-reported and parent-reported body size perception of Dutch children at the age of 11 and 14

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English Abstract

Self-reported and parent-reported body size perception of Dutch children at the age of 11 and 14.

Background: Accurate body size perceptions may help decreasing childhood overweight, however children and parents are poor in estimating BMI.

Aims: To investigate if the questions: 'Would you describe yourself/your child as slim/skinny?' and 'Would you describe yourself/your child as heavy/chubby?' can be used to identify underweight and overweight children. Additionally, age and gender differences are investigated and whether children and parents gave identical answers.

Method: In the Prevention and Incidence of Asthma and Mite Allergy (PIAMA-) cohort, children and their parents received questionnaires when the child was 11 (n=2379) and 14 (n=2164). Children were classified into underweight, normal-weight and overweight/obesity (using parent-reported height/weight). Sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) of the questions were assessed. Age and gender differences were evaluated and agreement between children and parents was calculated.

Results: For the question 'Would you describe yourself/your child as slim/skinny?' sensitivity was moderate in parents of 11-year-old boys (71.7%), poor in 11-year-old girls (47.7%) and low in the rest (51.7%-67.4%). Specificity was good (82.0%-87.3%), but excellent in girls' parents (91.3%-93.2%). PPVs were low in girls' parents (54.5%-55.1%), poor in boys' parents and children (34.7%-40.3%).

For the question 'Would you describe yourself/your child as heavy/chubby?' sensitivity was low in boys and parents (53.8%-66.1%), but moderate in girls (70.2%-78.6%). Specificity was good in girls (84.6%-88.6%) and excellent in boys and parents (93.4%-97.8%). PPVs were poor in girls (27.0%-38.2%), moderate in parents of 14-year-old boys (72.8%), low in boys and in girls' parents (50.4%-60.8%). All NPVs were excellent (89.9%-98.2%).

Agreement was better between boys ($\kappa=0.504-0.658$), than between girls ($\kappa=0.373-0.541$) and their parents.

Conclusion: The questions cannot be used for identifying underweight or overweight children. Agreement between children and their parents was moderate/good. Yet, parents are more accurate.

Implications: Dutch children and their parents need assistance for accurate body size perceptions.

Keywords: Body size perception, children, parents, BMI-classification, agreement

Introduction

Worldwide, the prevalence of children who are overweight or even obese is rapidly growing¹. In 2013, over 42 million children under the age of five were estimated to be overweight¹. Childhood overweight is a risk factor for many chronic diseases and there is an increased risk of morbidity and mortality in adulthood²⁻⁴. Overweight and obesity are largely preventable¹. Healthy food habits and adequate physical activity during childhood reduces the risk of many chronic diseases^{5,6}. Food habits and weight management are strongly influenced by body size perception⁷. Overall, an accurate body size perception may lead to more healthy behaviors⁷.

Several studies investigated the association between children's body size perception and their real body weight. Percentages of children accurately estimating their weight vary (ranging from 38%-75%)⁸⁻¹³. The highest correct perception is found in normal-weight children⁸. Overweight or obese children were found to under-report their BMI^{10,14-16} and underweight children over-reported their BMI¹⁴. Misperception of weight also seems to differ by gender. Significantly more girls than boys correctly described their body weight status^{10,13,17}.

A successful approach for treatment and prevention of weight issues in children also involves parental support. Recognition by parents of weight problems in their children is of critical importance¹⁸. However, in general, the ability of parents to recognize under- or overweight seems poor¹⁹. In underweight children, about a quarter to half of the parents did not recognize their child as having underweight¹⁹⁻²¹. In overweight and obese children, even more than half of the parents did not recognize their child as having overweight or obesity¹⁹⁻²³.

In most studies, participants were asked to classify children according to BMI-classification (e.g. underweight, normal-weight, overweight). Subjective expressions (e.g. skinny or heavy) of body size have rarely been studied, though this might be easier for children and their parents to describe.

For the purpose of this study, data of the Prevention and Incidence of Asthma and Mite Allergy (PIAMA) birth cohort study will be used. In 1996, researchers investigated childhood asthma. Already in the early years of this study, it became apparent that not only asthma, but also overweight was increasing. Therefore, they collected weight and height data, together with a wide range of environmental and lifestyle factors, through annual questionnaires that parents and their children in the PIAMA-cohort received.

Aims

First of all, the aim of the present study is to investigate if the question: 'Would you describe yourself/your child as slim/skinny?' can be used to identify underweight children at the age of 11 and 14, by asking a child and his/her parent(s). Secondly, if the question: 'Would you describe yourself/your child as heavy/chubby?' can be used to identify overweight children at the age of 11 and 14, by asking a child and his/her parent(s).

In addition, this study aims to investigate whether the child and his/her parents have an identical perception of the child's body size. Age and gender differences will also be evaluated.

Methods

Design

This study is a secondary analysis of data gathered in the PIAMA birth-cohort study.

Participants

The study population consisted of children and their parents who participated in the PIAMA birth-cohort study, set up in 1996 in the Netherlands. In the original study, allergic and non-allergic pregnant women were recruited from the general population (in three different regions of the Netherlands) to identify children having a high or a low risk for childhood asthma. The baseline population consisted of 4146 pregnant women. They completed questionnaires during pregnancy, when their child was 3 months old (n=3963), and then annually from 1 up to 8 years old (n=3963, n=3910, n=3884, n=3842, n=3745, n=3723, n=3661, n=3649). At the child's age of 11 and 14 the children themselves also received a questionnaire. Further details of the PIAMA study have been published previously²⁴.

