

# The association between home availability and dietary behaviours among adolescents

*Master thesis in nutrition*

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*Part of the HEIA study*



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To write this master thesis has been rewarding and I have learned a lot. It has been interesting to be part of a larger project, with many experienced and friendly people.

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Trine Næss Henriksen



# Summary

**Background:** An increasing prevalence of overweight and obesity among children and adolescents has been observed worldwide and also in Norway, and this represents a major public health challenge. Dietary behaviours suggested to be associated with overweight includes sugar-sweetened beverages, fruit and vegetables. In order to develop interventions to prevent overweight and to promote population health it is important to gain knowledge on determinants of the dietary behaviours. There has recently been a shift in focus from individual determinants of health behaviours to environmental determinants. Parents and the home environment are found to be important influences of adolescents' dietary behaviours. A possible determinant of dietary behaviours in the home food environment is availability. There is a need to investigate how the home availability influences dietary behaviours and to explore the mediating pathways of this relation.

**Aim:** To investigate the home availability, including perceived and physical availability, of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables in the home of adolescents in 6<sup>th</sup> grade. Further, to investigate how perceived and physical availability was related to the adolescents' dietary behaviours.

**Subjects, design and methods:** This master thesis is part of the HEIA (HEalth In Adolescents) study. The master student participated in the data collection of the HEIA II study in September-October 2011, but only data from the baseline data collection of the HEIA study in September 2007 have been used in the analyses in this thesis. A sample of 796 adolescents and their mothers and fathers were included in this study. Data on dietary behaviours and determinants from the adolescents' questionnaire and on determinants from the parents' questionnaires and the food shelf inventory were used in the analyses. The dietary behaviours included were soft drinks with sugar, fruit drinks with sugar, fruit and vegetables, and the determinants were perceived and physical availability of the items at home. The investigation of perceived availability included both perceived availability measured by adolescents, mothers and fathers. Associations between perceived availability and physical availability at home and adolescents' intake were tested. Single mediation analyses were conducted to test if the potential association between physical availability and adolescents' intake were mediated by perceived availability.

**Results:** The perceived availability and also the physical availability of fruit and vegetables were high, while the perceived and physical availability of sugar-sweetened beverages were considerably lower. Levels of perceived availability by mothers were significantly lower for soft drinks with sugar and fruit drinks with sugar and higher for fruit and vegetables compared to the perceived availability by fathers. Higher levels of perceived availability by adolescents and parents of sugar-sweetened beverages were associated with higher intake among the adolescents of the beverages. Higher levels of perceived availability by adolescents of fruit and vegetables, by mothers of fruit for girls and boys and by fathers of fruit for girls were associated with higher intakes of the items. There was a positive association among both girls and boys between physical availability and intake of soft drinks with sugar and between physical availability and intake of fruit. A positive association between physical availability and intake of fruit drinks with sugar among girls was also found. Perceived availability by girls and mothers mediated the association between physical availability and girls' intake of soft drinks with sugar. The association between physical availability and boys' intake of soft drinks with sugar was mediated by perceived availability by boys, mothers and fathers. Further, perceived availability by girls, mothers and fathers mediated the association between physical availability and girls' intake of fruit drinks with sugar. There was found a significant direct association between physical availability and intake of fruit for girls.

**Conclusion:** The findings of this study indicate that both perceived and physical availability may influence dietary behaviours, and therefore may be determinants to target in interventions aiming to decrease intake of sugar-sweetened beverages and increase intake of fruit and vegetables. More studies are however needed to further explore the associations and to identify other determinants. This study supports that determinants may influence girls and boys differently, and therefore that different intervention strategies are needed to reach both genders. Further it supports that including intervention components aimed at parents and the home environment are important.



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**Appendix 2:** Adolescent questionnaire – relevant survey items

**Appendix 3:** Mother/father questionnaire – relevant survey items

# Abbreviations and definitions

**Adolescents:** 10-18 years of age.

**ANGELO:** Analysis Grid for Environments Linked to Obesity (1).

**EBRB:** Energy-balance related behaviours.

**EnRG:** The Environmental Research framework for weight Gain prevention (2).

**FV:** Fruit and vegetables.

**Md:** Median.

**SD:** Standard deviation.

**SSB:** Sugar-sweetened beverages; soft drinks with sugar and fruit drinks with sugar.

**HBSC:** The World Health Organization collaborative cross-national survey Health Behaviour in School-aged Children (3).

**HEIA (HEalth In Adolescents):** The HEIA study was a school-based randomized intervention study, aiming to promote healthy weight development among adolescents.

**WHO:** World Health Organization.

# 1 Background

## 1.1 Overweight and obesity among adolescents

An increasing prevalence of overweight and obesity among children and adolescents has been observed worldwide and also in Norway (4-8). This is a major public health challenge since it increases the burden of ill health and has substantial economic implications (4). The World Health Organization (4) considered in 2007 about 20% of European children and adolescents as overweight or obese. The child growth study (9), based on measurements taken by school health services, found that among Norwegian 8- to 9-year-old children 22% of girls and 17% of boys were overweight or obese in 2010. Self-reported data on weight and height from Norwegian 11-year-olds in the Health Behaviour in School-aged Children (HBSC) survey 2009/2010 showed that 12% of girls and 21% of boys were overweight or obese according to WHO growth reference (10).

Child and adolescent obesity raises the risk of several health problems, both physical and psycho-social. Some of the health problems occur already in childhood and adolescence, but there are also long term adverse effects (11, 12). Furthermore, overweight and obese children and adolescents are more likely to be overweight and obese as adults (12-16).

Overweight and obesity is a major cause of non-communicable diseases like cardiovascular diseases and diabetes type 2, and also several types of cancer (17, 18). According to the Public Health Report from 2010 (19) on the public health situation in Norway non-communicable diseases are the major public health challenge in Norway. In 2010 non-communicable diseases were estimated to be accountable for 87% of all deaths in Norway (20).

The direct cause of overweight and obesity is a positive energy balance, where the energy intake exceeds the energy expenditure over a period of time. Behaviours influencing the energy balance positively or negatively are often referred to as energy-balance related behaviours (EBRB). The behaviours are coexisting and interacting and also differ for different target groups, therefore it is not possible to focus on one single factor as a universal causal factor in obesity (2). The energy-balance related behaviours could be diet and physical activity, but the further focus in this thesis will be on dietary behaviours only.

## **1.2 Dietary behaviours**

Studies have observed associations between weight gain, overweight and obesity and different dietary behaviours such as a diet high in fat or carbohydrates and low in fibre, frequent snacking, low consumption of fruit and vegetables and frequent consumption of sugar-sweetened beverages (2, 17, 21). Although there are other dietary behaviours suggested to be associated with overweight, the further focus is on sugar-sweetened beverages, fruit and vegetables. It is particularly important to focus at children and adolescents as dietary behaviours formed in childhood and adolescence is often the basis for the diet throughout life (22-26). Lien et al. (25) found based on data from a Norwegian longitudinal cohort study, that the majority of individuals maintained their dietary behaviours, including intake of sugar-sweetened beverages, fruit and vegetables, from age 14 to age 21. Furthermore, a Finnish study (26) found that already in childhood and adolescence dietary behaviours and concrete food choices are established, and that it may significantly track into adulthood.

### **1.2.1 Sugar-sweetened beverages**

Concerns have been raised that high-sugar/low-nutrient foods, like sugar-sweetened beverages, may replace more nutrient-dense foods, or else be eaten in addition to these foods and therefore may lead to excess energy intake (25, 27-29). Several reviews and meta-analyses have been published in recent years, revealing conflicting results on the association between sugar-sweetened beverages and overweight. Some have suggested consumption of sugar-sweetened beverages to have a positive association with body weight and obesity (17, 18, 28-35). However not all have found this association or have suggested the association not to be substantiated by the science (36-40).

Several studies indicate that Norwegian children and adolescents have a high intake of sugar-sweetened beverages. In the national representative Ungkost study (41) conducted in Norway in 2000, the mean contribution of intake of added sugar to the total energy intake were found to be 18% for girls and 16% for boys among 9-year-olds and 19% for girls and 18% for boys among 13-year-olds. The percentages of 9- and 13-year-olds with a higher intake of sugar than the recommended maximum of 10E% from sugar (42) were 84-90%. Of the added sugar intakes, soft drinks with sugar and fruit drinks with sugar in total contributed with 38-48%. In



the Fruits and Vegetables Make the Marks project data on consumption of sugar-sweetened beverages among Norwegian 11- and 12-year-olds were collected in 2001 and 2008. There was observed a lower frequency of consumption among the adolescents in 2008 than in 2001, suggesting a reduction in the intake of sugar-sweetened beverages over time (43).

In the World Health Organization collaborative cross-national survey Health Behaviour in School-aged Children (HBSC) data are collected every fourth year on 11-, 13- and 15-year-old girls' and boys' health and well-being, social environments and health behaviours, including dietary behaviours (3). The inception of the survey was in 1982, and the survey now includes 43 countries across Europe and North America. Since the HBSC survey is conducted every fourth year it provides the opportunity to study trends over time. Between 1985 and 1989 it was found a decreased intake of soft drinks with sugar among Norwegian 11-year-olds, then an increased intake was found between 1989 and 2001, followed by a decline in intake between 2001 and 2005 (44). In the HBSC survey 2009/2010 (10) 5% of girls and 8% of boys among Norwegian 11-year-olds were found to drink soft drinks with sugar daily. This was below the average of 16% of girls and 19% of boys among all the European and North American countries participating in the HBSC survey.

### **1.2.2 Fruit and vegetables**

Fruit and vegetables are considered to be part of a healthy balanced diet and may contribute positively in weight management (17, 45). Regular intake of fruit and vegetables has been associated with lower risk of obesity, especially based on their contribution to intake of fibre (17, 46). More studies exploring this association are however requested (47, 48). A negative association have also been found between intake of added sugar, including sugar-sweetened beverages, and intakes of fruit and vegetables (49).

The intakes of fruit and vegetables among 11-year-olds were in 2003 found to be lower than the recommended daily intake levels both in Norway and in other European countries (50). The Ungkost study from 2000 reported mean intakes of fruit and vegetables of 225-255 gram per day among the participants consisting of 4-year-olds, 4th graders and 8th graders (51). Trend data from the HBSC surveys showed an overall slight decreased intake of fruit between 1985 and 2001 among Norwegian 11-year-olds, then an increased intake between 2001 and

2005 (44). In the HBSC survey 2009/2010 (10) 53% of girls and 40% of boys among Norwegian 11-year-olds were found to eat fruit daily. This was above the average of 46% of girls and 38% of boys among all the European and North American countries participating in the HBSC survey. For vegetables the HBSC survey 2009/2010 showed that 37% of girls and 31% of boys ate it daily, which was below the average of 40% and 32% respectively for all participating countries.

