Overweight and obesity among 12-year-old children in Vestfold county, Norway: Prevalence and associated lifestyle-, socioeconomic-, hereditary-, and health factors

Mathillas J, Handeland M, Lindbæk M.

Abstract:

Background: **The prevalence of overweight and obesity in children is increasing rapidly worldwide, and this poses as a major health concern. Identifying potential risk factors to which preventive strategies can be implemented is of importance. The objective of this study was to determine the prevalence of overweight/obesity in 12-year-old children in Vestfold county, Norway, and to map associated lifestyle-, socioeconomic-, hereditary- and health factors.**

Methods: **This was conducted as a cross-sectional study. Questionnaires were sent to all 12-year-olds (n=3298) in Vestfold county in 2003/2004. The respond rate was 59%. Cut-off values from The International Obesity Task Force were used to group the children as overweight or obese based on their self-reported height and weight. Logistic regression analysis were performed to examine for associations.**

Results: **The prevalence of overweight+obesity/obesity in our study was 16,5%/2,8% for boys and 12,1%/1,6% for girls. Parental overweight/obesity, parents receiving governmental financial aid, school absence due to illness >2 weeks/year, and a birth weight >3790g, were positively correlated with overweight/obesity in the adjusted analysis. Being a girl, high level of vigorous to moderate physical activity, household income <300 000 NOK and >600 000 NOK, were negatively associated with overweight/obesity. In the adjusted, stratified analysis of the boys, maternal overweight/obesity, parents receiving governmental financial aid, and school absence due to illness >2 weeks/year, were positively correlated with overweight/obesity. Household income <300 000 NOK, and high level of vigorous to moderate physical activity, were negatively correlated with overweight/obesity. In the adjusted analysis of the girls, only parental overweight/obesity, birth weight <3330g, and alcohol experimentation, turned out to be significantly and positively correlated with overweight/obesity.**

Conclusion: **Our study gives an indication of 12-year-old overweight/obese girls being at higher risk for engaging in health-risk behaviors such as drinking alcohol, than their normal weight peers. The study also indicates that overweight/obese 12-year old boys are more prone to absenteeism than their normal weight peers. This should grant more awareness regarding these issues from parents and other people working with, and meeting these children, and it should grant more studies on the subject. Furthermore, our study indicates that several factors affect boys and girls differently in regards to the development of overweight/obesity. Perhaps future preventive strategies should be tailored separately for boys and girls.**

Introduction

Over the past few decades, numerous studies have reported a rapidly increasing prevalence of overweight and obesity among children worldwide (1,2). The International Obesity Task Force has described this trend as "-a crisis in public health-" (3). Childhood obesity has a high risk of tracking into adulthood (4). The consequences of overweight/obesity among adults, such as cardiovascular events and type-2 diabetes, are well known. In addition there is also evidence pointing towards serious consequences of childhood overweight and obesity, making preventive strategies imperative. These consequences include hypertension, dyslipidemia, type 2 diabetes, sleep apnea, asthma, fatty liver disease and psychosocial problems (5,6). Poorer school performance, including absenteeism, has also been proposed as a consequence of overweight/obesity (7,8,9).

In the attempt to counteract this "-crisis in public health-", identify the children at risk, and make better preventive strategies, modifiable lifestyle factors associated with overweight and obesity have to some extent been identified. These include level of physical activity, sedentary behaviors, energy content in food and socioeconomic status (10,11,12). Furthermore, an increased participation in health-risk behaviors has been described among overweight/obese adolescent girls. Farat et al. found that frequent smoking and drinking were associated with both overweight and obesity among younger girls, whereas these behaviors were associated only with obesity among older girls (13). Some non-modifiable factors potentially associated with overweight/obesity have also been explored, such as gender, age, parental weight and chronic diseases like asthma (14,15,16,17).

The International Obesity Task Force (IOTF), has developed definitions for child overweight and obesity based on weight and height measurements from almost 200 000 children from six different countries (18). These definitions have been used in an increasing amount of studies, making it possible to compare the prevalence in different countries. Yngve et al. reports that the prevalence of overweight/obesity in 11-year olds in Europe varies from 11,0% (Belgium) to 30,6% (Portugal) among boys, and between 8,6% (The Netherlands) and 21,6% (Portugal) in girls (19). In Norway, studies have also reported an increase in the prevalence, with a prevalence of overweight/obesity among 8-12-year-olds being 15-20% and among 15-16-year-olds 8-14% (20,21).