For the present study, data of 11- and 14-year-old children and their parents were used. At the child's age of 11, questionnaires were returned by 2,651 children and 2,660 parents. At the age of 14, 2521 children and 2337 parents returned the questionnaire.

Children were included if complete data on age, weight and height (parent-reported) were available and when the child or parent(s) answered at least one question about body size perception. Extreme cases (BMI z-scores below or above 3, (n=41)), conflicting answers on body size perception (describing their selves/their child as both slim/skinny and heavy/chubby (n=12)), and children diagnosed with an eating disorder (n=6) were excluded, as they were more likely to bias the results.

The study population of this study then consisted of 2,379 11-year-olds (1,203 boys and 1,176 girls) and 2,164 14-year-olds (1,101 boys and 1,063 girls) (Figure 1).

Data collection

Children and their parents received questionnaires at the child's age of 11 years (2008/2009) and 14 years old (2011/2012).

Topics of the child's questionnaire were: demographic characteristics (age, grade), health (allergies/infections, body size perception, dieting), health care and medication use (GP visits), mental well-being, physical activity, sedentary behaviour, sleep duration and quality, food and drinks consumption, smoking (passive, active), stages of puberty and education.

Topics of the parental questionnaires regarding their children were: growth characteristics (age, weight, height), health (allergies/infections, body size perception) health care and medication use (GP visits), food consumption and dieting, housing characteristics (carpeting,

mould, dampness, gas cooking), traffic, smoking and pets. In addition, parents answered questions about the pregnancy and parental health (their own weight and family history of asthma, allergies and other diseases).

For the purpose of the current research several questions have been selected.

Body size perception

To define the perception that children and their parents have of the body size of the child, the yes-/no-questions: 'Would you describe yourself/your child as slim/skinny?' and 'Would you describe yourself/your child as heavy/chubby?' were derived from both questionnaires.

Reported weight and height

Parents were asked to report weight of their child in kilograms at the nearest 0.1 kg and height of their child in centimeters. If the child was weighed and measured by a professional recently (within the last year), parents were asked to report those measurements. When the child was not recently weighed and/or measured, parents had to weigh and measure their child, without him/her wearing shoes or heavy clothes.

BMI

Child's BMI was calculated based on the parent-reported weight and height (weight in kilograms divided by height squared in meters (kg/m^2)). The age and gender specific BMI cut-off values proposed by the International Obesity Task Force (IOTF) were used to classify the children into the groups 'underweight' (thinness grade 1, 2 and 3), 'normal-weight' and 'overweight/obese'^{25,26}. The IOTF cut-off values represent cut-off points that match adult cut-offs: values at 18 years of age were tracked back to define BMI values at younger ages (Appendix 1). Thinness grade 3, 2, 1, overweight and obesity correspond to BMI cut-offs of 16, 17, 18.5, 25 and 30 at age 18, respectively.

Age

Age (in days) was calculated by taking the difference between date of birth and date of measuring weight and height.

Parent(s)

Parents answered the question: 'Who filled in the questionnaire?'. Answer categories were: 'mom', 'dad', 'both' and 'other'.

Data analysis

Children were classified into the groups 'underweight' (thinness grade 1, 2 and 3), 'normal-weight' and 'overweight/obese' according to the BMI cut-off values of the IOTF. Sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) of the questions 'Would you describe yourself/your child as slim/skinny?' and 'Would you describe yourself/your child as heavy/chubby?' were assessed. Analyses were stratified by sex and age, and differences were evaluated.

Sensitivity and specificity

Sensitivity was defined as the percentage of 'true positives' (e.g. percentage of underweight children described as slim/skinny by their selves/their parents). A high sensitivity for the question: 'Would you describe yourself/your child as slim/skinny?' would indicate that the question can be used for identifying underweight children. In addition, a high sensitivity for the question: 'Would you describe yourself/your child as heavy/chubby?' would indicate that this question can be used for at identifying overweight/obese children.

Specificity was defined as the percentage of 'true negatives' (e.g. percentage of non-overweight children described as not heavy/chubby by their selves/their parents). A high specificity for the question: 'Would you describe yourself/your child as slim/skinny?' would indicate that this question can be used for identifying non-underweight children. In addition, a high specificity for the question: 'Would you describe yourself/your child as heavy/chubby?' would indicate that this question can be used for identifying non-overweight/non-obese children.

In this study, sensitivity and specificity values below 50% were defined as poor, between 50%-70% as low, between 70%-80% as moderate, between 80%-90% as good and above 90% as excellent.

Positive (PPV) and negative predictive values (NPV)

Positive predictive values for the question 'Would you describe yourself/your child as slim/skinny?' were defined as the percentage who described their selves/their child as slim/skinny and where the child is, based on the BMI cut-off values, in fact underweight. Positive predictive values for the question 'Would you describe yourself/your child as heavy/chubby?' were defined as the percentage who described their selves/their child as heavy/chubby and where the child is, based on the BMI cut-off values, in fact overweight.

Negative predictive values for the question 'Would you describe yourself/your child as slim/skinny?' were defined as the percentage who did not describe their selves/their child as underweight and where the child is, based on the BMI cut-off values, not underweight. Negative predictive values for the question 'Would you describe yourself/your child as heavy/chubby?'

were defined as the percentage who did not describe their selves/their child as heavy/chubby and where the child is, based on the BMI cut-off values, not overweight.

In this study, PPVs and NPVs below 50% were defined as poor, between 50%-70% as low, between 70%-80% as moderate, between 80%-90% as good and above 90% as excellent.