## **1.3 Determinants of adolescents' dietary behaviour**

It is not enough just to identify the specific dietary behaviours causing overweight and illness. To develop targeted interventions to prevent overweight and to promote population health it is important to gain knowledge on determinants of the dietary behaviours (52, 53). The determinants that influence the dietary behaviours of adolescents can be on individual and environmental level. There has recently been a shift in focus from individual determinants of health behaviours to environmental determinants (54). Studies have suggested that one of the main driving forces for the obesity epidemic may be the environment encouraging eating and discouraging physical activity (55, 56).

### **1.3.1 Individual determinants**

Potential individual determinants of adolescents' dietary behaviour include taste preferences, nutrition knowledge, attitude, subjective norm, perceived behavioural control, self-efficacy and intention (52, 57-59). Different social cognitive models have been used to explain how individual determinants influence dietary behaviours, in particular the Theory of Planned Behaviour (60). Studies have reported taste preferences, attitude, subjective norm and intention to be associated with children's and adolescents' intake of sugar-sweetened beverages (60-63). Taste preferences, knowledge and self-efficacy have been found to be associated with children's and adolescents' intake of fruit and vegetables (59, 64-67). Individual determinants have however been found to be inadequate to fully explain the dietary behaviours and the widespread prevalence of obesity (58, 60, 68).

### **1.3.2 Environmental determinants**

Environmental determinants have in recent years got more attention as possible determinants of dietary behaviours (52, 68-71). The environment may produce opportunities and obstacles for healthy behaviours. By Brug and van Lenthe (54) the environment is referred to as “anything outside the individual”.

Social-ecological frameworks to better understand the environmental determinants have been suggested. The ANGELO (Analysis Grid for Environments Linked to Obesity) framework developed by Swinburn et al. (1) dissects environment by two dimensions, size and type. The two environmental sizes are at micro level (for example homes, schools and neighbourhoods, communities) and macro level (for example health system, urban/rural development and media). Within these levels there are different types of environment, categorized as physical, economic, political or socio-cultural.

A large review done by Brug and van Lenthe (54) provided an overview of the existing evidence on environmental determinants and interventions related to physical activity, dietary behaviours and smoking, in children, adolescents and adults. In this review it was found several studies among children and adolescents on micro level environments, mostly on home environment, some on school environment and one on the neighbourhood environment. Only a few studies among children and adolescents examined macro level environments, and they were all on cities/municipalities and none on political environments. It must be taken into consideration that this review was written in 2005 and more recent studies on the topic have been conducted in the years from 2005 and up until today. The review referred to that it is well documented that the environment is important for the energy-balance related behaviours of children and adolescents. The review however recommended more studies especially on the physical environmental determinants (54). In this thesis only the home environment will be discussed further.

#### **Home food environment**

The home and the parents are an important part of adolescents’ everyday life. Parents and the home environment are also found to be important influences on adolescents’ dietary behaviours (12, 72, 73). Possible determinants of adolescents’ dietary behaviour in the home

environment include parental modelling, various parenting practices, home availability and accessibility (62, 65, 69, 74-76).

By deciding what food and drink items that are available at home, the parents influence their children's physical and social environment (75, 77). Parents can also influence their children's behaviours indirectly through modelling and socialization processes (77). They can for example come up with rules on when and how much their children are allowed to eat or drink of different types of food and beverages. This may influence whether the children perceive the food or beverage as available, regardless of whether it is physically available at home.

A study by Vereecken et al. (75) on Belgian 10-year-olds found that the availability of less healthy foods and beverages and parents permissiveness had a positive association with intake of soft drinks with sugar, sweets and crisps, and a negative association with intake of fruit and vegetables. Van der Horst et al. (78) found in their study that adolescents' perceived restrictions on consumption set by parents had a negative association with the adolescents' consumption of sugar-sweetened beverages.

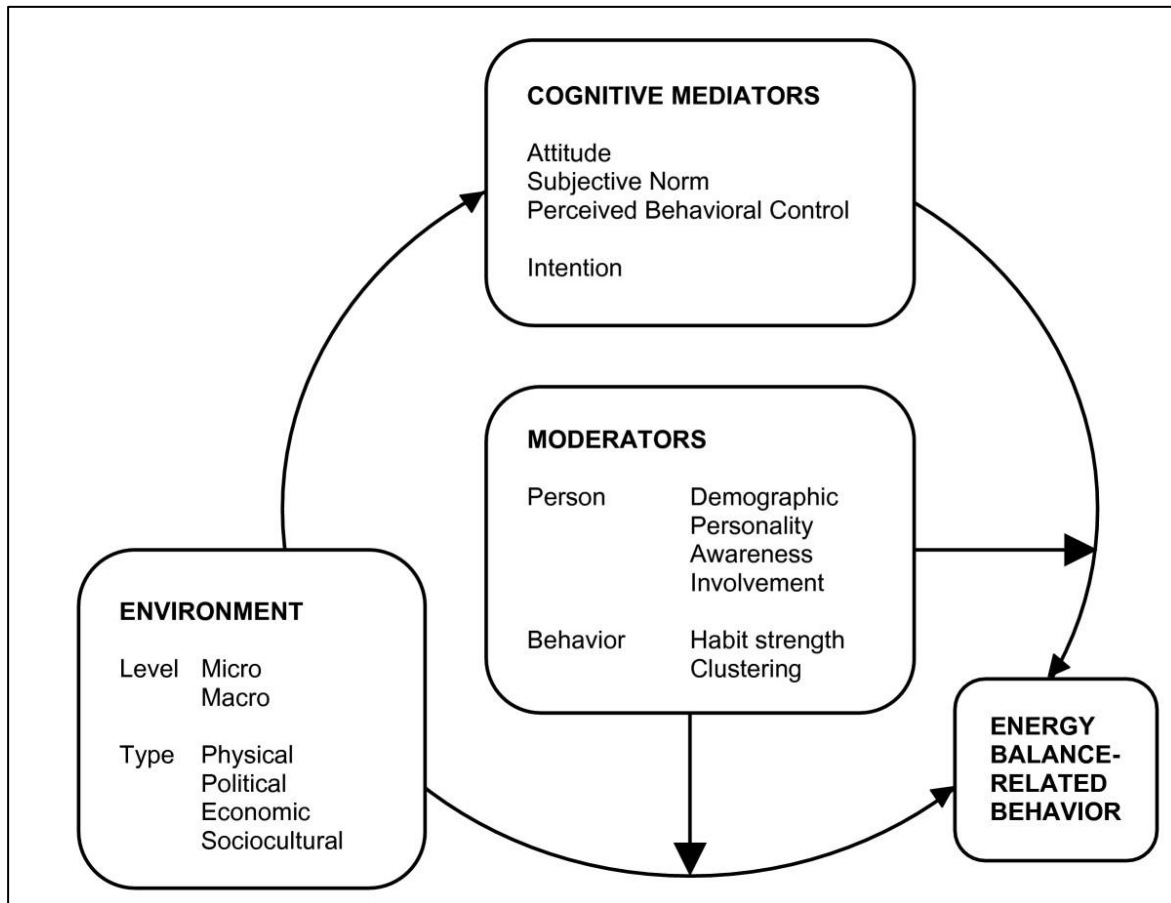
Several studies have showed that the availability of sugar-sweetened beverages, fruit and vegetables at home have a significant positive association with adolescents' intake of the food and drink items (59, 61, 62, 66, 69, 79-81). However there is some inconsistency as some studies have found no association between availability and adolescents' intake (65, 82, 83). That there is inconsistency regarding availability was also pointed out by Brug and van Lenthe (54) in their review, and they urged more studies on the topic.

## **1.4 The understanding of the relation between determinants and dietary behaviour by the EnRG framework**

Determinants may directly and indirectly influence adolescents' dietary behaviour. The relation between determinants and dietary behaviour may also be affected by a third variable. This third variable influencing the relation can be a confounder, covariate, moderator or mediator. When the determinants influence dietary behaviour through an intermediate

variable in the causal sequence, the variable is called a mediator. The mediator can be used to explain the process by which one variable affects another (84). Few studies have so far explored whether environmental determinants have a direct and/or mediated effect on adolescents' dietary behaviours (85).

The Environmental Research framework for weight Gain prevention (EnRG) was proposed by Kremers et al. (2) in order to help obtain insight into the most important determinants of energy-balance related behaviours and also into the underlying causal mechanisms of these behaviours (figure 1). The EnRG framework suggests that environmental determinants influence energy-balance related behaviours both directly and indirectly, representing a dual-process view. The direct influence indicates the automatic and unconscious effect of the environmental determinants on behaviour. The indirect influence reflects the mediating role of cognitive factors in the effect of the environmental determinants on behaviour. Concerning the environmental determinants, the EnRG adopted the dissection of environment into level and type from the ANGELO framework developed by Swinburn et al. (1). In the EnRG framework it is also suggested that various factors (for example gender) moderate the relation between environmental determinants and behaviour.



**Figure 1:** The Environmental Research framework for weight Gain prevention (EnRG) proposed by Kremers et al. (2). This article is distributed under the terms of the Creative Commons Attribution License (86) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Few studies have explored the influences of the home food environment on adolescents’ dietary behaviours in Norway. Further, there are also few studies both in Norway and internationally that have explored whether environmental determinants have a direct and/or a mediated association with adolescents’ dietary behaviours.

Moreover, studies including both adolescents and their mothers and fathers are needed in order to obtain a comprehensive understanding of the home food environment. Most previous studies only included one parent in addition to the adolescent, and this has usually been the mother. It will therefore be interesting study how the adolescent and both parents perceive the home food environment, and to compare how the mothers and the fathers perceive the home food environment.

One of the home food environment factors that are suggested to be studied further, as mentioned earlier, is the home availability of different types of food and beverages. A growing number of studies have used food shelf inventories to measure the home food environment and to inform on what is physically available at home, but the method has not been used much in Northern Europe.

## **2 Aim and research questions**

### **2.1 Aim**

The aim of this master thesis was to investigate the home availability, including perceived and physical availability, of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables in the home of Norwegian adolescents in 6<sup>th</sup> grade. The investigation of perceived availability included both perceived availability measured by adolescents, mothers and fathers.

Furthermore the aim was to investigate how perceived and physical availability was related to adolescents' intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables.