Studies with the aim of elucidating correlations between overweight/obesity and various environmental and genetic factors usually look at only a few potentially important factors at a time. The need for more studies on socioeconomic status versus overweight, where parental weight is adjusted for, has been identified (22). In our study we asked all the 12-year-olds in one of the Norwegian counties, Vestfold, to participate. We included a wide range of background variables, which were likely to discribe a large part of the variability in genetic-, socioeconomic-, lifestyle- and health background. As far as we know, this study is the only one which has included such a wide variety of variables, in this age group, in Norway. The objectives of the current study were 1) to describe the prevalence of overweight and obesity in 12-year-old children in Vestfold county, Norway, and 2) to examine the associations between overweight/obesity and certain socioeconomic-, lifestyle-, hereditary-, and health factors.

Subjects and methods

The study was conducted as a standard cross sectional study. It was submitted to the Regional Committee for Ethics in Medical Research and approved by the Data Inspectorate of Norway. The study was conducted in full accordance with the ethical principles of the World Medical Association Declaration of Helsinki.

Subjects:
A questionnaire, consisting of 78 questions with a focus on health issues, was sent to 3577 children in Vestfold County in October 2003, followed by two reminders in January and April 2004. All the children living in Vestfold and born between the 1st of December 1990 and the 31st of January 1992, received the questionnaire. There were no records of the reply date on the forms, and for that reason the reply date for all questionnaires was set to the 1st of January 2004. 1934 forms were filled in, 279 forms were returned due to an unknown address or because the child was no longer living in the county, and 14 subjects reported that they did not wish to reply. When we subtracted the 279 forms returned, this gave a respond rate of 59%.

Data collection and data entry methods:
The questionnaires were sent by mail, and there was no physical examination included. The questionnaire explained that one part was to be answered by the parent, and the other part by the child. The data were imported to SPSS using photo optic reading.

Weight and height related measures:
The children were sorted into three groups related to age intervals: 11,99-12,49 years, 12,50-12,99 years and 13,00-13,49 years, based on a calculation of their age on the 1st of January 2004. The children were then classified as underweight, normal weight, overweight or obese, by comparing their BMI with the recommendations made by the International Obesity Task Force. The BMI was calculated from the subjects' self-reported weight and height. Those who had not reported these data (n= 290), were excluded from the analysis.

Other variables asked for in the questionnaire:
Socioeconomic factors: These included educational status of parents, the parents' income after tax, number of adults and children in the household, and main source of income, including whether any of the parents were receiving governmental financial aid. Regarding the household income variable, we asked for the male caregiver's and the female caregiver's incomes separately, and due to the wide intervals provided, it was impossible to group the combined household income correctly. The intervalls were <150 000 NoK, 150 000 NoK-300 000 NoK, 301 000 NoK-450 000 NoK, 451 000 NoK-600 000 NoK and finally >600 000 NoK. When the two incomes were added, the families, in which one parent had an income between 150 000 NoK and 300 000 NoK, and the other parent has an income of less than 150 000 NoK, were not included in the lowest income group although they might have had a true combined income of less than 300 000 NoK. The number of families with this particular combination of answers was about 250. Similarly, the following combination of answers have been included in the group "income >600 000 NoK: One parent making between 150 000 NoK and 300 000 NoK, and the other making between 300 000 NoK – 450 000 NoK, in addition to: one parent making between 300 000 NoK and 450 000 NoK, and the other making less than 150 000 NoK. The number of families with these combinations is about 300.

Living habits in the family: These included number of adult smokers in the household, screen time, degree of moderate to vigorous physical activity, and whether the child participates in any cultural activities outside school.
Health-risk behavior: These included questions on whether the children had ever tried to smoke, or to drink alcohol, and whether the child had ever been drunk.
Health factors: These included the incidence of various illnesses like common cold, headache and abdominal pain, over the last 12 months. It was specified not to answer if the answer to these questions was never. Asthma symptoms were also asked for, in addition to birth weight and school absence due to illness the last 12 months. The questionnaire also included questions about the parents' height and weight.

Data analysis:
Data were analyzed using SPSS 15,0. Underweight- and normal weight children were grouped together, and overweight- and obese children were grouped together. Cross tabulation with chi-square analysis was used to determine associations between the weight groups and the other factors.
Bivariate and multivariate analyses were performed using logistic regression. The inclusion of variables in the adjusted analysis was based on their anticipated importance, based on previous studies. The number of variables in the adjusted analysis was attempted not to exceed 10% of the number of overweight/obese children in the sample, in order to avoid missing out on important correlations. However, in all the analysis we needed to include more variables than 10% of the sample size, because they were suspected to be significant confounders, changing the OR with more than 10% when removed. As a result of including a large number of variables in the adjusted analysis, only about half the subjects were analyzed because many of them had not answered all the questions included in the analysis. To be able to compare the unadjusted analysis with the adjusted analysis, and to check whether the children included in the adjusted analysis were representative of the total sample, the unadjusted analysis was performed with only the children included in the adjusted analysis, and these results were subsequently compared with the unadjusted analysis of the total sample.
Some of the grouped variables in the table could potentially have been displayed as continuous variables, but due to non-linearity they could not be included as continuous in the logistic regression. A linear regression analysis was also preformed, but did not add any significant information.

Examination of potential bias:
In an attempt to examine whether our respondents were a representative sample of the population of Vestfold, we compared statistics on family income and educational level in Vestfold at the time when the study was conducted. We did have a relative underrepresentation of the parents with only compulsory school, and a relative overrepresentation of the parents with university education or similar, compared with the overall statistics from the county. Similarly, there was a relative underrepresentation of the low-income families and a relative overrepresentation of the highest-income families, although this might be related to the problem with the combined household income variable described earlier.

Results

Table 1 displays the unadjusted and adjusted logistic regression analysis of the total sample. Table 2 displays the analysis of the boys, and table 3 of the girls.

The prevalence of overweight+obesity in our study was 16,5% for boys and 12,1% for girls, and of obesity 2,8% for boys and 1,6% for girls.

With a significance level of 0,05 in p-value, several factors showed significant correlation with overweight/obesity.

Unadjusted analysis of the total sample:
There was a marked gender difference with the girls being thinnest (OR:0,5 CI:0,3–0,8). Parental overweight/obesity was strongly associated with the children being overweight. High household income did also show a significant correlation in the protective direction, and so did a high degree of physical activity. "Parents receiving governmental financial aid", was positively associated with overweight, while the number of parents and children in the household showed no significant correlation. "Both parents having higher education", was not significantly correlated with lower prevalence of overweight, while low degree of physical activity was. Cultural activities did not show a significant correlation. Neither did "child tried to drink or smoke" or adults smoking in the household. School absence more than 2 weeks the last 12 months and high birth weight, were correlated with overweight, while asthma symptoms and chronic illness were not. In the unadjusted analysis done on all the children who had answered the various individual questions, the following discrepancies from the above results were found: Adults smokers in the household and low level of physical activity were positively correlated with overweight/obesity, while low screen time was negatively correlated.

Adjusted analysis of the total sample:
Parental overweight/obesity, parents receiving governmental financial aid, high birth weight and school absence more than 2 weeks last 12 months (OR:2,5 CI:1,4–7,9), were upheld as positively correlated with overweight/obesity. Being a girl (OR:0,5 CI:0,3–0,8), high degree of physical activity, and household income >600 000 NOK, were upheld as negatively associated with overweight/obesity. In addition, household income <300 000 NOK became significantly correlated in the adjusted analysis. Asthma symptoms were close to significantly correlated, with the alternative "occasional mild" being close to positively correlated with overweight/obesity, and "moderate/severe" asthma was close to negatively associated with overweight/obesity. 770 of the children were included in the final adjusted analysis.

Unadjusted analysis of the boys:
The unadjusted analysis of the boys was similar to that of the total sample with the exception of high level of physical activity being negatively associated with overweight/obesity, and birth weight showing no correlation. Low screen time came close to being significantly correlated in the protective direction. In the unadjusted analysis done on all the children who had answered the various individual questions, the following discrepancies from the above results were found: Parental smoking was positively correlated with the overweight/obesity, and so were asthma symptoms. Low screen time was negatively associated with overweight/obesity.

Adjusted analysis of the boys:
Maternal overweight/obesity, parents receiving governmental financial aid, and school absence more than 2 weeks last 12 months, were upheld as positively correlated with overweight/obesity. High level of physical activity was upheld as negatively associated with overweight/obesity. Household income <300 000 NOK turned out to be negatively correlated in the adjusted analysis despite not being correlated in the unadjusted analysis. Thus paternal overweight/obesity (though close to significantly correlated) and screen time did not turn out to be significant when included in the multivariate analysis. 445 boys were included in the analysis,

Unadjusted analysis of the girls:
Also among the girls, maternal overweight/obesity was strongly associated with overweight/obesity, and so was paternal overweight/obesity. Except for birth weight <3330g which was positively associated with overweight/obesity, none of the other variables showed any significant association. In the unadjusted analysis done on all the children who had answered the various individual questions, the following discrepancies from the above results were found: Household income >600 000 NOK were negatively associated with overweight/obesity, whilst "child tried alcohol", and low level of physical activity were positively correlated with overweight/obesity.

Adjusted analysis of the girls:
In the adjusted analysis, parental overweight/obesity and birth weight <3330g (OR:2,0 CI:1,1–5,6), turned out to be significantly correlated, along with alcohol consumption (OR:3,2 CI:1,3–8,0), which was a variable not significantly correlated in the unadjusted analysis. 433 girls were included in this analysis.

Discussion

Principal findings:
The prevalence of overweight+obesity/obesity in our study was 16,5%/2,8% for boys and 12,1%/1,6% for girls. Parental overweight/obesity, parents receiving governmental financial aid, school absence due to illness >2 weeks/year, and a birth weight >3790g, were positively correlated with overweight/obesity in the adjusted analysis. Being a girl (OR:0,5 CI:0,3 – 0,8), high level of vigorous to moderate physical activity, household income <300 000 NOK and >600 000 NOK, were negatively associated with overweight/obesity. In the adjusted, stratified analysis of the boys, maternal overweight/obesity, parents receiving governmental financial aid, and school absence due to illness >2 weeks/year, were positively correlated with overweight/obesity. Household income <300 000 NOK, and high level of vigorous to moderate physical activity, were negatively correlated with overweight/obesity. In the adjusted analysis of the girls, only parental overweight/obesity, birth weight <3330g, and alcohol experimentation (OR:2,5 CI:1,3 – 4,8), turned out to be significantly correlated with overweight/obesity.

Limitations of this study:
This study was a cross sectional study, and therefore only a momentary picture of the situation, with no potential to draw conclusions about causality. The respond rate was only 59%, which can be an important bias: Who has not responded? Is it the overweight/obese or maybe the families with low socio economic status? Self reported weight and height is another weakness of this study, and one can anticipate underreporting of overweight/obesity. Some studies have

been done, however, to examine the validity of self reported data. Andresen et. al found that self-reports from Norwegian eight graders were quite accurate, while a review by Gorber et al concludes with the occurrence of underreporting of weight and over reporting of height (21, 23). We did not include questions about diet and ethnicity and hence were unable to control for these factors in our analysis. The questionnaires were answered in 2003/2004, making our material slightly old. Due to the rapid development of the overweight/obesity epidemic, the prevalence might be even higher today. Given the missing response date on the forms, all the children were assumed to have answered the questionnaire on the 1st of January 2004, this might have put some of the children in the wrong age interval category. However, it is unlikely that this is an important bias given the rather small differences between the IOTF percentiles from 12 to 13 years. Finally, the low number of children included in the multivariate analysis is another potential bias. In the attempt to examine if these children were representative for the total sample, some discrepancies were found, although not many. This might be an indication of there being interesting correlations we have not been able to find in our adjusted analysis. The inability of the screen time variable to prove itself as significantly correlated with overweight/obesity in our study might be related to this problem.

Strengths of this study:
An important strength of this study was the inclusion of a wide range of different variables in the questionnaire, which made it possible to examine and control for many factors shown to be correlated in previous studies. Another strength was the selection, which included all 12-year-olds in a certain geographical area.

What is already known on the subject?
Juliusson et al. have used material from The Bergen Growth Study, and report a prevalence of overweight/obesity almost identical to our study (24). However, the prevalence in our study was lower than the 2005-figures published by the Norwegian Institute of Public Health (20). This might be an indication of children in Vestfold county being thinner than the country average, but it might also be an indication of more overweight/obese children in the group of non-responders, or perhaps an indication of underreporting of weight. The Norwegian Institute of Public Health based their numbers on a study conducted in 2005, so it is not likely that this discrepancy is caused by an increase in the prevalence over the years since our material was collected. Previous studies have reported that overweight/obesity is more prevalent among children than among adolescents (25), and with the wider age interval The Norwegian Institute of Public Health has based its numbers on, this could also be an explanation of the discrepancy.

Several studies have reported associations between overweight/obesity and genetics, sedentary behavior and physical activity. In our study we found some of the same associations, although our “time in front of screens”-variable did not show a significant correlation. In the table we refer to daily screen time, but in the questionnaire this variable consisted of two alternatives, namely screen time every day more than 3 hours per day, or screen time less than 3 hours a day. In the statistical analysis when using these two variables separately, there was still no significant association in the adjusted analysis. One can argue that sedentary behavior and physical activity are two sides of the same variable, but sedentary behavior has in previous studies been identified as an independent factor promoting overweight, regardless of level of physical activity (26). It has been suggested that the everyday light level of physical activity, which is reduced by

high amounts of screen viewing, is an important component of the total energy expenditure.(27) For that reason, the lack of significance in our adjusted analysis is surprising.

Quite a few articles have been written about a negative association between affluence and overweight/obesity. In this study there were two socioeconomic status variables associated with overweight/obesity, namely household income and parent/parents receiving governmental financial aid. However, parent's educational status did not prove to be significantly correlated in our study. This is a result which is in contrast with most studies done on the subject, where educational status tends to be more strongly associated with overweight/obesity than household income (11). The explanation often proposed is that educational status is a more stable variable, whereas household income can change over time. An explanation for the non-correlation in our study could be the lack of a pronounced social inequality in Norway, or related to the discrepancy between the respondents' educational status and the education statistics from the county. We did not find an association between single parent households and overweight/obesity in our study, which is in accordance with another Norwegian study from 2009 (24). We found a protective association between low income and overweight/obesity which is in contrast with most other studies, in addition to being a contrast to our "parent/parents receiving governmental financial aid"-variable, an indicator of low socioeconomic status. This could all be related to the problematic nature of the household income variable explained above.

We found pronounced gender differences in this study, of which the association between overweight/obese girls and experimentation with alcohol perhaps was the most surprising . One can argue that asking questions about alcohol and smoking is problematic in a questionnaire meant to be answered by the child and the parent together, and that the children might underreport. This makes this finding even more interesting. The fact that this variable is correlated to overweight only in girls might be explained by girls being more mature than boys when they are 12. Girls at that age might also be more concerned with peer approval. It has been reported that girls are more prone to be discriminated than boys because of overweight/obesity, and this might be another important factor for the gender difference in health-risk behavior (28). Farat et al. reported that girls with overweight were more susceptible to engage in health-risk-behaviors such as drinking alcohol and smoking tobacco, while the overweight boys tended to turn to violence (13). More research is needed to examine the mechanisms behind this association.

The gender difference is it itself interesting. Other studies have shown that underreporting of weight is more common among girls, and this might be part of the explanation of the gender differences (29). Studies where they have not relied on self-reported weight and height, however, have suggested a true gender difference in the prevalence of overweight/obesity, where the girls tend to be heavier in childhood and the boys taking over as the heaviest in adolescence (20). There is also reason to believe that different factors influence boys and girls to different degrees. Genetic studies have reported that different genes affect the genders differently in regard to the development of overweight/obesity. (30) This might also be the case for environmental factors as there are indications of in this material.

The variable "School absence due to illness", was positively correlated with overweight/obesity in our study. To our knowledge, not many studies have reported this association. However, two

articles from America, and a review by Taras et al, were found (7,8,9). They all report an association between decreased scholastic achievement and overweight/obesity, where absenteeism was one of the outcomes measured. Embarrassment about participating in physical activities, co morbidities like asthma and apnea, in addition to bullying, have all been proposed as potential explanations for this association. In our questionnaire we had questions about various illnesses like the common cold, headaches and abdominal pain, none of which showed any significant association with overweight/obesity. Regardless of explanation, this association should grant an increased awareness of the overweight/obese children being at risk of falling behind in school, with the associated consequence of being at increased risk of reaching a lower socioeconomic status as adults, possibly making the problem with overweight/obesity worse. This association should also grant more studies on psychosocial status of overweight/obese children in this age group, as a way of trying to explain this correlation.

Our asthma variable shows some discrepancies from previous studies which have reported a positive correlation between overweight/obesity and asthma (14). We did not find this correlation however, although we found an indication of moderate to severe asthma symptoms being negatively correlated with overweight. One can speculate that an explanation of this result might be a more pronounced focus on health and fitness among the children with more serious asthma symptoms, perhaps making a variable like physical activity an important confounding factor.

Finally, we found that being in the upper birth weight tertile was positively associated with overweight/obesity in the total sample. This is in accordance with previous studies. (31) Surprisingly, when the genders were analyzed separately, being in the lowest birth weight tertile was positively associated with overweight in girls. Ong reports that low birth weight is associated with a higher ratio of fat mass to lean mass and greater central fat and insulin resistance. This is reported to be partly explained by the observation that infants who have been growth restrained in utero tend to gain weight more rapidly during the early postnatal period, which leads to increased central fat deposition. (31) Thus both low and high birth weight might predispose for overweight/obesity.

What this study adds?
Our study gives an indication of 12-year-old overweight/obese girls being at higher risk for engaging in health-risk behaviors such as drinking alcohol, than their normal weight peers. The study also indicates that overweight/obese 12-year old boys are more prone to absenteeism than their normal weight peers. This should grant more awareness regarding these issues from parents, physicians, teachers and other people working with, and meeting these children, and it should grant more studies on the subject. Furthermore, our study indicates that several factors affect boys and girls differently regarding the development of overweight/obesity. Perhaps future preventive strategies should be tailored separately for boys and girls.

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Table 1

Logistic Regression Analysis	*Unadjusted*			*Adjusted (n=770)*		
Dependent Variable: Underweight/normal weight vs overweight/obese	*OR*	*CI (95%)*	*P-value*	*OR*	*CI (95%)*	*P-value*
Gender:						
Boy (n=395)	1,0			1,0		
Girl (n=375)	0,5	0,3 - 0,8	0,002	0,5	0,3 - 0,8	0,002
Parental weight group:						
Underweight/normal weight mother (n=507)	1,0			1,0		
Overweight/obese mother (n=263)	2,5	1,7 - 3,8	0,000	2,3	1,5 - 3,7	0,000
Underweight/normal weight father (n=318)	1,0			1,0		
Overweight/obese father (n=452)	2,5	1,6 - 4,1	0,000	2,3	1,4 - 3,8	0,002
Socio-economic factors:						
Household income after tax						
< 300 000 NOK (n=100)	0,5	0,3 - 1,1	0,084	0,4	0,2 - 1,0	0,044
300 000 NOK - 600 000 NOK (n=397)	1,0			1,0		
> 600 000 NOK (n=273)	0,5	0,3 - 0,9	0,009	0,5	0,3 - 0,9	0,012
Education status of parents						
Both parents university or similar (n=242)	0,9	0,6 - 1,4	0,547	1,3	0,8 - 2,3	0,272
1 parent university/2 parents secondary school (n=507)	1,0			1,0		
Both parents compulsory school only (n=21)	1,4	0,5 - 4,4	0,519	1,1	0,3 - 3,8	0,841
Parent/parents receiving governmental financial aid						
No (n=654)	1,0			1,0		
Yes (n=116)	2,0	1,2 - 3,3	0,008	1,8	1,0 - 3,1	0,044
Number of adults in the household						
Two or more (n=698)	1,0			1,0		
Single parent houshold (n=72)	1,3	0,7 - 2,5	0,432	1,5	0,6 - 3,7	0,414
Number of children in the household						
2 or less children (n=516)	1,0			1,0		
3 or more (n=240)	0,8	0,5 - 1,2	0,256	0,8	0,5 - 1,4	0,443
5 or more children (n=14)	0,4	0,1 - 3,5	0,439	0,4	0,0 - 3,2	0,355
Living habits in the family:						
Number of adult smokers in the household						
None (n=528)	1,0			1,0		
One or more (n=242)	1,1	0,7 - 1,7	0,651	1,0	0,6 - 1,6	0,922

Time in front of screens						
Daily (n=566)	1,0			1,0		
3-6 days per week (n=144)	0,5	0,3 - 1,0	0,054	0,7	0,3 - 1,3	0,220
< 3 days per week (n=60)	0,5	0,2 - 1,3	0,151	0,6	0,2 - 1,7	0,361
Moderate or vigorous physical activity						
Less often than once a week (n=41)	2,7	1,3 - 5,4	0,006	2,2	1,0 - 4,9	0,066
1-3 times per week (n=468)	1,0			1,0		
> 3 times per week (n=261)	0,6	0,3 - 0,9	0,022	0,5	0,3 - 0,9	0,016
Cultural activities outside school						
No cultural activities (n=470)	1,0					
Cultural activities (n=295)	0,9	0,6 - 1,4	0,748			
Health-risk behavior:						
Child tried to smoke						
Never tried (n=727)	1,0			1,0		
Once or more (n=43)	1,7	0,8 - 3,7	0,156	1,5	0,6 - 3,9	0,398
Child tried alcohol						
Never tried (n=633)	1,0			1,0		
Once or more (n=137)	0,9	0,6 - 1,6	0,852	0,8	0,4 - 1,5	0,470
Health factors:						
Absence from school due to illness past 12 months						
<One week (n=573)	1,0			1,0		
1-2 weeks (n=159)	1,3	0,8 - 2,1	0,338	1,2	0,7 - 2,1	0,546
>2 weeks (n=38)	2,9	1,4 - 6,2	0,005	2,5	1,4 - 7,9	0,047
Asthma symptoms						
Never (n=658)	1,0			1,0		
Occational mild (n=82)	1,7	1,0 - 3,1	0,061	1,9	1,0 - 3,6	0,069
Moderate or severe (n=30)	0,5	0,1 - 2,0	0,315	0,2	0,0 - 1,2	0,083
Chronic illness						
No chronic illness (n=661)	1,0			1,0		
Chronic illness (n=109)	0,9	0,5 - 1,7	0,795	0,8	0,4 - 1,6	0,524
Birthweight						
300g-3330g (n=243)	1,2	0,7 - 2,1	0,470	1,3	0,7 - 2,3	0,425
3331g-3790g (n=262)	1,0			1,0		
3791g-5890g (n=265)	1,8	1,1 - 2,9	0,029	1,8	1,0 - 3,2	0,035

Table 2

Logistic Regression Analysis Boys	*Unadjusted*			*Adjusted (n=445)*		
Dependent Variable: Underweight/normal weight vs overweight/obese	*OR*	*CI (95%)*	*P-value*	*OR*	*CI (95%)*	*P-value*
**Groups added toghether due to missing values*						
Parental weight group						
Underweight/normal weight mother (n=303)	1,0			1,0		
Overweight/obese mother (n=142)	2,2	1,3 - 3,6	0,002	1,8	1,0- 3,1	0,042
Underweight/normal weight father (n=179)	1,0			1,0		
Overweight/obese father (n=266)	2,1	1,2 - 3,6	0,007	1,8	1,0 - 3,2	0,055
Socio-economic factors:						
Household income after tax						
< 300 000 NOK (n=56)	0,6	0,2 - 1,3	0,190	0,3	0,1 - 1,0	0,046
300 000 NOK - 600 000 NOK (n=238)	1,0			1,0		
> 600 000 NOK (n=151)	0,7	0,4 - 1,3	0,291	0,8	0,4 - 1,4	0,438
Education status of parents						
Parents compulsory or secondary school (n=320)	1,0			1,0		
Both parents university degree or similar (n=125)	0,7	0,4 - 1,2	0,154	0,9	0,5 - 1,7	0,710
Parent/parents receiving governmental financial aid						
No (n=379)	1,0			1,0		
Yes (n=66)	2,1	1,2 - 3,9	0,012	2,0	1,0 - 4,0	0,045
Number of adults in the household						
Two or more (n=400)	1,0			1,0		
Single parent houshold (n=45)	1,4	0,6 - 2,9	0,409	2,6	0,9 - 7,5	0,074
Number of children in the household						
2 or less children (n=299)	1,0			1,0		
3 or more children (n=146)	0,6	0,3 - 1,0	0,070	0,7	0,4 - 1,2	0,203
Living habits in the family:						
Number of adult smokers in the household						
None (n=299)	1,0			1,0		
One or more (n=146)	1,3	0,8 - 2,2	0,282	1,1	0,6 - 1,9	0,779
Time in front of screens						
Daily (n=346)	1,0			1,0		
6 days per week or less (n=99)*	0,5	0,3 - 1,0	0,053	0,6*	0,3 - 1,3*	0,187*

Moderate to vigorous physical activity						
Less often than once a week (n=23)	3,3	1,4 - 8,0	0,007	2,3	0,9 - 6,2	0,099
1-3 times per week (n=241)	1,0			1,0		
> 3 times per week (n=181)	0,4	0,2 - 0,6	0,001	0,4	0,2 - 0,7	0,002
Cultural activites outside school						
No cultural activities (n=318)	1,0					
Cultural activities (n=125)	1,3	0,8 - 2,2	0,307			
Health-risk behavior:						
Child tried to smoke						
Never tried (n=417)	1,0					
Once or more (n=26)	1,8	0,7 - 4,4	0,204			
Child tried alcohol						
Never tried (n=351)	1,0					
Once or more (n=94)	0,9	0,5 - 1,7	0,834			
Health factors:						
Absence from school due to illness past 12 months						
<One week (n=323)	1,0			1,0		
1-2 weeks (n=95)	1,2	0,6 - 2,1	0,625	1,0	0,5 - 1,9	0,987
>2 weeks (n=27)	3,7	1,6 - 8,4	0,002	2,7	1,0 - 7,2	0,044
Asthma symptoms						
Never asthma symptoms (n=375)	1,0			1,0		
Asthma symptoms (n=70)	1,3	0,7 - 2,5	0,382	1,0	0,5 - 2,2	0,905
Chronic illness						
No chronic illness (n=330)	1,0					
Chronic illness (n=66)	0,8	0,4 - 1,7	0,556			
Birthweight						
300g-3330g (n=129)	0,5	0,3 - 1,1	0,075	0,6	0,3 - 1,3	0,169
3331g-3790g (n=132)	1,0			1,0		
3791g-5890g (n=184)	1,1	0,6 - 2,0	0,695	1,3	0,7 - 2,5	0,365

Table 3

Logistic Regression Analysis Girls	*Unadjusted*			*Adjusted (n=433)*		
Dependent Variable: Underweight/normal weight vs overweight/obese	*OR*	*CI (95%)*	*P-value*	*OR*	*CI (95%)*	*P-value*
Parental weight group:						
Underweight/normal weight mother (n=282)	1,0			1,0		
Overweight/obese mother (n=151)	3,2	1,7 - 6,0	0,000	3,5	1,7 - 7,1	0,000
Underweight/normal weight father (n=189)	1,0			1,0		
Overweight/obese father (n=244)	2,6	1,3 - 5,3	0,008	2,3	1,1 - 4,8	0,033
Socio-economic factors:						
Household income after tax						
< 300 000 NOK (n=56)	0,7	0,2 - 1,8	0,425	0,5	0,2 - 1,8	0,308
300 000 NOK - 600 000 NOK (n=218)	1,0			1,0		
> 600 000 NOK (n=159)	0,6	0,3 - 1,1	0,103	0,6	0,3 - 1,3	0,193
Education status of parents						
Parents compulsory or secondary school (n=290)	1,0			1,0		
Both parents university degree or similar (n=143)	0,9	0,5 - 1,8	0,773	1,2	0,6 - 2,5	0,671
Parent/parents receiving governmental financial aid						
No (n=366)	1,0			1,0		
Yes (n=67)	1,2	0,5 - 2,7	0,652	0,8	0,3 - 2,0	0,639
Number of adults in the household						
Two or more (n=401)	1,0			1,0		
Single parent houshold (n=32)	0,9	0,3 - 3,0	0,845	1,6	0,3 - 7,7	0,549
Number of children in the household						
2 or less children (n=299)	1,0			1,0		
3 or more children (n=134)	1,0	0,5 - 2,0	0,980	1,3	0,6 - 2,7	0,516
Living habits in the family:						
Number of adult smokers in the household						
None (n=293)	1,0					
One or more (n=128)	1,3	0,6 - 2,4	0,501			
Time in front of screens						
Daily (n=299)	1,0			1,0		
3-6 days per week (n=90)	0,4	0,1 - 1,1	0,062	0,4	0,1 - 1,1	0,076
< 3 days per week (n=44)	1,5	0,6 - 3,6	0,389	1,7	0,7 - 4,3	0,282

Moderate to vigorous physical activity						
Less often than once a week (n=26)	2,4	0,8 - 7,0	0,098	2,2	0,7 - 7,2	0,177
1-3 times per week (n=292)	1,0			1,0		
> 3 times per week (n=115)	1,4	0,7 - 2,8	0,320	2,1	1,0 - 4,5	0,060
Cultural activites outside school						
No cultural activities (n=215)	1,0					
Cultural activities (n=?)	0,9	0,5 - 1,6	0,637			
Health-risk behavior:						
Child tried to smoke						
Never tried (n=413)	1,0			1,0		
Once or more (n=20)	1,6	0,4 - 5,5	0,493	1,4	0,3 - 6,2	0,621
Child tried alcohol						
Never tried (n=369)	1,0			1,0		
Once or more (n=64)	1,8	0,8 - 3,8	0,142	3,2	1,3 - 8,0	0,012
Health factors:						
Absence from school due to illness past 12 months						
<One week (n=324)	1,0			1,0		
1-2 weeks (n=90)	1,1	0,5 - 2,3	0,799	1,0	0,4 - 2,3	0,962
>2 weeks (n=19)	1,0	0,2 - 4,7	0,962	0,6	0,1 - 3,5	0,610
Asthma symptoms						
Never asthma symptoms (n=370)	1,0			1,0		
Asthma symptoms (n=63)	1,3	0,6 - 3,0	0,518	1,5	0,6 - 3,9	0,380
Chronic illness						
No chronic illness (n=341)	1,0					
Chronic illness (n=45)	1,5	0,6 - 3,8	0,406			
Birthweight						
300g-3330g (n=145)	2,2	1,0 - 4,6	0,040	2,5	1,1 - 5,6	0,031
3331g-3790g (n=167)	1,0			1,0		
3791g-5890g (n=121)	1,4	0,6 - 3,3	0,410	1,3	0,5 - 3,2	0,558

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