Agreement between children and their parents

Agreement between children and their parents on the perception of the child's body was calculated by using cross tabulations and the formula of Cohen's Kappa. A Kappa between 0.4 and 0.75 means there is a moderate to good agreement, a Kappa > 0.75 means there is a very good agreement between children and their parents²⁷. Agreement between the perception of children and parents could only be calculated when data was available for both children and their parents. When the child or the parent(s) did not answer the question: 'Would you describe yourself/your child as slim/skinny?', they both were left out of this analysis. The same applied for the question 'Would you describe yourself/your child as heavy/chubby?'.

Procedures

Statistical analyses were conducted using SPSS version 21 (IBM Corporation, UK). All statistical tests were two-tailed with a level of significance of 0.05 and stratified by sex and age. When more than 5% of the answers on the questions concerning body size perception was missing, the randomness of the missing answers was evaluated. This was done by dividing the sample into two groups: those with and those without missing answers. Then the BMI of the two groups was compared to see if the groups were comparable.

Ethical issues

The Medical Ethical Committees of the participating institutes approved the original PIAMA birth cohort study and all participants gave written informed consent.

Results

Characteristics

In 2008/2009, ages of the children ranged from 9.8 to 13.5 years (median 11.3) and in 2011/2012 from 12.3 to 16.4 years (median 14.8). Weight and height of the children are shown in Table 1. At the age of 11 years, no significant differences were found between boys and girls in age, weight and height. At the age of 14, boys were found to be reported as taller (175.0 cm vs. 168.0 cm) and heavier (60.0 kg vs. 55.8 kg) than girls, yet resulting in a lower BMI (19.2 kg/m² vs. 19.7 kg/m²). At the age of 11, about three quarters of the children (76.4%) were classified as having normal-weight. Of the remaining children, more were classified as having underweight (14.2%) than as having overweight (9.4%). Quite similar percentages were found at the age of 14; 78.4% of the children were classified as having normal-weight, 13.3% as having underweight and 8.3% as having overweight. Of the returned questionnaires, most were filled in by mothers (85.9%). A small percent was filled in by fathers (6.8%) and a similar percent of the questionnaires was filled in by both mother and father (6.5%).

'Would you describe yourself as slim/skinny?'

For the question: 'Would you describe yourself as slim/skinny?' sensitivity was poor for 11-year-old girls (47.7%). In 14-year-old girls and in boys, the sensitivity was low (53.8%-62.3%). Specificity for this question was good for all children (82.7%-87.3%).

PPVs for the question 'Would you describe yourself as slim/skinny?' were poor for all children (34.7%-40.3%). On the other hand, NPVs for this question were excellent for all children (89.9%-93.7%).

'Would you describe your child as slim/skinny?'

For the question: 'Would you describe your child as slim/skinny?' sensitivity was moderate in parents of 11-year-old boys (71.7%). In parents of 14-year-old boys and in parents of girls, the sensitivity was low (51.7%-67.4%). Specificity for this question was good in parents of boys (82.0%-84.3%), but excellent in parents of girls (91.3%-93.2%).

PPVs for the question 'Would you describe your child as slim/skinny?' were poor in parents of boys (35.6%-40.1%) and low in parents of girls (54.5-55.1%). NPVs for this question were excellent for all parents (91.9%-95.3%).

'Would you describe yourself as heavy/chubby?'

For the question: 'Would you describe yourself as heavy/chubby?' sensitivity was low in boys (53.8%-62.2%), but moderate in girls (70.2%-78.6%). Specificity, on the other hand, was good in girls (84.6%-88.6%), but excellent in boys (93.4%-95.5%).

PPVs for the question 'Would you describe yourself as heavy/chubby?' were poor in girls (27.0%-38.2%), but low in boys (50.4%-56.4%). NPVs for this question were excellent for all children (95.0%-98.2%).

Would you describe your child as heavy/chubby?

For the question: 'Would you describe your child as heavy/chubby?' sensitivity was low for all parents (55.1%-66.1%). Specificity for this question was excellent for all parents (94.7%-97.8%).

PPVs for the question 'Would you describe your child as heavy/chubby?' were moderate in parents of 14-year-old boys (72.8%). In parents of 11-year-old boys and in parents of girls, PPVs were low (52.9%-60.8%). NPVs for this question were excellent for all parents (95.3%-96.9%).

Agreement between children and their parents

Overall, the agreement on body size between children and their parents was moderate to good. In boys and their parents, kappa's for agreement range from 0.504 to 0.658 (at age 11: $\kappa=0.589$ for slim/skinny, $\kappa=0.658$ for heavy/chubby and at age 14: $\kappa=0.504$ for slim/skinny, $\kappa=0.552$ for heavy/chubby) . In girls and their parents, kappa's for agreement range from 0.373 to 0.541 (at age 11: $\kappa=0.541$ for slim/skinny, $\kappa=0.538$ for heavy/chubby and at age 14: $\kappa=0.401$ for slim/skinny, $\kappa=0.373$ for heavy/chubby) (Table 3).

Missing answers

Only in 11-year-old boys, more than 5% was missing on a single question. Of them, 5.2% did not answer the question 'Would you describe yourself as heavy/chubby?'. BMI-values of those who did not answer the question were compared to BMI-values of those who did answer. No significant differences were found ($p=0.950$).

Discussion

This study reveals a discrepancy between the body size perception of children and the BMI-classification. Sensitivity and positive predictive values of the questions 'Would you describe yourself/your child as slim/skinny?' and 'Would you describe yourself/your child as heavy/chubby?' are rather low, however specificity and negative predictive values are high.

Sensitivity and PPVs of the questions are comparable with values for classifying children as under- or overweight as reported in the literature^{14,28-34}. With few exceptions, higher sensitivity and PPVs are found for the question 'Would you describe yourself/your child as heavy/chubby?' than for the question 'Would you describe yourself/your child as slim/skinny?'. Similar findings were reported in previous studies for classifying children as over- and underweight, respectively^{30,31}. A possible explanation for this, is the growing attention for overweight and its risks. Therefore, children and their parents might be more likely to recognize a child that's too heavy than a child that's too thin. In addition, heavy children are more at risk for bullying^{35,36}, which might create more awareness for being overweight than for being underweight.

In line with other studies, specificity and negative predictive values are high^{14,28-34}. This would indicate that children and their parents are good in identifying non-underweight and non-overweight children. However, those high percentages can also be explained by the relatively large amount of normal-weight children in this study.

In previous studies^{17,21,37,38}, it appeared that girls were better able to recognize themselves as overweight than boys. As for this study, sensitivity of the question 'Would you describe yourself as heavy/chubby?' was moderate in girls. However PPVs were poor. This would imply that high percentages of the overweight girls answered 'Yes' to the question. But, in addition, only a low percentage of all the girls that answered 'Yes', actual had overweight. Apparently, girls seem to be more likely to answer 'Yes' to the question 'Would you describe yourself as heavy/chubby?' even when they are not overweight, consistent with previous findings^{8,11}. Page and Fox³⁹ suggest that many girls confuse the pubertal maturation as becoming 'fat'. Early maturation might even lead to more 'fat' feelings⁴⁰. In this study, pubertal maturation was not part of the analyses. Therefore, no conclusions can be drawn regarding the pubertal maturation of the girls that answered 'Yes'. It is recommended that future studies should include this topic.

In this study, parents were found to be more accurate in their perceptions than the children, in line with the study of Boddé et al²³. Yet, between 33.9%-44.9% of the parents of overweight children answered 'No' to the question 'Would you describe your child as heavy/chubby?'. A possible explanation for answering 'No' to this question, is that overweight is becoming more common and therefore parents might be more likely to think of it as normal. In the study of Juliusson et al.¹⁹ an even higher number of parents (71.2%) described their overweight children as being of normal-weight. Their study population however, consisted of

children aged between 2 and 19 years and inaccurate perceptions were more common in pre-school children in the age of 2-5 years¹⁹, which could explain the difference.

As for agreement between children and their parents, van Vliet et al.⁴¹ concluded that mothers and their daughters did not agree very well on body size perception. In the present study, agreement between girls and their parents on body size was found to be only moderate. Between boys and their parents, however, there is a slightly better agreement than between girls and their parents. As said before, girls seem to be more likely to describe themselves as heavy/chubby, even when they are not overweight. Parents are found to be more accurate in their perceptions and might therefore, disagree more often with the daughters than with the sons. Furthermore, there is a better agreement between children and their parents at the age of 11 than at the age of 14. Overall, children seem to have a slightly (but not remarkable) higher sensitivity and PPVs at the age of 14 than at the age of 11, in line with the study of Chung et al.¹⁷. The parents, however, have slightly (also not remarkable) lower sensitivity and PPVs at the age of 14. This might explain a somewhat lower agreement between 14-year-olds and their parents.

Furthermore, between 21.4%-46.2% of the overweight children answered 'no' to the question 'Would you describe yourself as heavy/chubby?'. Overweight children who do not see themselves as overweight, are unlikely to change their lifestyle in order to obtain a healthy weight⁷. Chung et al.¹⁷ found a 20% to 30% increase in weight loss efforts in children who had an accurate perception of being overweight/obese. On the other hand, in this study, between 43.6%-73% of the non-overweight children described themselves as heavy/chubby. Children who are not overweight, but see themselves as overweight, may be at risk for eating disorders or unhealthy dieting and exercising^{7,42}. It is therefore of importance that both children and their parents have an accurate perception of the child's body size. In the Netherlands, the juvenile health care program of the Public Health Department (GGD) provides guidance to parents and children from 4 to 19 years of age in terms of the physical, mental and social development. They check the child's growth and development at certain points in time. They are able to recognize under- or overweight and may help the child and his/her parents to identify a healthy weight. It is recommended that those professionals assist the child and his/her parents to get an accurate perception of the body size of the child.

By interpreting the results of this study, several limitations of this should be taken into account. First of all, this is a secondary analysis of already gathered data. Body size perception was determined by only two subjective questions and nuances about body size perception may not be evident, since there were only 2 choices to answer (yes/no). Consequently, the results should be interpreted with caution. Second, the study may be limited due to the parent-reported data. It is not clear whether the parents actually had measured height and weight of their children. As a result, misclassification of children into groups may have occurred. Bekkers et al.⁴³

investigated the children in the PIAMA-cohort when they were 8 years old and found that body weight and height reported by the parents corresponded well with the actual measured values. However, the prevalence of childhood overweight (11.9%), was slightly underestimated by parents compared with measured BMI of the children (13.7%) ($P=0.0027$)⁴³. For this study this might imply that a small proportion of the overweight children was misclassified as normal-weight. However, this study used a large sample, and a small underestimation of overweight children may not lead to big differences in sensitivity, specificity, PPVs and NPVs. This study was further strengthened by including both sexes and was not limited to a single geographical area. The results are therefore likely to be representative for the total population of Dutch children and their parents. Yet, future research should include more factors that could influence both parents' and children's body size perception. In this study, only age, sex and weight status were part of the analysis.

Conclusion

In conclusion, this study shows that the questions 'Would you describe yourself/your child as slim/skinny?' and 'Would you describe yourself/your child as heavy/chubby?' cannot be used for identifying underweight and overweight children, respectively. Children and their parents tend to be poor in describing underweight children as slim/skinny and overweight children as heavy/chubby. On the other hand, high percentages are found in describing non-underweight and non-overweight children. Agreement between children and their parents is moderate to good, but overall, parents are found to be more accurate than their children. As for gender differences, girls describe their selves more often as heavy/chubby, as compared to boys, even when they are not overweight.

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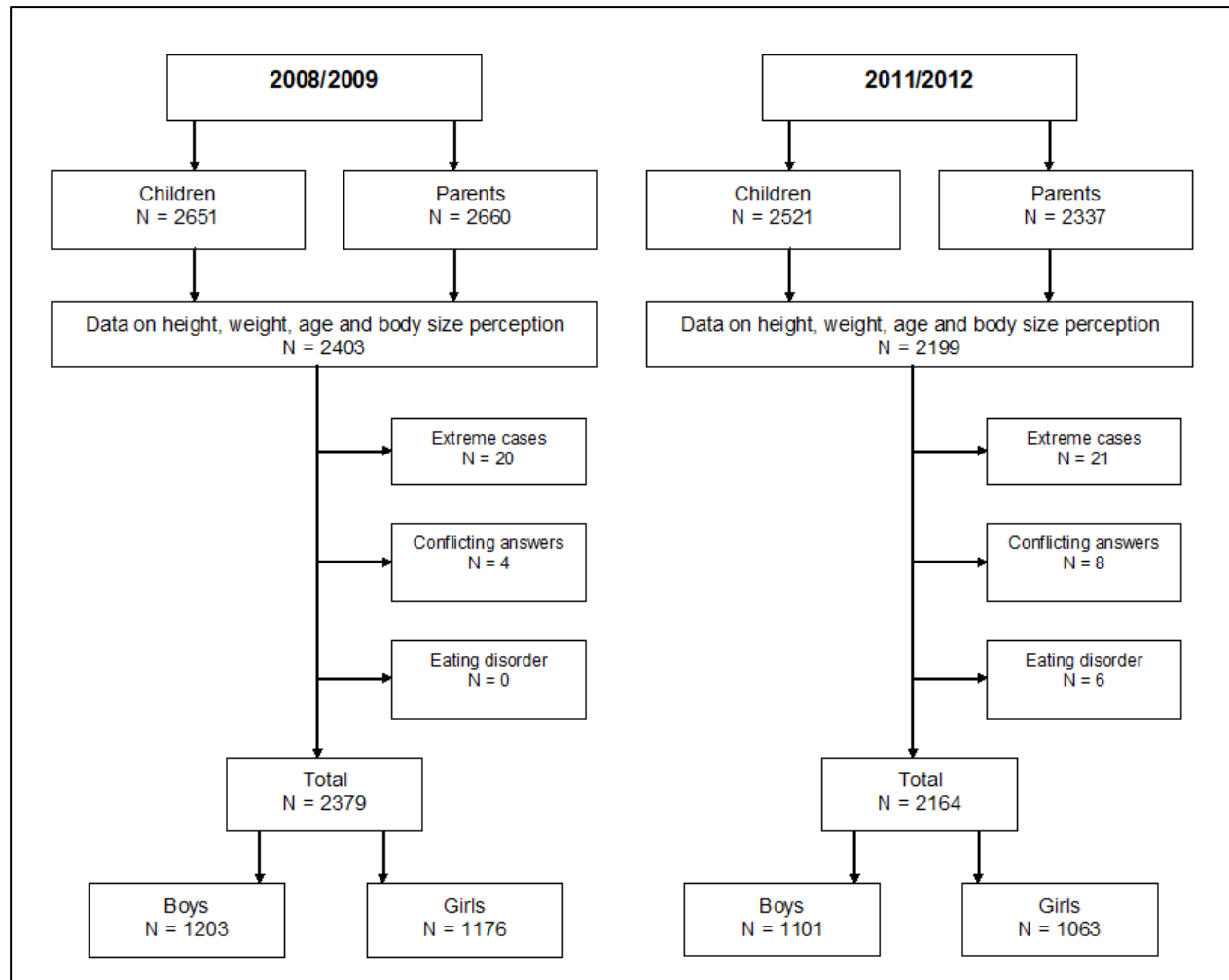


Figure 1 – Flowchart of children and their parents included in the study

Table 1 – Descriptive statistics by age and sex*

		2008/2009		2011/2012	
		Children at age 11 (n=2379)		Children at age 14 (n=2164)	
		Boys (n=1203)	Girls (n=1176)	Boys (n=1101)	Girls (n=1063)
Age (in years)		11.3 (9.8-13.5)	11.3 (10.1-13.4)	14.8 (12.4-16.4)	14.8 (12.3-16.0)
Parent-reported anthropometrics of their child	Weight (in kg)	39.5 (26-68)	40.0 (22-72)	60.0 (34-99)	55.8 (35-91)
	Height (in cm)	152.0 (131-178)	152.0 (118-176)	175.0 (146-198)	168.0 (142-187)
	BMI (in kg/m ²)	17.1 (13.2-24.8)	17.2 (12.1-24.7)	19.2 (12.4-28.1)	19.7 (12.4-27.6)
Classification**	Thinness grade 3	0	11 (0.9%)	8 (0.7%)	8 (0.8%)
	Thinness grade 2	19 (1.6%)	22 (1.9%)	18 (1.6%)	27 (2.5%)
	Thinness grade 1	134 (11.1%)	151 (12.8%)	115 (10.4%)	112 (10.5%)
	Normal	931 (77.4%)	887 (75.4%)	853 (77.5%)	844 (79.4%)
	Overweight	119 (9.9%)	105 (8.9%)	107 (9.7%)	72 (6.8%)
	Obesity	0	0	0	0
Parent(s) who filled in the questionnaire	Mom	1023 (85.5%)	1040 (88.9%)	940 (85.8%)	901 (85.3%)
	Dad	105 (8.8%)	70 (6.0%)	72 (6.6%)	63 (6.0%)
	Both	68 (5.7%)	60 (5.1%)	83 (7.6%)	86 (8.1%)
	Other	0	0	1 (0.1%)	6 (0.6%)

*Data are presented as medians (range) and n (%)

**IOTF-criteria for thinness by Cole et al. (26) and criteria for overweight by Cole et al. (25)

(Thinness grade 3: <16 kg/m², Thinness grade 2: 16-17 kg/m², Thinness grade 1: 17-18.5 kg/m², Normal: 18.5-25 kg/m², Overweight: 25-30 kg/m², Obesity: >30 kg/m² at age 18.)

Table 2a – Sensitivity and specificity (% and CI) for body size perception by sex and age

		Sensitivity		Specificity	
		Age 11	Age 14	Age 11	Age 14
Slim/skinny	Boys	61.7 (53.9-69.5)	62.3 (54.2-70.4)	83.3 (81.0-85.6)	82.7 (80.3-85.1)
	Parents	71.7 (64.6-78.9)	67.4 (59.6-75.1)	84.3 (82.1-86.5)	82.0 (79.6-84.5)
	Girls	47.7 (40.3-55.1)	53.8 (45.7-62.0)	85.6 (83.4-87.9)	87.3 (85.1-89.5)
	Parents	56.3 (49.1-63.5)	51.7 (43.6-59.8)	91.3 (89.6-93.1)	93.2 (91.6-94.9)
Heavy/chubby	Boys	62.2 (53.1-71.2)	53.8 (44.3-63.3)	93.4 (91.9-94.9)	95.5 (94.1-96.8)
	Parents	66.1 (57.4-74.7)	55.1 (45.7-64.6)	95.4 (94.2-96.7)	97.8 (96.9-98.7)
	Girls	70.2 (61.4-79.0)	78.6 (69.0-88.2)	88.6 (86.6-90.5)	84.6 (82.3-86.9)
	Parents	61.5 (52.2-70.9)	56.9 (45.5-68.4)	94.7 (93.3-96.0)	96.4 (95.2-97.5)

Table 2b – Positive and Negative Predictive Values (% and CI) for body size perception by sex and age

		Positive Predictive Value		Negative Predictive Value	
		Age 11	Age 14	Age 11	Age 14
Slim/skinny	Boys	35.5 (29.7-41.4)	34.7 (28.8-40.6)	93.6 (92.0-95.2)	93.7 (92.1-95.4)
	Parents	40.1 (34.3-45.9)	35.6 (29.8-41.3)	95.3 (94.0-96.7)	94.5 (92.9-96.0)
	Girls	37.8 (31.5-44.2)	40.3 (33.4-47.3)	89.9 (88.0-91.9)	92.2 (90.4-94.0)
	Parents	54.5 (47.4-61.6)	55.1 (46.8-63.4)	91.9 (90.2-93.6)	92.3 (90.6-94.0)
Heavy/chubby	Boys	50.4 (42.0-58.7)	56.4 (46.8-66.1)	95.8 (94.6-97.1)	95.0 (93.6-96.3)
	Parents	60.8 (52.2-69.4)	72.8 (63.2-82.5)	96.3 (95.2-97.5)	95.3 (94.0-96.6)
	Girls	38.2 (31.3-45.1)	27.0 (20.9-33.1)	96.7 (95.6-97.9)	98.2 (97.3-99.1)
	Parents	52.9 (44.0-61.8)	53.2 (42.1-64.4)	96.2 (95.0-97.4)	96.9 (95.8-97.9)

Table 3 – Agreement between children and their parents on body size perception (Cohen's Kappa)

		Age 11		Age 14	
		n	Cohen's Kappa	n	Cohen's Kappa
Slim/skinny	Boys	1139	0.589	1073	0.504
	Girls	1135	0.541	1038	0.401
Heavy/chubby	Boys	1131	0.658	1070	0.552
	Girls	1132	0.538	1035	0.373

Appendix 1 – IOTF cut-off points

Boys						
BMI (kg/m ²) at age 18 years						
Age (years)	<16 Thin 3	<17 Thin 2	<18,5 Thin 1	>25 Overweight	>30 Obesity	>35 Morbid obesity
9,75	12,65	13,41	14,56	19,61	23,66	27,88
9,83	12,67	13,43	14,58	19,67	23,76	28,04
9,92	12,68	13,45	14,61	19,74	23,86	28,2
10	12,7	13,47	14,63	19,8	23,96	28,35
10,08	12,71	13,49	14,66	19,86	24,06	28,51
10,17	12,73	13,51	14,68	19,92	24,16	28,65
10,25	12,74	13,53	14,71	19,97	24,25	28,8
10,33	12,76	13,55	14,73	20,04	24,35	28,94
10,42	12,78	13,57	14,76	20,09	24,44	29,08
10,5	12,8	13,59	14,79	20,15	24,54	29,22
10,58	12,81	13,61	14,82	20,21	24,63	29,35
10,67	12,83	13,63	14,84	20,27	24,72	29,48
10,75	12,85	13,66	14,87	20,33	24,81	29,61
10,83	12,87	13,68	14,9	20,39	24,9	29,73
10,92	12,89	13,7	14,93	20,45	24,98	29,86
11	12,91	13,73	14,96	20,51	25,07	29,97
11,08	12,94	13,75	14,99	20,56	25,15	30,09
11,17	12,96	13,78	15,02	20,62	25,24	30,2
11,25	12,98	13,8	15,05	20,68	25,32	30,31
11,33	13	13,83	15,08	20,74	25,4	30,42
11,42	13,03	13,86	15,12	20,79	25,48	30,52
11,5	13,05	13,89	15,15	20,85	25,56	30,63
11,58	13,08	13,92	15,18	20,91	25,64	30,73
11,67	13,1	13,94	15,22	20,97	25,72	30,83
11,75	13,13	13,97	15,25	21,03	25,79	30,93
11,83	13,16	14,01	15,29	21,08	25,87	31,02
11,92	13,19	14,04	15,32	21,14	25,94	31,12
12	13,21	14,07	15,36	21,2	26,02	31,21
12,08	13,24	14,1	15,4	21,25	26,09	31,3
12,17	13,28	14,13	15,44	21,31	26,17	31,39
12,25	13,31	14,17	15,47	21,37	26,24	31,47
12,33	13,34	14,2	15,51	21,43	26,31	31,56
12,42	13,37	14,24	15,55	21,49	26,38	31,64
12,5	13,4	14,27	15,59	21,54	26,45	31,73
12,58	13,44	14,31	15,63	21,6	26,52	31,81
12,67	13,47	14,34	15,67	21,66	26,59	31,89
12,75	13,5	14,38	15,71	21,72	26,66	31,97
12,83	13,54	14,42	15,75	21,78	26,73	32,04
12,92	13,58	14,46	15,8	21,83	26,8	32,12
13	13,61	14,5	15,84	21,89	26,87	32,19
13,08	13,65	14,54	15,88	21,95	26,94	32,27

13,17	13,69	14,58	15,93	22,01	27	32,33
13,25	13,73	14,62	15,97	22,07	27,07	32,41
13,33	13,76	14,66	16,02	22,13	27,14	32,48
13,42	13,8	14,7	16,06	22,19	27,2	32,54
13,5	13,84	14,74	16,11	22,24	27,26	32,6
13,58	13,88	14,79	16,16	22,3	27,33	32,67
13,67	13,93	14,83	16,2	22,36	27,39	32,74
13,75	13,97	14,87	16,25	22,42	27,46	32,8
13,83	14,01	14,92	16,3	22,48	27,52	32,86
13,92	14,05	14,96	16,35	22,54	27,58	32,92
14	14,09	15,01	16,39	22,6	27,64	32,97
14,08	14,14	15,05	16,44	22,66	27,7	33,03
14,17	14,18	15,1	16,49	22,72	27,76	33,08
14,25	14,22	15,14	16,54	22,77	27,82	33,14
14,33	14,26	15,19	16,59	22,83	27,88	33,19
14,42	14,31	15,23	16,64	22,89	27,94	33,25
14,5	14,35	15,28	16,68	22,95	28	33,3
14,58	14,4	15,33	16,73	23	28,05	33,34
14,67	14,44	15,37	16,78	23,06	28,11	33,39
14,75	14,48	15,42	16,83	23,12	28,16	33,43
14,83	14,53	15,46	16,88	23,17	28,22	33,47
14,92	14,57	15,51	16,93	23,23	28,27	33,52
15	14,61	15,55	16,98	23,28	28,32	33,56
15,08	14,66	15,6	17,02	23,33	28,37	33,6
15,17	14,7	15,64	17,07	23,39	28,42	33,64
15,25	14,74	15,69	17,12	23,44	28,47	33,67
15,33	14,78	15,73	17,16	23,49	28,52	33,71
15,42	14,83	15,78	17,21	23,54	28,56	33,74
15,5	14,87	15,82	17,26	23,59	28,61	33,78
15,58	14,91	15,87	17,3	23,64	28,66	33,81
15,67	14,95	15,91	17,35	23,69	28,7	33,85
15,75	15	15,95	17,4	23,74	28,75	33,88
15,83	15,04	16	17,44	23,79	28,8	33,92
15,92	15,08	16,04	17,49	23,84	28,84	33,95
16	15,12	16,08	17,53	23,89	28,89	33,98
16,08	15,16	16,12	17,57	23,94	28,93	34,01
16,17	15,2	16,17	17,62	23,99	28,97	34,05
16,25	15,24	16,21	17,66	24,04	29,02	34,08
16,33	15,28	16,25	17,71	24,08	29,06	34,12
16,42	15,32	16,29	17,75	24,13	29,11	34,15

Girls						
BMI (kg/m ²) at age 18 years						
Age (years)	<16 Thin 3	<17 Thin 2	<18,5 Thin 1	>25 Overweight	>30 Obesity	>35 Morbid obesity
9,75	12,57	13,33	14,49	19,58	23,64	27,88
9,83	12,59	13,36	14,52	19,64	23,75	28,04
9,92	12,61	13,38	14,55	19,71	23,86	28,2
10	12,63	13,4	14,58	19,78	23,97	28,36
10,08	12,65	13,43	14,61	19,85	24,08	28,52
10,17	12,67	13,46	14,64	19,92	24,19	28,68
10,25	12,69	13,48	14,68	19,99	24,29	28,83
10,33	12,72	13,51	14,71	20,07	24,4	28,98
10,42	12,74	13,54	14,75	20,14	24,51	29,14
10,5	12,77	13,57	14,78	20,21	24,62	29,28
10,58	12,79	13,6	14,82	20,28	24,72	29,43
10,67	12,82	13,63	14,86	20,36	24,83	29,58
10,75	12,85	13,67	14,9	20,43	24,94	29,72
10,83	12,88	13,7	14,94	20,51	25,04	29,86
10,92	12,91	13,74	14,98	20,58	25,15	30
11	12,94	13,77	15,03	20,66	25,25	30,14
11,08	12,97	13,81	15,07	20,73	25,36	30,28
11,17	13,01	13,84	15,11	20,81	25,46	30,41
11,25	13,04	13,88	15,16	20,89	25,57	30,54
11,33	13,08	13,92	15,2	20,96	25,67	30,67
11,42	13,11	13,96	15,25	21,04	25,77	30,8
11,5	13,15	14	15,3	21,12	25,87	30,93
11,58	13,18	14,04	15,35	21,2	25,98	31,05
11,67	13,22	14,09	15,39	21,27	26,08	31,17
11,75	13,26	14,13	15,44	21,35	26,18	31,3
11,83	13,3	14,17	15,49	21,43	26,28	31,42
11,92	13,34	14,22	15,54	21,51	26,38	31,54
12	13,38	14,26	15,59	21,59	26,47	31,66
12,08	13,42	14,31	15,65	21,66	26,57	31,77
12,17	13,47	14,35	15,7	21,74	26,67	31,89
12,25	13,51	14,4	15,75	21,82	26,76	32
12,33	13,55	14,45	15,8	21,9	26,86	32,11
12,42	13,6	14,5	15,86	21,97	26,95	32,22
12,5	13,64	14,54	15,91	22,05	27,05	32,33
12,58	13,69	14,59	15,96	22,12	27,14	32,43
12,67	13,73	14,64	16,02	22,2	27,22	32,53
12,75	13,78	14,69	16,07	22,27	27,31	32,63
12,83	13,82	14,74	16,13	22,35	27,4	32,73
12,92	13,87	14,79	16,18	22,42	27,49	32,82
13	13,92	14,84	16,23	22,49	27,57	32,91

13,08	13,96	14,89	16,29	22,56	27,65	33
13,17	14,01	14,94	16,34	22,63	27,73	33,09
13,25	14,06	14,99	16,4	22,7	27,81	33,17
13,33	14,1	15,04	16,45	22,77	27,88	33,24
13,42	14,15	15,09	16,5	22,84	27,96	33,32
13,5	14,2	15,13	16,55	22,9	28,03	33,39
13,58	14,24	15,18	16,61	22,97	28,1	33,47
13,67	14,29	15,23	16,66	23,03	28,16	33,53
13,75	14,34	15,28	16,71	23,09	28,23	33,6
13,83	14,38	15,33	16,76	23,15	28,29	33,66
13,92	14,43	15,38	16,81	23,21	28,36	33,72
14	14,47	15,42	16,86	23,27	28,42	33,78
14,08	14,52	15,47	16,91	23,33	28,48	33,83
14,17	14,57	15,52	16,96	23,39	28,53	33,88
14,25	14,61	15,57	17,01	23,44	28,59	33,93
14,33	14,65	15,61	17,06	23,5	28,64	33,98
14,42	14,7	15,66	17,11	23,55	28,69	34,03
14,5	14,74	15,71	17,16	23,6	28,74	34,07
14,58	14,79	15,75	17,2	23,65	28,79	34,11
14,67	14,83	15,8	17,25	23,7	28,84	34,15
14,75	14,87	15,84	17,3	23,75	28,88	34,18
14,83	14,92	15,88	17,34	23,8	28,92	34,21
14,92	14,96	15,93	17,39	23,84	28,97	34,25
15	15	15,97	17,43	23,89	29,01	34,28
15,08	15,04	16,01	17,47	23,93	29,05	34,31
15,17	15,08	16,05	17,51	23,97	29,08	34,33
15,25	15,12	16,09	17,56	24,01	29,12	34,36
15,33	15,16	16,13	17,6	24,05	29,15	34,39
15,42	15,2	16,17	17,64	24,09	29,19	34,41
15,5	15,24	16,21	17,68	24,13	29,22	34,43
15,58	15,27	16,25	17,72	24,17	29,25	34,45
15,67	15,31	16,28	17,75	24,21	29,29	34,48
15,75	15,34	16,32	17,79	24,24	29,31	34,49
15,83	15,38	16,36	17,82	24,28	29,34	34,51
15,92	15,41	16,39	17,86	24,31	29,37	34,53
16	15,45	16,42	17,9	24,34	29,4	34,54
16,08	15,48	16,46	17,93	24,38	29,42	34,56
16,17	15,51	16,49	17,96	24,41	29,45	34,58
16,25	15,54	16,52	17,99	24,44	29,48	34,6
16,33	15,57	16,55	18,02	24,47	29,5	34,62
16,42	15,6	16,58	18,06	24,5	29,53	34,63