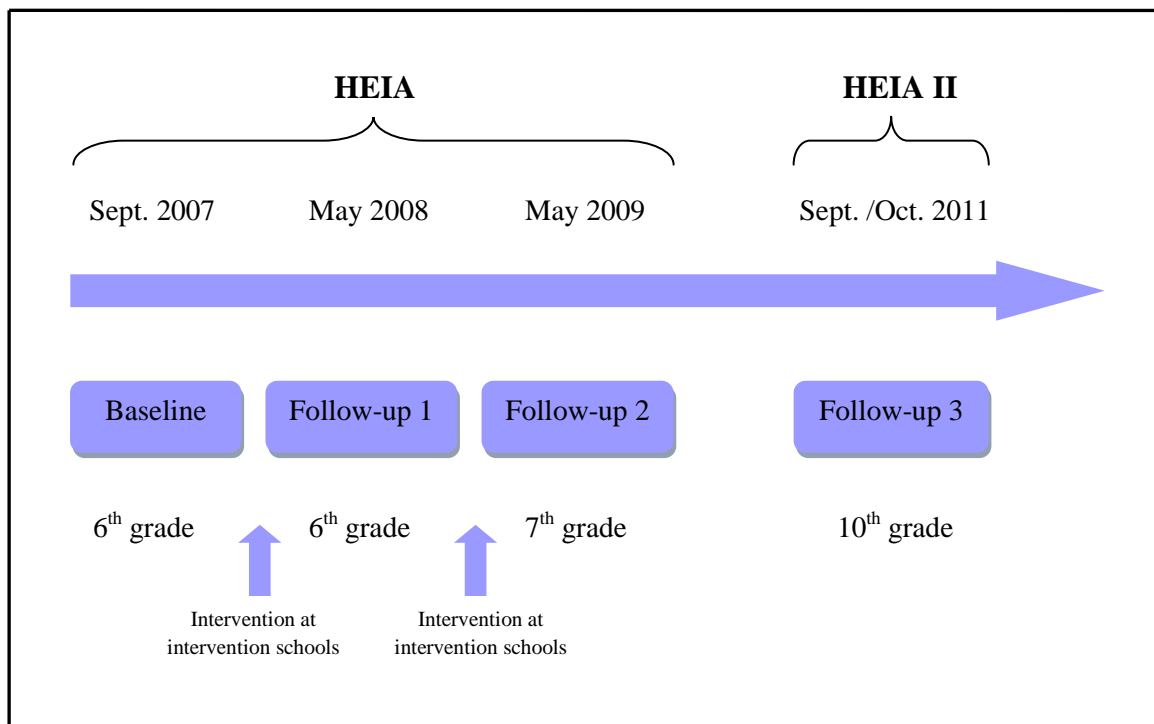
### **2.2 Research questions**

1. How is the perceived and physical availability of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables in adolescents' homes?
2. Is there an association between perceived and physical availability at home and adolescents' intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables?
3. Is the potential association between physical availability at home and adolescents' intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables mediated by perceived availability of the items?



### 3 Subjects and methods

This master thesis is part of the HEIA (HEalth In Adolescents) study. The master student participated in the data collection of the HEIA II study in September-October 2011, but only data from the baseline data collection of the HEIA study in September 2007 have been used in the analyses in this thesis. See figure 2 for overview of the HEIA and HEIA II studies.



**Figure 2:** Timeline of the HEIA and HEIA II studies.

#### 3.1 The HEIA study

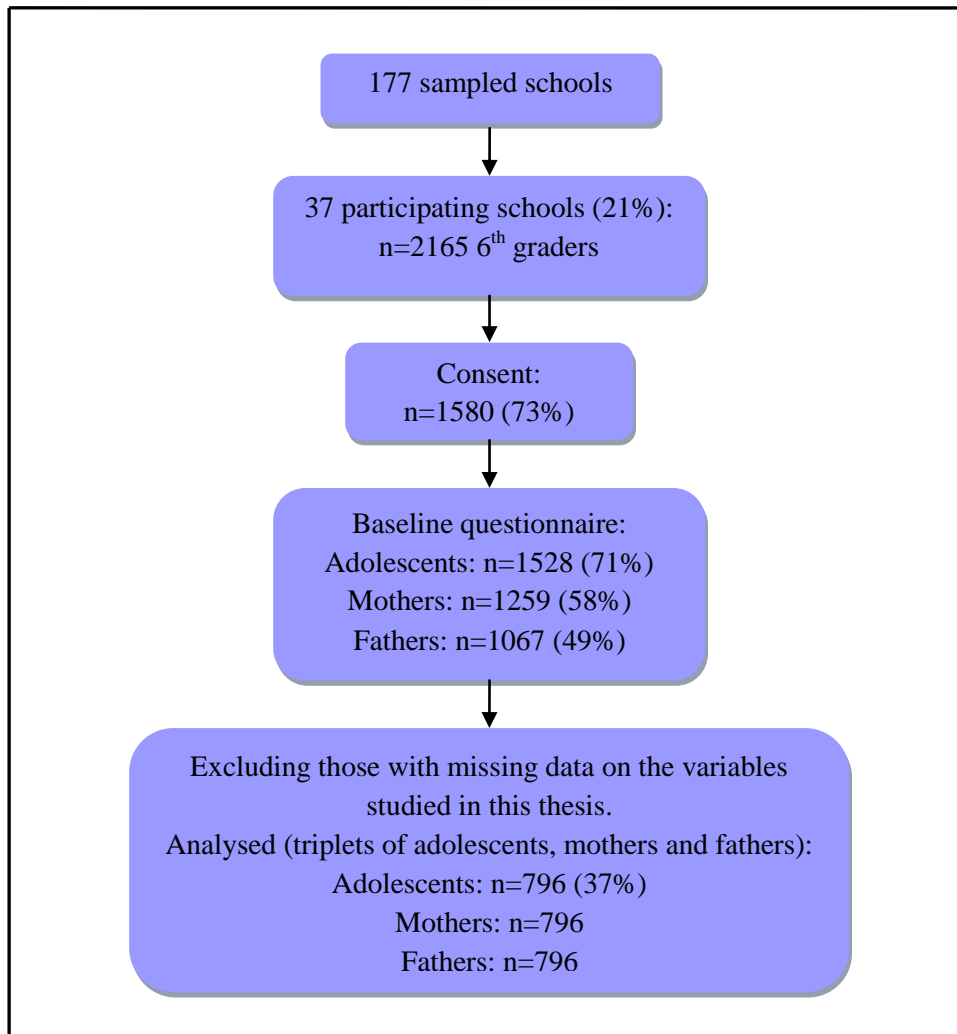
The HEIA study was a school-based randomized intervention study, aiming to promote healthy weight development among adolescents. The study was conducted as a collaboration between the University of Oslo and the Norwegian School of Sport Sciences. The main goal of the HEIA study was to design, implement and evaluate a comprehensive intervention programme to promote healthy weight development among young adolescents (11- to 13-year-olds) (87).

Recruitment of schools to the HEIA study was conducted by the research team in 2007. A total of 177 primary schools in the largest towns and municipalities in seven counties (Akershus, Buskerud, Oppland, Hedmark, Telemark, Vestfold and Østfold) surrounding Oslo were invited to participate. The schools had to have at least 40 enrolled pupils in 6<sup>th</sup> grade at the time of recruitment to be invited. Out of the invited schools 37 (21%) agreed to participate. The schools that agreed to participate were randomly assigned by simple drawing to 12 intervention schools and 25 control schools. Data was collected at baseline in September 2007, and at follow-up 1 in May 2008 and follow-up 2 in May 2009 (87).

### **3.1.1 Subjects**

The target group of the HEIA study was adolescents aged 11-13 years. All 6<sup>th</sup> graders in the 37 participating schools (n=2165) and their parents or legal guardians (hereafter called parents) were invited to participate (figure 3). A total of 1580 adolescents returned a parent-signed informed consent form (appendix 1) for participation, and 1528 of the adolescents (71% of the 2165 6<sup>th</sup> graders) filled in the baseline questionnaire. Among the parents 1259 of the mothers (58%) and 1067 of the fathers (49%) completed the baseline questionnaire.

To be included in the analyses in this thesis the cases could not have any missing variables in the baseline questionnaire from either adolescent, mother or father among the variables studied in this thesis, resulting in a sample of 796 adolescents (52% of the 1528 participating adolescents) and their mothers and fathers.



**Figure 3:** Flow diagram of recruitment and participation of adolescents and parents at baseline in the HEIA study, and also of the number included in this thesis.

### 3.1.2 Design of the baseline data collection

The baseline data collection was done during four weeks in September 2007. Three research teams consisting of four people per team visited and collected data at one school per day. All team members were trained and measurements were conducted according to standard procedures.

The adolescents were asked to fill in an internet-based questionnaire with 121 questions (see appendix 2). The questionnaire included questions about diet, physical activity, sedentary behaviour and determinants of these behaviours, and also questions on weight related issues. Approximately 45 minutes were needed to finish the questionnaire. Questions on puberty

status were given on a separate paper form to ensure privacy. If an adolescent was absent on the day the research team visited the school, the adolescent was asked to fill in the questionnaire on a later day. Anthropometric measurements and measurements of physical activity by accelerometers were also collected for adolescents.

Questionnaires to mothers and fathers (see appendix 3) were scannable paper forms, and the forms were sent home with the adolescent. The questionnaires for parents covered the same behaviours and determinants as for adolescents. Mothers and fathers were asked to fill in self-reported anthropometrics. In the mothers questionnaire a food shelf inventory was included to assess physical availability of 71 items or categories of food, drinks and dietary supplements. The parental questionnaires were returned to the teachers in a sealed envelope, and project staff collected the forms from the schools. Information about parental education was reported by the parents themselves in the informed consent form.

The school management and the school nurse were also asked to fill in questionnaires. The project staff made observations and filled in a form on opportunities for physical activity in the school yards and around the schools. An observation of availability of food and drinks that children are likely to buy themselves in food outlets around the schools were also conducted by the project staff.

Data collected through the internet-based questionnaire for the adolescents and in the scannable questionnaires for the mothers and fathers are used in the analyses in this thesis.

## **3.2 The HEIA II study**

The lower secondary schools, where the majority of the pupils from the elementary schools participating in the HEIA study had been transferred, received an invitation to the HEIA II study. The HEIA II study was conducted as a third follow-up in the HEIA study. The adolescents that participated in the HEIA study and their parents were asked to participate in the HEIA II study. The data collection in the HEIA II study took place in September-October 2011. At the collection time the adolescents were in 10th grade. The master student was one of the trained project staff who visited schools and collected data. One by one the project staff visited one school per day.

Instruments and procedures used in the HEIA II study were mainly the same as used in the HEIA study. Questions on alcohol, tobacco and education plans were added to the adolescents' questionnaire. Anthropometric measurements and measurements of physical activity by accelerometers were not collected in the HEIA II study.

Due to uncertainty on whether the data collected in the HEIA II study would be ready for analyses in time, the master student used data from the baseline data collection of the HEIA study for the analyses in this thesis.

### **3.3 Ethical aspects**

The study protocol of the HEIA study was approved at the regional branch of The National Committee for Medical Research Ethics and by the Norwegian Social Science Data Service. One parent or legal guardian provided a written informed consent for the participation of the adolescent. Anthropometrics were not given to the adolescents, and if they expressed concerns about their weight they were advised to contact the school nurse or their family doctor. Throughout the intervention care was taken to focus on the behaviours rather than weight to avoid discrimination or pressure related to weight and body image among the adolescents. School nurses and teachers were informed about the project.

The study protocol of the HEIA II study was also approved at the regional branch of The National Committee for Medical Research Ethics. One parent or legal guardian provided a written informed consent for the participation of the adolescent.

### **3.4 Methods**

The behaviours studied in this thesis were intake of carbonated soft drinks with sugar (hereafter called soft drinks with sugar), fruit drinks with sugar, fruit and vegetables. The determinant for intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables studied in this thesis was home availability. Home availability included both perceived availability and physical availability of the different food and drink items at home. The

selection of determinants was based on the conceptual model of the HEIA study (figure 4) (87).

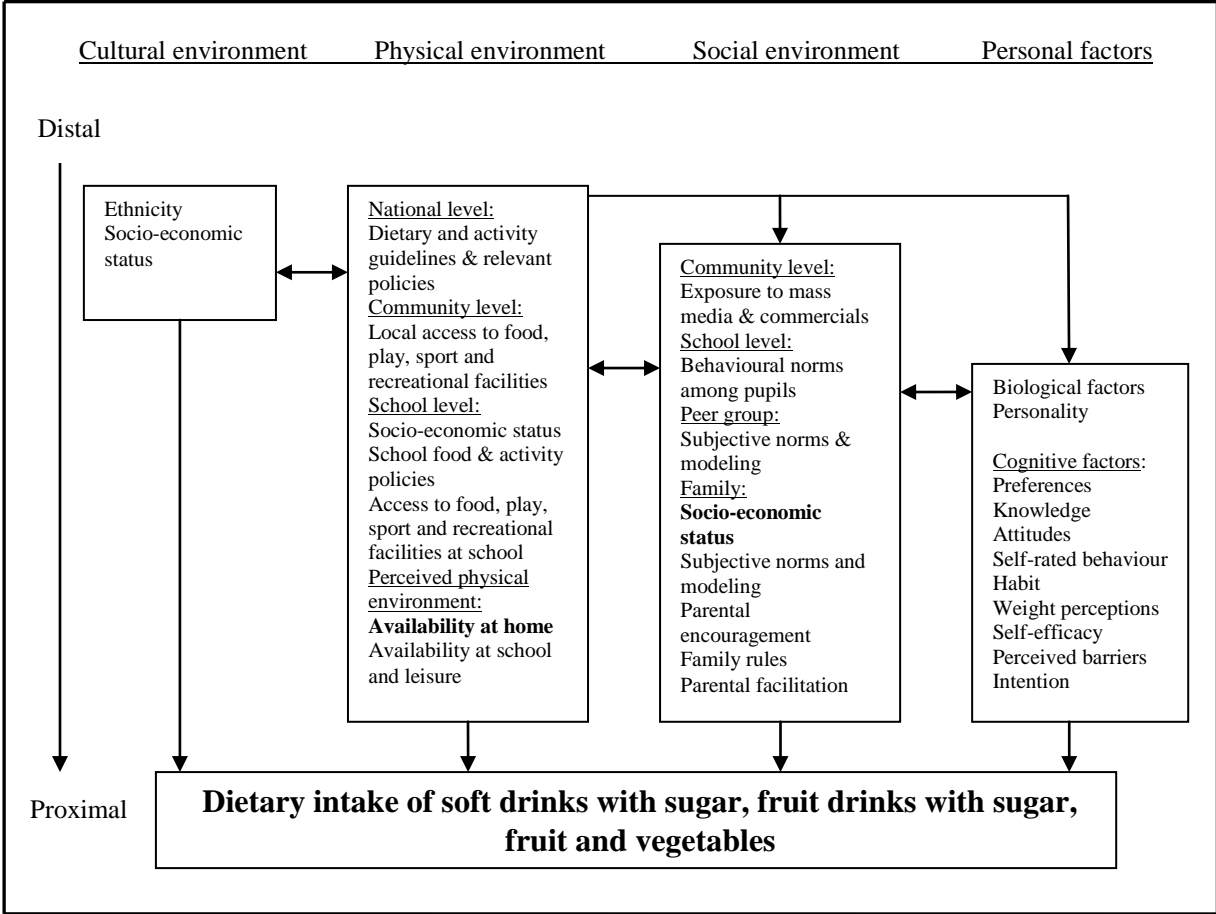


Figure 4: A modified version of the proposed conceptual model for the HEIA study (87).

### 3.4.1 Dietary behaviours

#### Sugar-sweetened beverages

Intake of soft drinks with sugar and fruit drinks with sugar were found through questions on amount and frequency of consumption on weekdays and a question on amount of consumption during weekends. The question measuring frequency on weekdays, “On weekdays (Monday to Friday), how often do you usually drink soft drinks with sugar/fruit drinks with sugar?”, had six answer categories from never/seldom to every weekday. If the

participant reported that it was consumed at least at one weekday every week, the participant was asked; “When drinking soft drinks with sugar/fruit drinks with sugar on weekdays how much do you usually drink? (1/2 liter=3 glasses)”. The question had four answer categories from one glass to four glasses or more. For intake during weekends the adolescent were asked “How much soft drinks with sugar/fruit drinks with sugar do you usually drink? (1/2 liter=3 glasses) Add up what you drink on Saturday and Sunday”. The question had eight answer categories from never/seldom to seven glasses or more. All questions were combined into new variables on intake of soft drinks with sugar and fruit drinks with sugar in deciliter per week.

### **Fruit and vegetables**

Intake of fruit and vegetables were found through questions on frequency of consumption. The question on intake of fruit only included fresh fruit; “How often do you usually eat fresh fruit?”. For vegetables there were two questions on intake; “How often do you usually eat raw vegetables?” and “How often do you usually eat cooked vegetables?”. All questions on intake of fruit and vegetables had eight answer categories from never/seldom to three times or more per day. The questions on intake of raw and cooked vegetables were combined to one variable. The variables on intake of fruit and vegetables were recoded to times per week.

## **3.4.2 Determinants**

### **Perceived availability**

Perceived availability by adolescents of soft drinks with sugar at home was assessed using the question “When soft drinks with sugar are available at home, can you serve yourself as you please?” in the adolescents’ questionnaire. The question “When soft drinks with sugar are available at home, can your child serve herself/himself as she/he pleases?” in the parents’ questionnaires were used to assess adolescents’ perceived availability measured by mothers and fathers (hereafter called perceived availability by mothers and fathers/by parents). Similar questions on fruit drinks with sugar as for soft drinks with sugar were used to assess perceived availability of fruit drinks with sugar.

For vegetables one question from the adolescents' questionnaire was used to assess perceived availability by adolescents "When vegetables that you like are available at home, can you serve yourself as you please?". From the parents' questionnaires the question "Can your child serve herself/himself with vegetables at home as she/he pleases?" was used to assess perceived availability by mothers and fathers. Two similar questions on fruit were used to assess perceived availability of fruit.

The questions on perceived availability of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables had five or six answer categories on a 5- or 6-point scale. The answer categories were; always (= 6), most days (= 5), sometimes (= 4), seldom (= 3), never (= 2) and some of the questions also had the category do not have at home (= 1). The answer categories were combined in the analyses based on the distribution of data.

### **Physical availability**

Physical availability of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables in the home were assessed using a food shelf inventory in the mothers' questionnaire. The food shelf inventory asked the respondent "What food and drinks do you have at home right now?" (see appendix 3).

The food shelf inventory had two answer categories for soft drinks with sugar and for fruit drinks with sugar; "yes" or "no". For fruit and vegetables there was one question for each with a number of sub-questions listing different types of fruit or vegetables. Each sub-question had the options "yes" or "no", apart from the last sub-question which was an open question asking the number of other types of fruit or vegetables; "How many other types of fruit/vegetables do you have? (Write the number)". The respondent was expected to give a number as an answer to these questions, and the number were then typed in as the variable value. Some respondents did instead list the names of the types they had. The number of names was counted and typed in as the variable value for these respondents. Other respondents answered with "-" or "x", and this was interpreted as 0. A couple of the respondents wrote "many" as an answer. The median for the variable was identified and typed in for these respondents.

The respondent was in the food shelf inventory asked to tick the "yes"-option if they had the questioned food or drink item (except for in the last sub-question described above), and to tick



the “no”-option if they did not have the questioned food or drink item at home. However, for the questions regarding fruit and vegetables there was seen a tendency in the questionnaires that the participant only ticked off for a sub-question when having the fruit or vegetable at home, thus ticking off only for the “yes”-option, and no ticking off for the “no”-option but instead leaving it unanswered. To reduce the number of missings due to this tendency, missing was recoded to “no” when at least one sub-question for fruit or vegetables had been ticked off.

The “yes”-option from the food shelf inventory was coded as 1 in the data file and the “no”-option was coded as 0. Categorical variables were made for soft drinks with sugar and for fruit drinks with sugar based on yes/no. Sum variables for physical availability of fruit and vegetables were made by adding up the numbers from the sub-questions. Categorical variables for fruit and vegetables were made based on these sum variables by computing new variables coded yes ( $\geq 1$ ) and no ( $= 0$ ) and also by computing variables splitting the sum variables at the median value.

### **3.5 Statistical analyses**

Analyses of data were conducted using IBM SPSS Statistics, version 19 (88). Data from the baseline data collection in the HEIA study was available as SPSS files. Data from adolescents, mothers and fathers were in three different files, so the files were merged. The last sub-questions on physical availability from the food shelf inventory, “How many other types of fruit/vegetables do you have? (Write the number)”, were not in the SPSS files. The master student therefore typed in these variables manually for all subjects. The significance level was set at  $p < 0.05$ . Stratification of data was done based on gender. Data was checked for violations of the assumptions of the tests.

The age of the adolescent was calculated based on the questions on birth year and month and the time of data collection (September 2007). Parental education was categorized into three levels, based on categories from Statistics Norway. The categories were  $\leq 12$  years, 13-16 years and  $> 16$  years of education. The educational level of the parent with the highest education was used in the analyses. If data on parental education only was available for one of the parents, the parental educational level of the one available was used.

Descriptive statistics were used to find mean, standard deviation and median for age and intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables, and to find percentage distribution of parental education level. An attrition analysis was conducted to compare those included and those not included in the further analyses. Differences between those included and those not included were assessed by independent-samples t-test, Mann-Whitney U Test and Pearson chi-square test.

The intake variables did not show normally distributed scores. Both non-parametric and parametric tests were conducted, and the results were not similar. Results from non-parametric tests are therefore reported.

In relation to aim 1 descriptive statistics were used. For perceived availability by adolescents and by parents of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables percentage distribution were found. Differences in perceived availability between girls and boys and between mothers and fathers were assessed by chi-square tests. Proportions having soft drinks with sugar, fruit drinks with sugar, fruit and vegetables physical available at home according to the food shelf inventory were calculated. Mean and standard deviation for the number of different types of fruit and vegetables physical available at home were also calculated.

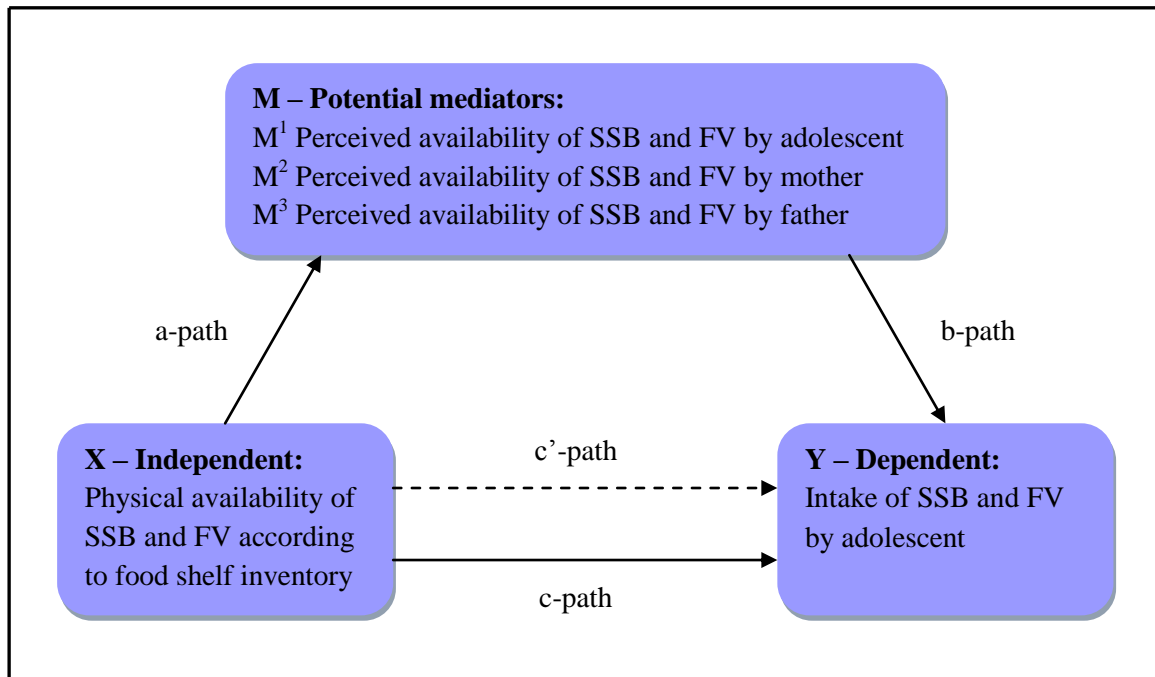
Associations between perceived availability by adolescents and by parents and adolescents' intake and also between physical availability and adolescents' intake, in accordance with aim 2, were tested using Kruskal-Wallis Test and Mann-Whitney U Test.

Single mediation analyses were conducted in relation to aim 3. According to MacKinnon (84) a mediator is a variable that transmits the effect of an independent variable on a dependent variable. In figure 5 the mediation model for this thesis is shown, with perceived availability by adolescents, by mothers and by fathers as the potential mediators of the association between physical availability at home and adolescents' intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables. In single mediation analyses separate analyses are conducted for each potential mediator, and the potential mediators are not adjusted for each other. The a-path represents the association between the independent variable (X) and the mediator (M). The association between M and the independent variable (Y) adjusted for X is represented in the b-path. The c-path represents the association between X and Y (overall association), and the c'-path represents the association between X and Y adjusted for M

(direct association). The difference between  $c-c'$  and the product of  $a*b$  can both be used to calculate the mediated effect ( $c-c'=a*b$ ). An effect is assumed to be mediated if X has a statistical significant effect on M (a-path), M has a statistical significant effect on Y after controlling for X (b-path) and the mediated effect ( $a*b$ ) is statistically significant (84).

MacKinnon (84) used the term effect on the associations for the paths, but as the analyses in this thesis used cross-sectional data no conclusions could be drawn of causality. For that reason terms used in other cross-sectional studies of mediation (85, 89) are used further on in this thesis.

The independent variables used in the mediation analyses were physical availability of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables as reported in the food shelf inventory. For soft drinks with sugar and fruit drinks with sugar the yes/no-variables were used, but for fruit and vegetables the categorical variables based on  $\leq$  or  $>$  the median were used. The dependent variables used were the continuous variables on intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables. The potential mediators included were perceived availability by adolescents, mothers and fathers and the variables were used as continuous variables.



**Figure 5:** Suggested mediation model for the potential mediated effect of perceived availability on the association between physical availability and intake of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables. Single mediation analyses were conducted, hence the potential mediators were not adjusted for each other in the analyses.

SSB: sugar-sweetened beverages; soft drinks with sugar and fruit drinks with sugar.  
FV: fruit and vegetables.

For each path linear regression was conducted, and assumptions for linear regression analyses were checked. The residuals were checked for normal distribution. Cook's distance and Mahalanobis distance were used to check outliers. Separate analyses were done for girls and boys. The product of coefficient test ( $a*b$ ) as described by MacKinnon (84) was used to find the mediated effect. The Sobel test (90, 91) was conducted to calculate the standard error for the mediated effect. The standard error was used to find the confidence intervals of the mediated effect and to check for statistical significance. If the confidence interval did not contain 0 the mediated effect was significant. If there was a significant mediated effect percentage mediated effect ( $ab/c$ ) were calculated.

Assumptions for mediation analyses were checked. However not all assumptions are testable, so proof of mediation is impossible (84). To test if the residuals were independent Durbin-Watson statistics were conducted. A Durbin-Watson value around 2 indicates no autocorrelation of the residuals. The residuals were also studied in a scatterplot to decide if

the distribution was rectangular and with most points around 0. Interactions between the independent variable and the mediator were tested by creating a new variable  $X*M$  and the regression analyses should not give significant values for this variable. Some of the assumption values were however borderline, but was considered to be acceptable.

# 4 Results

## 4.1 Sample

Of the 1528 adolescents participating in the HEIA baseline data collection 796 adolescents and their parents were included in the further analyses in this thesis. A total of 732 adolescents were excluded, because one or more of the variables studied were missing. Of the 796 included adolescents 51.3% were girls.

Characteristics of the participants included and those not included in the further analyses are presented in table 1, showing an attrition analysis. The mean age was 11.2 years for girls and boys in both groups. Boys in the included group had a significant lower intake of soft drinks with sugar (5.2 vs. 6.6 dl/week,  $p = 0.001$ ) and fruit drinks with sugar (5.5 vs. 7.2 dl/week,  $p = 0.035$ ) compared to boys in the excluded group. Girls in the included group had a significant lower intake of fruit drinks with sugar (4.3 vs. 5.3 dl/week,  $p = 0.004$ ) than girls in the excluded group, for soft drinks with sugar there was no significant difference in intake among the girls. Intakes of fresh fruit and vegetables were not significantly different between included and excluded. Distributions of parental educational levels were significant different ( $p < 0.001$ ) between the two groups, with higher parental educational levels in the included group.

**Table 1:** An attrition analysis comparing those adolescents included and those not included in the further analyses in this thesis with regard to age, intakes and parental educational level by gender (n=1528).

	Included (n=796)				Excluded (n=732) <sup>a</sup>				P-value	
	Girls (n=408)		Boys (n=388)		Girls (n=332) <sup>b</sup>		Boys (n=400) <sup>b</sup>		Girls	Boys
	Mean (SD)	Md	Mean (SD)	Md	Mean (SD)	Md	Mean (SD)	Md		
Age (years)	11.2 (0.28)	11.0	11.2 (0.27)	11.0	11.2 (0.27)	11.0	11.2 (0.26)	11.0	0.869 <sup>c</sup>	0.823 <sup>c</sup>
Soft drinks with sugar (dl/week)	4.4 (4.8)	3.3	5.2 (5.9)	3.3	4.7 (5.1)	3.3	6.6 (6.7)	5.0	0.453 <sup>d</sup>	<b>0.001<sup>d</sup></b>
Fruit drinks with sugar (dl/week)	4.3 (6.7)	1.7	5.5 (7.3)	3.3	5.3 (6.8)	3.3	7.2 (9.2)	3.3	<b>0.004<sup>d</sup></b>	<b>0.035<sup>d</sup></b>
Fresh fruit (times/week)	11.0 (7.1)	7.0	9.5 (6.6)	7.0	10.1 (6.9)	7.0	9.0 (7.0)	5.5	0.071 <sup>d</sup>	0.180 <sup>d</sup>
Vegetables (times/week)	11.7 (8.7)	9.0	10.5 (9.1)	8.0	11.7 (9.9)	9.0	10.6 (9.8)	7.0	0.327 <sup>d</sup>	0.581 <sup>d</sup>
Parental educational level	Girls (n=408)		Boys (n=388)		Girls (n=332)		Boys (n=400)		P-value <sup>e</sup>	
	n	%	n	%	n	%	n	%	Girls	Boys
≤ 12 years	98	24.0	91	23.5	121	36.4	132	33.0	<b>&lt;0.001</b>	<b>&lt;0.001</b>
13-16 years	148	36.3	155	39.9	94	28.3	139	34.8		
> 16 years	162	39.7	142	36.6	94	28.3	100	25.0		
Missing	-	-	-	-	23	6.9	29	7.3		

Md: Median, SD: Standard deviation.

Bold values represent significant differences (p<0.05).

<sup>a</sup> Participants missing one or more of the variables studied in this thesis.

<sup>b</sup> The numbers (n) vary slightly across variables/items.

<sup>c</sup> Independent-samples t-test. Tested girls included - girls excluded and boys included - boys excluded.

<sup>d</sup> Mann-Whitney U Test. Tested girls included - girls excluded and boys included - boys excluded.

<sup>e</sup> Chi-square test. Tested girls included - girls excluded and boys included - boys excluded.

## 4.2 Determinants

### 4.2.1 Perceived availability

The percentage of adolescents reporting soft drinks with sugar as perceived available at home always/most days was 4.4%, compared to fruit drinks with sugar where the percentage was 20.4% (table 2). The majority of both girls and boys (80.9-92.4%) perceived fruit and vegetables to be available at home always/most days. There was a significant difference ( $p = 0.008$ ) between girls and boys in perceived availability of fruit drinks with sugar, among girls 15.9% answered always/most days while 25.0% of boys answered always/most days. A borderline significant difference in perceived availability by girls and boys of fruit were also found. There were no significant differences in perceived availability by girls and boys of soft drinks with sugar and vegetables.

The perceived availability by parents of fruit and vegetables was high, while the perceived availability of sugar-sweetened beverages was quite low. Perceived availability of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables were significantly different ( $p < 0.001$ ) for mothers and fathers (table 3). Mothers reported lower levels of perceived availability of soft drinks with sugar and fruit drinks with sugar and higher levels of perceived availability of fruit and vegetables compared to fathers.



**Table 2:** Perceived availability of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables at home measured by adolescents.

	<b>Total (n=796)</b>		<b>Girls (n=408)</b>		<b>Boys (n=388)</b>		<b>P- value<sup>a</sup></b>
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	
When soft drinks with sugar are available at home, can you serve yourself as you please?							
Always/ most days	35	4.4	13	3.2	22	5.7	0.281
Sometimes/ seldom	421	52.9	225	55.1	196	50.5	
Never	229	28.8	115	28.2	114	29.4	
Do not have at home	111	13.9	55	13.5	56	14.4	
When fruit drinks with sugar are available at home, can you serve yourself as you please?							
Always/ most days	162	20.4	65	15.9	97	25.0	<b>0.008</b>
Sometimes/ seldom	408	51.3	215	52.7	193	49.7	
Never	119	14.9	71	17.4	48	12.4	
Do not have at home	107	13.4	57	14.0	50	12.9	
When vegetables that you like are available at home, can you serve yourself as you please?							
Always/ most days	667	83.8	353	86.5	314	80.9	0.111 <sup>bc</sup>
Sometimes/ seldom	117	14.7	52	12.7	65	16.8	
Never	10	1.3	2	0.5	8	2.1	
Do not have at home	2	0.3	1	0.2	1	0.3	
When fruit that you like are available at home, can you serve yourself as you please?							
Always/ most days	720	90.5	377	92.4	343	88.4	0.051 <sup>bc</sup>
Sometimes/ seldom	71	8.9	28	6.9	43	11.1	
Never	5	0.6	3	0.7	2	0.5	
Do not have at home	0	0.0	0	0.0	0	0.0	

Bold values represent significant differences (p<0.05).

<sup>a</sup> Chi-square test for independence. Tested girls-boys.

<sup>b</sup> The “never”-group and the “do not have at home”-group excluded to not violate the assumptions.

<sup>c</sup> Yates’ Correction for Continuity was used to compensate for the overestimate of the chi-square value when used with a 2 by 2 table.

**Table 3:** Adolescents perceived availability of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables at home measured by parents.

	Mothers (n=796)		Fathers (n=796)		P- value <sup>a</sup>
	n	%	n	%	
When soft drinks with sugar are available at home, can your child serve herself/himself as she/he pleases?					
Always/ most days	22	2.8	28	3.5	<b>&lt;0.001</b>
Sometimes/ seldom	329	41.3	415	52.1	
Never	288	36.2	231	29.0	
Do not have at home	157	19.7	122	15.3	
When fruit drinks with sugar are available at home, can your child serve herself/himself as she/he pleases?					
Always/ most days	128	16.1	155	19.5	<b>&lt;0.001</b>
Sometimes/ seldom	372	46.7	380	47.7	
Never	130	16.3	112	14.1	
Do not have at home	166	20.9	149	18.7	
Can your child serve herself/himself with vegetables at home as she/he pleases?					
Always/ most days	757	95.1	737	92.6	<b>&lt;0.001<sup>bc</sup></b>
Sometimes/ seldom	39	4.9	59	7.4	
Never	0	0.0	0	0.0	
Can your child serve herself/himself with fruit at home as she/he pleases?					
Always/ most days	769	96.6	756	95.0	<b>&lt;0.001<sup>bc</sup></b>
Sometimes/ seldom	27	3.4	40	5.0	
Never	0	0.0	0	0.0	

Bold values represent significant differences (p<0.05).

<sup>a</sup> Chi-square test for independence. Tested mothers-fathers.

<sup>b</sup> The “never”-group excluded to not violate the assumptions.

<sup>c</sup> Fisher’s Exact Probability Test.

## 4.2.2 Physical availability

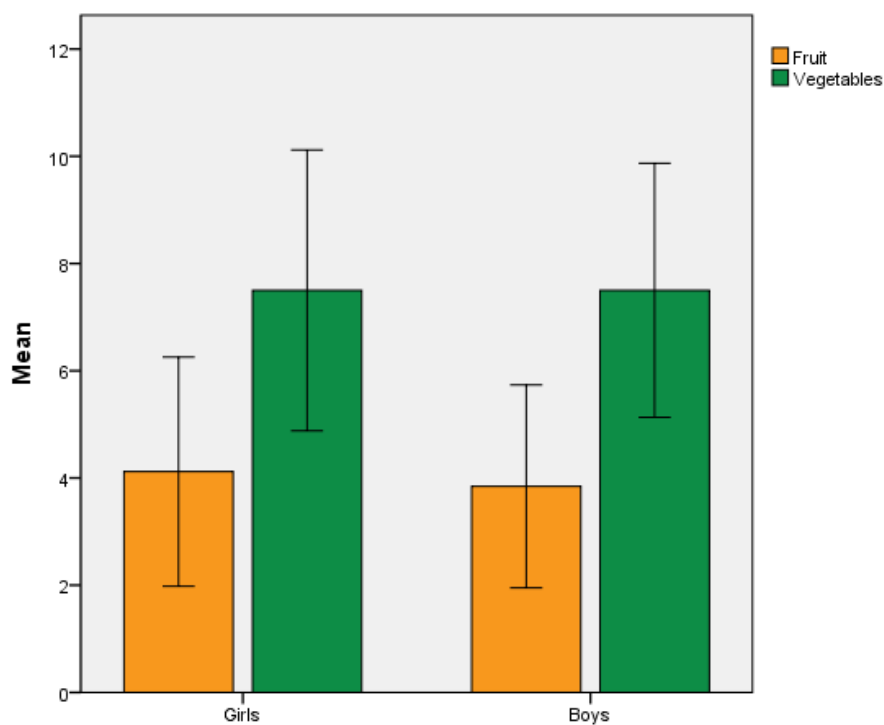
About 40% of families had soft drinks with sugar physical available at home (table 4).

Furthermore, almost 50% of families had fruit drinks with sugar physical available. All families had vegetables physical available at home, and a high proportion (97.4-99.3%) had fruit physical available. The mean numbers of different types of vegetables physical available at home were 7.5 (standard deviation 2.6) for girls and 7.5 (standard deviation 2.4) for boys (figure 6). The mean numbers of vegetables were higher than the mean numbers of different types of fruit which were 4.1 (standard deviation 2.1) and 3.8 (standard deviation 1.9) for girls and boys respectively.

**Table 4:** Physical availability<sup>a</sup> of soft drinks with sugar, fruit drinks with sugar, fruit and vegetables at home according to the food shelf inventory (n=796).

	Girls (n=408)		Boys (n=388)	
	n	%	n	%
Soft drinks with sugar	170	41.7	153	39.4
Fruit drinks with sugar	201	49.3	187	48.2
Fruit	405	99.3	378	97.4
Vegetables	408	100.0	388	100.0

<sup>a</sup> Physical availability: The participant has ticked off “yes” in the food shelf inventory when asked if the drink item is present in the home, or have ticked off “yes” for at least one type of fruit/vegetable.



**Figure 6:** Mean (SD) number of different types of fruit and vegetables available in the homes according to the food shelf inventory (n=796).

### 4.3 Associations between perceived availability and adolescents’ intake

There were significant differences ( $p < 0.05$ ) in intakes of soft drinks with sugar and fruit drinks with sugar between adolescents with different levels of perceived availability of the specific drink item (tables 5 and 6). The significant differences were seen for both perceived

availability measured by girls and boys, by mothers and by fathers. The more often soft drinks with sugar and fruit drinks with sugar were perceived available by adolescents and by parents the higher the intake of the beverages were.

Intakes of fruit and vegetables were significantly ( $p < 0.05$ ) higher with higher levels of perceived availability by adolescents of the item (tables 7 and 8). There was found a significant higher intake of fruit among girls and boys with higher levels of perceived availability by mothers compared to those with lower levels, and also when measured by fathers for girls ( $p < 0.05$ ). No significant differences in intake of vegetables were found for either girls or boys with different levels of perceived availability by parents.

#### **4.4 Associations between physical availability and adolescents' intake**

Intakes of soft drinks with sugar were significantly higher among girls ( $p = 0.001$ ) and boys ( $p < 0.001$ ) having soft drinks with sugar physical available at home compared to those not having it physical available (table 5). For girls there was found a significant ( $p = 0.002$ ) higher intake of fruit drinks with sugar when having it physical available at home, but for boys no significant difference were found (table 6).

There was not found a significant difference in intake between adolescents having  $\leq$  or  $>$  the median amount of vegetables physical available at home (table 7), however for boys the difference was borderline significant ( $p = 0.053$ ). For fruit there was found a significant ( $p = 0.040$ ) higher intake among boys having it physical available at home compared to those not having it physical available (table 8), for girls the difference was borderline significant ( $p = 0.067$ ). There was also found a significant ( $p = 0.001$ ) higher intake of fruit among girls having  $>$  the median amount of fruit physical available at home compared to those having  $\leq$  the median amount, for boys the difference was borderline significant ( $p = 0.051$ ).

**Table 5:** Associations between perceived availability at home and adolescents' intake of soft drinks with sugar, and also between physical availability at home and adolescents' intake of soft drinks with sugar.

	Adolescents' intake of soft drinks with sugar (dl/week)					
	Girls (n=408)			Boys (n=388)		
	n	Mean (SD)	Md	n	Mean (SD)	Md
<b>Perceived availability</b>						
<b>Adolescents</b>						
When soft drinks with sugar are available at home, can you serve yourself as you please?						
Always/ most days	13	7.8 (9.8)	6.7	22	12.7 (11.1)	9.2
Sometimes/ seldom	225	5.5 (5.0)	5.0	196	6.6 (5.0)	6.7
Never	115	3.5 (3.4)	3.3	114	3.0 (3.2)	1.7
Do not have at home	55	0.8 (1.7)	0.0	56	2.0 (6.4)	0.0
<b>P-value<sup>a</sup></b>		<b>&lt;0.001</b>			<b>&lt;0.001</b>	
<b>Mothers</b>						
When soft drinks with sugar are available at home, can your child serve herself/himself as she/he pleases?						
Always/ most days	13	7.2 (5.1)	6.7	9	10.6 (11.8)	5.0
Sometimes/ seldom	165	5.5 (5.9)	5.0	164	5.8 (5.7)	5.0
Never	149	3.9 (3.6)	3.3	139	5.4 (6.2)	3.3
Do not have at home	81	2.4 (3.2)	0.0	76	3.1 (4.2)	1.7
<b>P-value<sup>a</sup></b>		<b>&lt;0.001</b>			<b>&lt;0.001</b>	
<b>Fathers</b>						
When soft drinks with sugar are available at home, can your child serve herself/himself as she/he pleases?						
Always/ most days	15	6.9 (4.0)	6.7	13	10.4 (11.2)	6.7
Sometimes/ seldom	226	4.4 (4.4)	3.3	189	5.6 (4.9)	5.0
Never	109	4.1 (3.7)	3.3	122	5.4 (6.8)	5.0
Do not have at home	58	4.1 (7.6)	1.7	64	2.8 (4.4)	1.7
<b>P-value<sup>a</sup></b>		<b>0.003</b>			<b>&lt;0.001</b>	
<b>Physical availability</b>						
Availability of soft drinks with sugar at home according to the food shelf inventory:						
Yes	170	5.1 (4.7)	5.0	153	6.3 (6.6)	5.0
No	238	3.8 (4.8)	3.3	235	4.5 (5.3)	3.3
<b>P-value<sup>b</sup></b>		<b>0.001</b>			<b>&lt;0.001</b>	

Md: Median, SD: Standard deviation.

Bold values represent significant associations ( $p < 0.05$ ).

<sup>a</sup> Kruskal-Wallis Test.

<sup>b</sup> Mann-Whitney U Test.

**Table 6:** Associations between perceived availability at home and adolescents' intake of fruit drinks with sugar, and also between physical availability at home and adolescents' intake of fruit drinks with sugar.

		Adolescents' intake of fruit drinks with sugar (dl/week)					
		Girls (n=408)			Boys (n=388)		
		n	Mean(SD)	Md	n	Mean(SD)	Md
<b>Perceived availability</b>							
<b>Adolescents</b>							
When fruit drinks with sugar are available at home, can you serve yourself as you please?							
	Always/ most days	65	8.2 (9.9)	5.0	97	10.4 (9.9)	8.3
	Sometimes/ seldom	215	5.2 (6.5)	3.3	193	4.7 (5.1)	3.3
	Never	71	1.2 (1.9)	0.0	48	2.4 (5.0)	0.0
	Do not have at home	57	0.8 (2.0)	0.0	50	2.3 (6.1)	0.0
	<b>P-value<sup>a</sup></b>		<b>&lt;0.001</b>			<b>&lt;0.001</b>	
<b>Mothers</b>							
When fruit drinks with sugar are available at home, can your child serve herself/himself as she/he pleases?							
	Always/ most days	64	5.9 (8.1)	3.3	64	6.9 (6.7)	5.0
	Sometimes/ seldom	191	4.9 (7.0)	1.7	181	5.3 (6.7)	3.3
	Never	71	2.9 (4.5)	1.7	59	4.4 (7.3)	1.7
	Do not have at home	82	3.0 (6.0)	0.0	84	5.8 (8.9)	1.7
	<b>P-value<sup>a</sup></b>		<b>0.001</b>			<b>0.008</b>	
<b>Fathers</b>							
When fruit drinks with sugar are available at home, can your child serve herself/himself as she/he pleases?							
	Always/ most days	78	6.9 (8.7)	4.2	77	7.1 (7.6)	5.0
	Sometimes/ seldom	198	4.3 (6.5)	1.7	182	5.2 (6.2)	3.3
	Never	60	3.4 (4.5)	1.7	52	5.0 (8.2)	2.5
	Do not have at home	72	2.5 (5.4)	0.0	77	5.1 (8.8)	1.7
	<b>P-value<sup>a</sup></b>		<b>&lt;0.001</b>			<b>0.037</b>	
<b>Physical availability</b>							
Availability of fruit drinks with sugar at home according to the food shelf inventory:							
	Yes	201	5.0 (6.9)	3.3	187	5.3 (5.9)	3.3
	No	207	3.7 (6.5)	0.0	201	5.8 (8.5)	1.7
	<b>P-value<sup>b</sup></b>		<b>0.002</b>			0.176	

Md: Median, SD: Standard deviation.

Bold values represent significant associations ( $p < 0.05$ ).

<sup>a</sup> Kruskal-Wallis Test.

<sup>b</sup> Mann-Whitney U Test.

**Table 7:** Associations between perceived availability at home and adolescents' intake of vegetables, and also between physical availability at home and adolescents' intake of vegetables.

	Adolescents' intake of vegetables (times/week)						
	Girls (n=408)			Boys (n=388)			
	n	Mean(SD)	Md	n	Mean(SD)	Md	
<b>Perceived availability</b>							
<b>Adolescents</b>							
When vegetables that you like are available at home, can you serve yourself as you please?							
	Always/ most days	353	12.2 (8.9)	10.5	314	11.2 (9.5)	8.5
	Sometimes/ seldom/ never/ do not have at home	55	8.4 (6.5)	7.0	74	7.5 (6.2)	5.5
	<b>P-value<sup>a</sup></b>		<b>0.001</b>			<b>0.003</b>	
<b>Mothers</b>							
Can your child serve herself/himself with vegetables at home as she/he pleases?							
	Always/ most days	394	11.7 (8.7)	9.0	363	10.6 (9.0)	8.5
	Sometimes/ seldom/ never	14	11.3(10.9)	7.3	25	9.4 (10.6)	5.0
	<b>P-value<sup>a</sup></b>		0.502			0.177	
<b>Fathers</b>							
Can your child serve herself/himself with vegetables at home as she/he pleases?							
	Always/ most days	380	11.7 (8.5)	9.0	357	10.4 (8.6)	8.5
	Sometimes/ seldom/ never	28	11.9(11.8)	7.0	31	11.8(13.1)	7.0
	<b>P-value<sup>a</sup></b>		0.307			0.499	
<b>Physical availability</b>							
Availability of vegetables at home according to the food shelf inventory:							
	Yes	408	11.7 (8.7)	9.0	388	10.5 (9.1)	8.0
	No	0	-	-	0	-	-
	<b>P-value</b>		-			-	
	> median <sup>b</sup>	179	12.0 (8.7)	9.0	191	11.1 (8.9)	8.5
	≤ median <sup>b</sup>	229	11.5 (8.8)	9.0	197	9.9 (9.1)	7.0
	<b>P-value<sup>a</sup></b>		0.436			0.053	

Md: Median, SD: Standard deviation.

Bold values represent significant associations (p<0.05).

<sup>a</sup> Mann-Whitney U Test.

<sup>b</sup> Groups based on ≤ or > the median for physical availability of vegetables (median=7).

**Table 8:** Associations between perceived availability at home and adolescents' intake of fresh fruit, and also between physical availability at home and adolescents' intake of fresh fruit.

		Adolescents' intake of fresh fruit (times/week)					
		Girls (n=408)			Boys (n=388)		
		n	Mean(SD)	Md	n	Mean(SD)	Md
<b>Perceived availability</b>							
<b>Adolescents</b>							
When fruit that you like are available at home, can you serve yourself as you please?							
	Always/ most days	377	11.2 (7.0)	7.0	343	9.8 (6.8)	7.0
	Sometimes/ seldom/ never/ do not have at home	31	8.7 (7.7)	5.5	45	7.4 (5.2)	5.5
	<b>P-value<sup>a</sup></b>		<b>0.019</b>			<b>0.049</b>	
<b>Mothers</b>							
Can your child serve herself/himself with fruit at home as she/he pleases?							
	Always/ most days	399	11.1 (7.1)	7.0	370	9.6 (6.6)	7.0
	Sometimes/ seldom/ never	9	6.2 (7.1)	3.5	18	5.9 (6.4)	3.5
	<b>P-value<sup>a</sup></b>		<b>0.032</b>			<b>0.006</b>	
<b>Fathers</b>							
Can your child serve herself/himself with fruit at home as she/he pleases?							
	Always/ most days	390	11.2 (7.1)	7.0	366	9.5 (6.6)	7.0
	Sometimes/ seldom/ never	18	7.3 (6.2)	5.5	22	8.8 (7.0)	6.3
	<b>P-value<sup>a</sup></b>		<b>0.022</b>			0.418	
<b>Physical availability</b>							
Availability of fruit at home according to the food shelf inventory:							
	Yes	405	11.0 (7.1)	7.0	378	9.6 (6.7)	7.0
	No	3	3.5 (3.5)	3.5	10	5.2 (3.8)	4.5
	<b>P-value<sup>a</sup></b>		0.067			<b>0.040</b>	
	> median <sup>b</sup>	150	12.5 (6.9)	14.0	129	10.2 (6.6)	7.0
	≤ median <sup>b</sup>	258	10.1 (7.1)	7.0	259	9.1 (6.6)	7.0
	<b>P-value<sup>a</sup></b>		<b>0.001</b>			0.051	

Md: Median, SD: Standard deviation.

Bold values represent significant associations (p<0.05).

<sup>a</sup> Mann-Whitney U Test.

<sup>b</sup> Groups based on ≤ or > the median for physical availability of fruit (median=4).



## **4.5 Single mediation analyses**

### **4.5.1 Overall associations between physical availability and adolescents' intake (c-path)**

Regression analyses showed significant overall associations between physical availability of soft drinks with sugar at home and adolescents' intake of the items for both girls and boys (table 9). For fruit drinks with sugar and fruit the physical availability at home only had a significant overall association with intake for girls and not for boys (table 10 and 12). There were no significant overall association between physical availability of vegetables at home and intake for either girls or boys (table 11). These findings are in accordance with the findings in chapter 4.4.

### **4.5.2 Associations between physical availability and potential mediators (a-path)**

Physical availability of soft drinks with sugar at home was significantly associated with all the potential mediators among both girls and boys (table 9). For fruit drinks with sugar physical availability was significantly associated with all potential mediators among girls, but for boys only with perceived availability by mothers and by fathers (table 10). The associations between physical availability of vegetables and perceived availability by mothers and fathers were significant for girls, but for boys only between physical availability and perceived availability by fathers (table 11). Physical availability of fruit was significantly associated with perceived availability by mothers and fathers among boys, but for girls only with perceived availability by mothers (table 12).

### **4.5.3 Associations between potential mediators and intake adjusted for physical availability (b-path)**

Adjusted for physical availability, all potential mediators were significantly associated with the intake of soft drinks with sugar among boys, but for girls only perceived availability by girls and by mothers were significant (table 9). For fruit drinks with sugar all potential

mediators were significantly associated with intake among girls when adjusted for physical availability, but for boys only the potential mediator perceived availability by boys were significant (table 10). Adjusted for physical availability, significant associations for vegetables were found for perceived availability by girls and by mothers with girls' intake, and for perceived availability by boys with boys' intake (table 11). For fruit significant associations were found among girls and boys only for perceived availability by adolescents with intake of fruit when adjusting for physical availability (table 12).

#### **4.5.4 Mediation effects, proportions mediated and direct associations**

Mediation effects ( $ab$ ) were calculated for all potential mediators and are shown in table 9-12. Proportions mediated ( $ab/c$ ) are only shown where there was a significant mediated effect.

##### **Soft drinks with sugar**

For soft drinks with sugar the significant mediators among girls were perceived availability by girls and by mothers, and among boys all potential mediators were significant (table 9). Of the association between physical availability of soft drinks with sugar at home and adolescents' intake, 43.6% and 36.1% for girls and boys respectively was shown to be mediated through perceived availability by adolescents. Perceived availability by mothers of soft drinks with sugar explained a slightly higher proportion of the overall association with 48.1% for girls and 40.1% for boys. For perceived availability by fathers of soft drinks with sugar there was no significant mediated effect for girls, but for boys it explained 25.9% of the association. Among girls there were no significant direct associations ( $c'$ -path) between physical availability and intake for the significant mediators. Physical availability was found to be directly associated with intake when perceived availability by boys and fathers were significant mediators.

##### **Fruit drinks with sugar**

Perceived availability of fruit drinks with sugar by adolescents, by mothers and by fathers were all significant mediators for girls, but not for boys (table 10). The girls' perceived

availability explained 59.8% of the association between physical availability of and intake of fruit drinks with sugar. The girls' perceived availability measured by mothers and fathers explained respectively 66.1% and 46.7%. There were no significant direct associations between physical availability and intake among girls. For boys there was found no direct association between physical availability and intake.

### **Vegetables**

There were found no direct associations and no significant mediated effects between physical availability and intake with perceived availability of vegetables by adolescents, by mothers and by fathers as the potential mediators (table 11).

### **Fruit**

No significant mediated effects between physical availability and intake were found with perceived availability of fruit by adolescents, by mothers and by fathers as the potential mediators (table 12). There were found significant direct associations between physical availability and intake for girls, but not for boys.

**Table 9:** Results from regression analyses for all steps in single mediation analyses for the association between physical availability of soft drinks with sugar at home and adolescents' intake of soft drinks with sugar.

Perceived availability of soft drinks with sugar	c-path	a-path	b-path	c'-path	ab (95% CI) <sup>a</sup>	ab/c <sup>b</sup>
<b>Girls</b>						
	1.318**					
Perceived by girls		0.334**	1.719***	0.744	0.574 (0.187, 0.962)	43.6%
Perceived by mothers		0.613***	1.035***	0.684	0.634 (0.294, 0.975)	48.1%
Perceived by fathers		0.557***	0.352	1.121*	0.196 (-0.059, 0.451)	-
<b>Boys</b>						
	1.843**					
Perceived by boys		0.290*	2.295***	1.178*	0.666 (0.106, 1.225)	36.1%
Perceived by mothers		0.688***	1.074***	1.105	0.739 (0.280, 1.198)	40.1%
Perceived by fathers		0.535***	0.892**	1.367*	0.477 (0.128, 0.827)	25.9%

Linear regression analyses significant at \*p<0.05, \*\*p<0.01 and \*\*\*p<0.001.

<sup>a</sup> Mediated effect.

<sup>b</sup> Percentage mediated effect (ab/c).

**Table 10:** Results from regression analyses for all steps in single mediation analyses for the association between physical availability of fruit drinks with sugar at home and adolescents' intake of fruit drinks with sugar.

Perceived availability of fruit drinks with sugar	c-path	a-path	b-path	c'-path	ab (95% CI) <sup>a</sup>	ab/c <sup>b</sup>
<b>Girls</b>						
	1.320*					
Perceived by girls		0.409**	1.930***	0.531	0.789 (0.236, 1.343)	59.8%
Perceived by mothers		1.178***	0.741**	0.447	0.873 (0.279, 1.467)	66.1%
Perceived by fathers		0.698***	0.883***	0.703	0.616 (0.222, 1.010)	46.7%
<b>Boys</b>						
	-0.521					
Perceived by boys		0.261	2.121***	-1.074	0.554 (-0.077, 1.184)	-
Perceived by mothers		1.314***	0.518	-1.202	0.681 (-0.039, 1.400)	-
Perceived by fathers		0.885***	0.484	-0.949	0.428 (-0.031, 0.888)	-

Linear regression analyses significant at \*p<0.05, \*\*p<0.01 and \*\*\*p<0.001.

<sup>a</sup> Mediated effect.

<sup>b</sup> Percentage mediated effect (ab/c).

**Table 11:** Results from regression analyses for all steps in single mediation analyses for the association between physical availability of vegetables at home and adolescents' intake of vegetables.

Perceived availability of vegetables	c-path	a-path	b-path	c'-path	ab (95% CI) <sup>a</sup>	ab/c <sup>b</sup>
<b>Girls</b>						
	0.515					
Perceived by girls		0.124	2.152***	0.248	0.267 (-0.098, 0.632)	-
Perceived by mothers		0.128*	1.753*	0.290	0.224 (-0.050, 0.499)	-
Perceived by fathers		0.125*	0.035	0.510	0.004 (-0.165, 0.174)	-
<b>Boys</b>						
	1.226					
Perceived by boys		0.147	1.783***	0.964	0.262 (-0.114, 0.639)	-
Perceived by mothers		0.085	-0.042	1.230	-0.004 (-0.121, 0.114)	-
Perceived by fathers		0.181*	0.661	1.107	0.120 (-0.134, 0.373)	-

Linear regression analyses significant at \*p<0.05, \*\*p<0.01 and \*\*\*p<0.001.

<sup>a</sup> Mediated effect.

<sup>b</sup> Percentage mediated effect (ab/c).

**Table 12:** Results from regression analyses for all steps in single mediation analyses for the association between physical availability of fruit at home and adolescents' intake of fruit.

Perceived availability of fruit	c-path	a-path	b-path	c'-path	ab (95% CI) <sup>a</sup>	ab/c <sup>b</sup>
<b>Girls</b>						
	2.437**					
Perceived by girls		0.006	1.432**	2.428**	0.009 (-0.194, 0.211)	-
Perceived by mothers		0.135**	1.061	2.293**	0.143 (-0.079, 0.365)	-
Perceived by fathers		0.088	0.789	2.367**	0.069 (-0.069, 0.208)	-
<b>Boys</b>						
	1.140					
Perceived by boys		0.083	1.131**	1.046	0.094 (-0.110, 0.298)	-
Perceived by mothers		0.177**	0.709	1.015	0.125 (-0.096, 0.347)	-
Perceived by fathers		0.200**	-0.601	1.260	-0.120 (-0.355, 0.115)	-

Linear regression analyses significant at \*p<0.05, \*\*p<0.01 and \*\*\*p<0.001.

<sup>a</sup> Mediated effect.

<sup>b</sup> Percentage mediated effect (ab/c).

# 5 Discussion

In this chapter a discussion of the sample, methods and results is presented. The discussion leads to the conclusion and implications for further research presented in chapter 6.

## 5.1 Sample

Of the 177 invited schools only 37 (21%) agreed to participate, representing a low participation rate of schools. There may have been a difference between the participating schools and the ones that did not participate, for example the schools could represent different socio-economic areas. The participating schools may have been more interested in the topic of healthy eating and physical activity, and may not have been representative for all invited schools. Participation bias at the school level can however not be tested, since there is no data available on the schools not participating.

Nevertheless, the representativeness of the participating schools based on their location can be discussed. The 37 participating schools were from the largest towns and municipalities in seven counties surrounding Oslo. Therefore they did not represent strictly urban or rural schools. Although there were participating schools from all requested counties, 46% of schools were located in Akershus. Akershus is the closest surrounding county to the capital of Norway, and was in 2007 characterised by a higher proportion of adults with higher education (30.9%) than the average national level (25.9%) (92). A concentration of higher education institutions in this area may be the reason for this.

The participation rates for parents in the HEIA study were moderate, with 58% of mothers and 49% of fathers. Furthermore, among the parents in the HEIA sample the proportion of the highest educated was more than doubled compared to the national statistics collected by Statistics Norway, and the proportion of the lowest educated was about halved (93). The highest educated parents were thus overrepresented when comparing to a national representative sample, indicating participants with higher socio-economic status than the average. This is in line with previous studies that have found non-respondents of surveys to be more likely to be less educated (94, 95). Based on these considerations Bjelland (93) points out in her doctoral dissertation that the findings of the HEIA study appears to be generalisable

only to “the south-eastern region and semi-urban areas surrounding the largest cities in Norway; areas with highly educated people”.

A total of 1528 adolescents participated in the baseline data collection of the HEIA study, representing 71% of the invited participants. This is a quite high participation rate but lower than in other Norwegian school-based interventions promoting fruit and vegetables, including the Fruits and Vegetables Make the Marks project (76) with a participation rate of 85% and the Pro Children Project (50) with a participation rate of 90%. However these studies were less comprehensive to participate in, for instance they did not include measurement of physical activity by accelerometers. Further they did not include body measures, which may be a sensitive topic. Generally there have in recent years been seen declining participation rates in studies (96). Participation bias at the individual level cannot be assessed, as there is no data available on the adolescents and parents that declined the invitation to participate. Lien et al. (87) concluded based on power calculations that the power in the final baseline sample was sufficient according to the baseline assumptions.

In order to perform the mediation analyses only those with responses from both the adolescent and the adolescent’s mother and father on all variables of interest and also responses on the variables of interest available from the food shelf inventory, were included in the analyses in this thesis. This resulted in 796 included adolescents, 796 included mothers and 796 included fathers. Since 796 adolescents only represents 52% of the 1528 participating adolescents, an attrition analysis was conducted to compare those included and those excluded. The attrition analysis showed a significant higher intake of fruit drinks with sugar among excluded girls and boys and also of soft drinks with sugar among excluded boys. Furthermore the analysis showed that parental educational levels were significantly lower in the excluded group. Parental educational level was used as a measure of socio-economic status in the HEIA study, and previous studies have found lower socio-economic status to be related to poorer diets in adolescents (97, 98). Since there were found significant differences between the included and the excluded group, the results may not be applicable for the total HEIA sample. The included group had a higher socio-economic status and consumed less unhealthy beverages, and may therefore have been a special group that was more health conscious and more interested in healthy eating. This should be taken into consideration when interpreting the results.

## 5.2 Methods

Data on dietary behaviours and determinants of the behaviours were collected through an internet-based questionnaire for adolescents and a paper-based questionnaire for parents.

### 5.2.1 Dietary behaviours

To obtain information on the adolescents' dietary behaviours food frequency questionnaires were used as a part of the internet-based questionnaire completed by adolescents themselves. Food frequency questionnaire is a commonly used method for examining diet and intake of specific food and drink items in adults (99). The method has also been suggested to provide enough accuracy when studying the relation between diet and health outcomes in adolescents (100). Furthermore food frequency questionnaires are generally shown to have acceptable reliability and validity for children and adolescents. However higher validity are found when questionnaires do not assess portion size (101). In the HEIA study portion sizes were assessed for sugar-sweetened beverages.

In the development of questionnaires the cognitive abilities of the age group need to be taken into consideration. To self-report food intake certain cognitive abilities are required, including a good memory, a concept of time, attention span and knowledge of the names of foods. The ability to self-report intake increases rapidly from around the age of 8 years. The age group of 10 to 12-year-olds can be reliable reporters of their intake (102).

The questions on intake of sugar-sweetened beverages, fruit and vegetables used in the food frequency questionnaire of the HEIA study have been validated for the same age group in a previous study in Norway (103). This validation study examined food intake reported in a short food frequency questionnaire against a four-day precoded food diary. The conclusions of the study were that the results indicated an ability of the food frequency questionnaire to identify low and high consumers and a moderate capability to rank individuals by intake. Further the validation study showed that the reported intake of drinks, fruit and vegetables, the items studied in this thesis, were better correlated in the two methods than food items eaten less frequently (103). The questionnaire in the validation study was paper-based, and not internet-based as the HEIA questionnaire. However, mode of administration of questionnaires, computer or paper, have not been found to have significant effect on responses from adolescents on the majority of lifestyle behaviours (104).



A 2-week test-retest pilot study was conducted before the HEIA baseline data collection on a reasonably similar sample from the same area as the HEIA sample (87). The sample consisted of 114 adolescents, 44 mothers and 35 fathers. