Cues for obesity prevention in Dutch schools
A cross-sectional survey about energy balance related behaviour combined with anthropometric measures among Dutch adolescents

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Abstract

Purpose:
Energy balance related behaviour on schooldays and beliefs about school-based interventions may differ between students of different educational levels, sexes and BMI-categories.

Method:
In Zwolle, (the Netherlands) 1,084 adolescents (13-15 years) at 9 secondary schools completed a questionnaire.

Results:
Overweight prevalence (boys 18.1%, girls 19.3%) increased with decreasing educational level, especially in boys. Girls behaved healthier than boys regarding daily consumption of fruit (35% vs. 29%), vegetables (58% vs. 48%), ≤1 snack/candy (36% vs. 26%), ≤3 glasses of sugared drinks (80% vs. 73%) (all p<0.05). Unhealthier dietary behaviours were associated with lower educational level, except for eating snacks. Snacks and sugared drinks consumed at school were mostly brought from home (62% resp. 69%). Overweight students had less often breakfast, snacks and sugared drinks than non-overweight students. Of all students, 40% spent ≥1 hour per day cycling to school. Students with lower educational level reported less organized sports activities than higher level students, but more often played outside and had other activities. Overweight was negatively associated with cycling to school (boys) and participating in organized sports (girls). More girls than boys were interested in lessons about healthy nutrition (44% vs. 32%). Boys suggested more PE classes (63%) to stimulate physical activity, girls advised more variation (47%) and choice (43%). A healthy school canteen (57%) and offering free fruit (67%) were suggested as promising interventions to stimulate healthy behaviour.

Conclusion:
Unhealthy dietary and physical activity behaviour should be tailored to educational level and gender and tackled by educational and environmental interventions, in collaboration with parents.
Introduction

The high prevalence of childhood obesity needs to be tackled as it leads to both short and long term health problems \(^{(1,2)}\) and is strongly associated with adult obesity. \(^{(3)}\) Entering adolescence is associated with more autonomy, which has an impact on dietary, physical activity and sedentary behaviours. Because adolescent behavioural patterns are likely to influence long-term patterns of health behaviour, specific interventions for adolescents are needed. \(^{(4)}\)

Since 1980, the prevalence of overweight in Dutch children (2-21 year) has increased two to three fold to 14% and obesity prevalence four to six fold to 2% in 2009. \(^{(5)}\) In order to tackle the rising prevalence of overweight and obesity in youth, several Dutch cities, including Zwolle (120,000 inhabitants) have adapted the French EPODE-approach, which is called JOGG (Youth on a healthy weight) in the Netherlands. \(^{(6)}\) In this integrated approach, local stakeholders from business, education, healthcare, housing, media, sports and welfare are involved to stimulate healthy eating and physical activity in a community. \(^{(7)}\) School-based interventions are part of the approach because they can contribute considerably to the prevention of overweight. \(^{(8)}\)

The Dutch secondary education system consists of three educational levels: prevocational education (lowest level), senior general secondary education (middle level) and pre-university education (highest level). In the first two school years, all students follow a general curriculum, including three key objectives that are related to health behaviour: (a) to gain knowledge about body and health, (b) to take personal care, (c) to learn about healthy physical activities. \(^{(9)}\) In general, the teaching program includes 3–4 hours per week of physical education (PE) and 14–19 classes yearly about nutrition and energy balance related behaviour. \(^{(10)}\)

The target group of many school-based interventions are students with a low social-economic or a non-western background, who have an increased risk of adapting unhealthy lifestyles and, in the Netherlands, often attend prevocational schools. \(^{(11,12,13)}\) As a consequence, favourable results of school-based interventions are only found for prevocational students and it remains unclear whether these interventions have the same results for higher level students. \(^{(14,15,16)}\) This study aims to discern differences in overweight prevalence, dietary, physical activity and sedentary behaviour and beliefs about school-based health interventions of students of different sexes, educational levels and BMI-category in order to provide input for tailoring school-based interventions to the needs of the adolescent school population.
Methods

Design
CheckTeen is a cross-sectional study, carried out in 2010/2011, among students (age 13-15 years) in grade 2 of secondary schools in Zwolle, the Netherlands. All 12 secondary schools were invited and 75% (n = 9) agreed to participate. One comprehensive school and two categorical prevocational schools declined to participate because they were involved in another study.

Data collection took place between November 2010 and December 2011 and consisted of anthropometric measures (height, weight) and a digital questionnaire on socio-demographic characteristics, dietary, physical activity and sedentary behaviours and beliefs about school-based interventions. The questionnaire was pretested to four groups of students in another region. Students filled out the questionnaire in the presence of a teacher and a research assistant. Parents were informed about the study by an informative letter distributed via the schools and additional information on a website. They were given the option to withdraw their child from the study. CheckTeen was approved by the Medical Committee of the VU Medical Centre, Amsterdam.

Anthropometric measures
Body weight and height were measured according to protocol by school nurses of the local public health service (GGD IJsselland) during the periodical medical check, that is part of the nationwide Youth Health Care program. Cut-off points for Body Mass Index (BMI) in adolescents defined by Cole et al. were used to define the categories: thinness, healthy weight, overweight and obesity.

Digital questionnaire
The digital questionnaire consisted of 72 questions about the students’ characteristics, dietary behaviour, physical activity and sedentary behaviour on schooldays, and beliefs about school-based overweight prevention. Ethnicity was dichotomized as a non-western background versus a Dutch or western background. The questions about dietary, physical activity and sedentary behaviours were based on the questionnaire of the ChecKid study, a comparable study in the same city targeting primary school children, and were asked only for schooldays.
**Dietary behaviour**

Students indicated the frequency of having breakfast and eating fruit and vegetables, the frequency and number of glasses per day of fruit juice, soft drinks (excluding diet soft drinks), energy drinks and sweetened dairy drinks, and the frequency and amount of sweets, candy bars, cookies, savoury snacks and crisps. Dietary behaviours were dichotomized based on dietary standards recommended for adolescents by the Dutch Nutrition Centre and the Dutch Health Council (2006); eating daily breakfast, daily consumption of fruit and vegetables, ≤ 3 three glasses of sugared drinks per day and ≤ 1 daily snack or candy. Students also reported the consumption frequency of snacks/candy and sugared drinks during school hours and the source of these snacks/candy and drinks.

**Physical activity and sedentary behaviour**

The physical activity behaviour items included in the study were playing outdoor games and sports (organized sports excluded), participating in organized sports, having other activities (e.g. side job, paper round) and active commuting to school. Sedentary behaviour implied TV/video/DVD viewing and computer use. Students were asked to indicate the frequency and time (five categories: < 0.5, 0.5-1.0, 1-2, 2-3, >3 h/day) spent on these activities on schooldays and for organized sports on all days of the week. Based on this information the average time per school day spent on each activity was calculated. For active commuting (cycling) frequency and distance between home and school were indicated and the average commuting time per day was calculated based on an average cycling speed of 12.5 km/h. The activities of active commuting, playing outdoor games and sports and other activities were dichotomized as > 1h or ≤ 1h of the activity per day, and organized sports was dichotomized as > 1h or ≤ 1h per week, based on the Dutch standard for exercise for youth. TV/video/DVD viewing was dichotomized as ≤ 2h or > 2 h per school day. The same cut-off was used for computer use and total screen time (TV/video/DVD + computer use).

**Perceptions and beliefs**

Students indicated their perceived weight status on a 5-point Likert-scale (much too thin, a little too thin, just about right, a bit overweight, very overweight). Perceived dietary, physical activity behaviours were indicated by comparing personal behaviour to other students’ behaviour on a 4-point Likert-scale ((totally) agree, (totally) disagree): I eat healthier/am more active than most other students in school. Beliefs about school-based health promotion were based on an existing questionnaire for adolescents and
the results of focus group interviews with the target group. Students were asked to agree or disagree with propositions on a 4-point Likert-scale. In addition students were asked to select the two best interventions out of 7 dietary behaviour and 6 physical activity options.

**Analysis**

Statistical analyses were performed using SPSS for Windows, version 17.0 (SPSS Inc., Chicago). The level of significance for all statistical tests was set at $p < 0.05$ (two-sided). Chi-square tests were used to identify differences in dietary and physical behaviour and beliefs about school-based health promotion between students with different gender, educational level and BMI-category. In addition, effect modification by gender was studied. Because of small numbers the BMI-categories were combined to overweight (including obesity) or non-overweight students (thinness and healthy weight) for further analyses.

**Results**

**Study population**

The digital questionnaire was completed by 1,432 students. Participation was refused by 53 students or their parents (4%). Reasons for refusal were participating in another lifestyle or medical research study (9%), not being motivated (9%) or no reason was provided (81%). Anthropometric measures of 1,301 students were assessed. Based on the students’ name and date of birth, we were able to combine data from both measurements for 1,084 students. The maximum time period between filling out the questionnaire and having anthropometric measures taken was 8 months. Mean age of the participants was 14.0 year (s.d. 0.55), 46.6% were boys and 9.2% of the students had a non-western background, which is in accordance with regional statistics (table 4.1). Because the association between educational level and breakfast, other activities and organized sports significantly differed between boys and girls, results for boys and girls are presented separately.

**Body weight**

The prevalence of overweight was similar for boys and girls but differed significantly between prevocational, senior general education, and pre-university levels overall (prevocational 25.3%, senior general education 14.2%, pre-university 12.7%, $p<0.001$) and for boys separately (table 4.1). Discrepancies were found between the measured BMI-
category and perceived body weight status. Of the girls, 35.2% perceived themselves to be too fat, while only 19.3% was categorized as being overweight. In contrast, 14.5% of the boys considered themselves too thin, while only 3.8% was underweight based on their BMI. Up to 25.3% of the healthy weight girls considered themselves to be too fat, against 9.4% of the healthy weight boys (p<0.001). Of the overweight boys, 40% judged their body weight as 'just about right', against 23.2% of the overweight girls (p<0.002) (whole group, data not shown).

**Dietary behaviour**

Girls reported significantly healthier dietary behaviours than boys, except for having a daily breakfast (table 4.2). No more than 1 snack per school day was eaten by 35.9% of the girls and 25.5% of the boys. The percentage of students (boys and girls), who had a daily breakfast, daily fruit and vegetables consumption and drank less than 3 glasses of sugared drinks per school day increased significantly with educational level.

Compared to non-overweight students, overweight students significantly less often had daily breakfast (70.6% vs. 78.9%, p=0.012). Overweight boys exhibited healthier dietary behaviours than non-overweight boys with regard to consuming snacks (40.7% vs. 22.0%, p<0.001) and sugared drinks (81.3% vs. 71.2%, p=0.049). No differences in dietary behaviour were found between non-overweight and overweight girls.

More boys than girls perceived their dietary behaviour healthier than other students' behaviour (48.1% vs. 38.5%, p = 0.001). The perception of a healthier dietary behaviour compared with others increased with educational level (boys p<0.001, girls p=0.002). Non-overweight students (46.1%) significantly more often than overweight students (32.7%) considered their dietary behaviour healthier compared with others (p=0.001).

Of all students, 30.9% consumed snacks and 32.2% consumed sugared drinks at least 3 days per week at school. The majority of the students brought snacks and sugared drinks from home (61.6% and 68.5% respectively), while a minority purchased these at school (19.7% respectively 11.2%) or in a store (14.9% respectively 17.4%). Non-overweight girls more often brought drinks from home compared with overweight girls (77.7% vs. 59.9%, p<0.001), while more overweight than non-overweight girls bought drinks at school or a nearby store (school 10.0% vs. 16.5%, p=0.051; store 8.9% vs. 19.3%, p=0.002). This difference was not found in boys.
Table 4.1. BMI and perception of body weight for students of different school levels and different sex (n = 1,084)

<table>
<thead>
<tr>
<th>Secondary educational level -&gt;</th>
<th>Boys</th>
<th>Girls</th>
<th>All Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevocational</td>
<td>Senior general</td>
<td>Pre-university</td>
</tr>
<tr>
<td>Age (year ± s.d.)</td>
<td>14.4 ± 0.54</td>
<td>14.0 ± 0.48</td>
<td>13.8 ± 0.48</td>
</tr>
<tr>
<td>Ethnicity (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Non-western</td>
<td>12.6</td>
<td>8.5</td>
<td>5.5</td>
</tr>
<tr>
<td>BMI-category (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Thinness</td>
<td>3.5</td>
<td>7.1</td>
<td>1.2</td>
</tr>
<tr>
<td>• Healthy weight</td>
<td>71.4</td>
<td>78.7</td>
<td>86.1</td>
</tr>
<tr>
<td>• Overweight/obesity</td>
<td>25.3</td>
<td>14.2</td>
<td>12.7</td>
</tr>
<tr>
<td>Perception body weight (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• (Much) too thin</td>
<td>11.1</td>
<td>16.3</td>
<td>17.0</td>
</tr>
<tr>
<td>• Just about right</td>
<td>65.3</td>
<td>66.0</td>
<td>70.3</td>
</tr>
<tr>
<td>• (Much) too fat</td>
<td>23.6</td>
<td>17.7</td>
<td>12.7</td>
</tr>
</tbody>
</table>

s.d. denotes standard deviation
Table 4.2. Dietary, physical activity and sedentary behaviour of students of different school levels and gender on schooldays (n = 1,084)

<table>
<thead>
<tr>
<th>Secondary educational level</th>
<th>Dietary behaviour (% students who meet the criteria)</th>
<th>Physical activity (PA) (% students who meet the criteria)</th>
<th>Sedentary behaviour (% students who meet the criteria)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>All Students</td>
</tr>
<tr>
<td></td>
<td>Prevocational</td>
<td>Senior general</td>
<td>Pre-university</td>
</tr>
<tr>
<td>Daily breakfast*</td>
<td>68.6</td>
<td>74.5</td>
<td>90.3</td>
</tr>
<tr>
<td>Daily fruit</td>
<td>21.6</td>
<td>30.5</td>
<td>37.7</td>
</tr>
<tr>
<td>Daily vegetables</td>
<td>41.7</td>
<td>48.2</td>
<td>55.2</td>
</tr>
<tr>
<td>≤ 3 gl sugared drinks/day</td>
<td>63.8</td>
<td>75.2</td>
<td>82.4</td>
</tr>
<tr>
<td>≤ 1 snack or candy/day</td>
<td>23.1</td>
<td>22.0</td>
<td>31.5</td>
</tr>
<tr>
<td>Perception behaviour:</td>
<td>Healthier than others</td>
<td>38.7</td>
<td>49.6</td>
</tr>
<tr>
<td>Playing outdoor games and sports &gt;1 hr/day</td>
<td>27.6</td>
<td>14.9</td>
<td>12.1</td>
</tr>
<tr>
<td>Other activities (hobby, job) &gt;1 hr/day*</td>
<td>25.1</td>
<td>14.2</td>
<td>6.7</td>
</tr>
<tr>
<td>Participation in organized sports</td>
<td>66.3</td>
<td>74.5</td>
<td>80.6</td>
</tr>
<tr>
<td>&gt; 1 hr/week*</td>
<td>42.2</td>
<td>34.0</td>
<td>46.7</td>
</tr>
<tr>
<td>Active commuting to school (cycling)</td>
<td>51.3</td>
<td>51.8</td>
<td>62.4</td>
</tr>
<tr>
<td>&gt;1 hr/day</td>
<td>Perception PA: healthier than others</td>
<td>67.8</td>
<td>75.2</td>
</tr>
<tr>
<td>Watching tv ≤ 2 hr/day</td>
<td>64.8</td>
<td>70.2</td>
<td>77.6</td>
</tr>
<tr>
<td>Using computer ≤ 2 hr/day</td>
<td>26.6</td>
<td>31.2</td>
<td>42.4</td>
</tr>
</tbody>
</table>

*: significant interaction for educational level by gender for breakfast, other activities and participation in organized sports
### Table 4.3. Perception of the lessons about healthy eating and physical education (% students who agreed with the statement) (n = 1,084)

| Secondary educational level -> | Boys | | | | | | Girls | | | | | | All | | |
|-------------------------------|------|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|
| Prevocational | Senior | Pre-university | p | Prevocational | Senior | Pre-university | p | Boys | p | Girls | p | p |
| n=199 | n=141 | n=165 | | n=224 | n=138 | n=217 | | n=505 | | n=579 | | |
| Lessons about healthy eating (% students agreeing with the statement) | | | | | | | | | | | | | | | | |
| I learn enough about healthy eating | 70.4 | 47.5 | 50.3 | <0.001 | 60.3 | 44.9 | 42.4 | 0.001 | 57.4 | 49.9 | 0.007 |
| I would like to learn more about preparing healthy food | 39.2 | 36.9 | 38.8 | n.s. | 48.7 | 47.8 | 48.8 | n.s. | 38.4 | 48.4 | 0.002 |
| I find lessons about healthy eating interesting | 33.7 | 31.2 | 29.7 | n.s. | 42.0 | 46.4 | 45.6 | n.s. | 31.7 | 44.4 | <0.001 |
| I talk with my parents about what I learn about healthy food* | 32.2 | 22.0 | 23.6 | n.s. | 25.9 | 34.1 | 24.4 | n.s. | 26.5 | 27.3 | n.s. |
| Due to lessons I have improved my healthy eating habits | 24.6 | 14.2 | 10.9 | 0.002 | 19.6 | 20.3 | 12.0 | n.s. | 17.2 | 16.9 | n.s. |
| Physical education lessons (% students agreeing with the statement) | | | | | | | | | | | | | | | | |
| I think we have sufficient PE lessons | 62.3 | 51.1 | 50.9 | 0.040 | 78.6 | 79.0 | 73.7 | n.s. | 55.4 | 76.9 | <0.001 |
| I would like to learn more about how to be sufficiently and healthily active | 42.7 | 45.4 | 34.5 | n.s. | 40.6 | 45.7 | 36.9 | n.s. | 40.8 | 40.4 | n.s. |
| I like PE lessons | 93.0 | 92.9 | 90.3 | n.s. | 79.5 | 85.5 | 79.3 | n.s. | 92.1 | 80.8 | <0.001 |
| Due to lessons I have become more active in sports in my spare time* | 37.7 | 29.8 | 18.2 | <0.001 | 23.7 | 26.1 | 18.4 | n.s. | 29.1 | 22.3 | 0.007 |

*: significant interaction for educational level by gender for the statements: ‘I talk with my parents about what I learn about healthy food’ and ‘Due to lessons I have become more active in sports in my spare time’.
Physical activity and sedentary behaviour

Most students (90.0%) cycled to school and 41.4% of the boys and 38.5% of the girls spent >1 hour per school day actively commuting, which contributed largely to the amount of physical activity on schooldays (table 4.2). Significant more boys than girls spent >1 hour per school day playing outdoor games and sports (19.0% vs. 14.2%). More girls than boys spent <2 hours on the computer per school day (77.7% vs. 70.5%). Significant differences per educational level were found for spending >1 hour per school day playing outdoor games and sports and on other activities, the prevocational educational level being the most favourable, while participation in organized sports was more favourable for pre-university students (table 4.2). Overweight girls were less involved in organized sports than non-overweight girls (59.1% vs. 70.7%, p=0.019), while overweight boys less often commuted >1 hour per school day compared with non-overweight boys (31.9% vs. 43.6%, p<0.040).

Beliefs about school-based interventions

Boys and girls differed in their beliefs about school-based interventions (table 4.3). Significantly more girls than boys disagreed with the proposition that they learn enough about healthy eating at school (51.1% vs. 42.6%). More girls than boys would like to learn more about preparing food (51.6% vs. 41.6%) and found the lessons about healthy eating interesting (44.4% vs. 31.7%). More prevocational than senior general and pre-university students agreed that they learn enough about healthy eating and had improved their dietary habits due to the lessons. Students reported that they considered a healthy school canteen (57%) and offering free fruit (67%) the most promising interventions to stimulate healthy dietary behaviour in school.

More girls (76.9%) than boys (55.4%) found the amount of PE lessons sufficient, while more boys than girls enjoyed the PE lessons (92.1% vs. 80.8%) or had become more active due to lessons (29.1% vs. 22.3%). Differences for educational level were found in boys only, the prevocational students being most positive about the amount of PE lessons (62.3% vs. 51.1% vs. 50.9%), and becoming more active in sports due to lessons (37.5% vs. 29.8% vs. 18.2%). To stimulate physical activity, boys mainly suggested more PE classes (63%), while girls advised more variation (47%) and more choice (43%) in activities.
Discussion

The prevalence of overweight was the highest in students in the lowest educational level. Compared with senior general and pre-university students, prevocational students had unhealthier dietary behaviours and participated less in organized sports. Cycling to school contributed largely to the daily amount of physical activities for all students. At all levels, girls had healthier dietary behaviours than boys, but similar physical activity behaviours. Overweight students less often ate a daily breakfast, and less often consumed snacks and sugared drinks on school days than non-overweight students. Snacks and drinks consumed at school were mainly brought from home. Beliefs about school-based interventions differed with gender, girls being interested in nutrition overall and variation and choice in physical activities and boys interested in a higher amount of physical activities in school.

Girls seemed to have a different perception or different standard for assessing their body weight status than boys. Possibly, girls are more interested in health in general than boys, as they were also more interested in lessons on healthy nutrition. On the other hand, boys could be less interested because they were more positive about their body weight status and dietary behaviour than their actual measured weight and reported behaviour reflected and thus less problem aware. Because of the cross-sectional design, it cannot be determined whether perception of body weight status and dietary behaviour are influenced by interest and awareness or vice versa. The perceived and actual body weight and behaviour should be addressed in lessons.

Especially prevocational students and overweight students tend to skip breakfast, which is not a good start of the school day and can negatively influence cognitive school performances. In addition, eating breakfast regularly can be an indicator for a healthy dietary lifestyle and a healthy body weight. Therefore, the importance of having breakfast should be stressed in school-based interventions.

The reported consumption of sugared drinks by the participants is relatively low compared with results of other studies with adolescents. However, our findings are in line with our earlier finding that soft drink sales are relatively small in secondary schools in Zwolle, and with a recent Canadian study. The consumption of sugared drinks by overweight boys is lower compared to non-overweight boys. Possibly overweight boys reported more socially desirable answers than non-overweight boys or had already changed their unhealthy behaviour in order to reduce their bodyweight. However, the consumption of sugared drinks should be addressed in health lessons as in general sugared drinks and overweight are strongly related.
Overweight students reported lower snack consumption compared with non-overweight students. However, overweight students more often bought snacks or drinks in or nearby school, while non-overweight students brought those goods from home. Possibly, the dietary choices of overweight adolescents are less supervised by their parents than the decisions of non-overweight students.\(^{(34,35)}\)

Active commuting contributes highly to daily physical activity and cycling is regarded in the Netherlands as standard and essential behaviour of adolescents.\(^{(24)}\) Differences in physical activity were more related to educational level than gender. Prevocational students were more active in playing outdoor games in the neighbourhood and having other activities than higher level students, but less often participated in organized sports. Possibly, social and economic conditions to participate in organized sports are less favourable for prevocational students, who spend time to earn money.\(^{(24)}\) It should be noted that it is not clear in this study how ‘other activities’ and ‘playing outdoor games and sports’ are interpreted by students and how vigorous these activities are. Overweight girls participated less in organized sports than non-overweight girls, and overweight boys spent less time on active commuting to school compared with non-overweight boys. Drake\(^{(36)}\) found the same associations in the USA and estimated that the risk of overweight and obesity could be reduced by more frequent sports participation and active commuting. Although the physical activity level of these 14 year old students is pretty good, it is known that the physical activity level declines from adolescence to adulthood.\(^{(37,38)}\) To prevent this, active commuting and participation in organized sports should be stimulated and kept attractive in the school environment.

Compared with data of primary school pupils in the same region, the prevalence of overweight in second grade secondary school students has risen and the dietary and sedentary behaviours of students at all educational levels has become less healthy.\(^{(19)}\) Thus, our findings confirm the importance of obesity prevention and promoting healthy dietary and physical activity behaviours during the adolescent period taking into account behavioural differences between students of different gender, educational levels and, to a lesser extent, BMI-category. Based on the results of the study, school-based interventions should make students aware of their body weight and personal behaviours to tackle existing misperceptions. The relationship between healthy behaviour and school performances could be used as an argument to motivate students and their parents to change adolescents’ behaviour. In health lessons, students should be offered knowledge, skills and reasons to make healthy choices. In addition, the food assortment in the school canteen should set a healthy example. As most students enjoy PE lessons, the opportunity should be taken to guide students to participate in sports activities after school or at sports clubs. The high level
of active commuting could be maintained by providing facilities such as bicycle storage. As most students have breakfast at home and tend to bring most of their food from home, schools should collaborate more with parents to stimulate adolescents to have breakfast at home every day, compile a healthy lunch box and cycle to school.

The dietary, physical activity and sedentary behaviours were measured by self-reported behaviour of the student, which is often done for practical reasons. Because self-reporting can lead to social desirable answers and underestimation of unhealthy behaviour, we asked detailed questions about the frequency and quantity of behaviours in our questionnaire. However, measuring physical activity by a questionnaire remains difficult, because the extent of physical strain is unknown.

The anthropometrical measurements and the questionnaire were not executed at the same because different persons and organizations were responsible for each measurement. Students in second grade have adapted to secondary school lifestyle and developed a routine in their behaviour, which will be reflected in their body weight status. The anthropometrical measurements were always taken after the questionnaire was filled out.

The total study population is relatively small for a detailed analysis of differences in subgroups based on gender educational level and ethnicity. For example, the prevalence of overweight in non-western students compared with western students at all educational levels was almost twice as high, but data are too limited to explore this further. Nevertheless the study has revealed some interesting differences between students based on gender and educational level that could be addressed in school-based interventions.

In conclusion, the results of the study indicate the need for school-based interventions at all educational levels, tackling the development of unhealthy dietary and physical activity behaviour of adolescents by a combination of educational and environmental interventions and the collaboration between school and parents. Rather than focusing on BMI-categories, school-based interventions should be tailored to educational level and gender.
References


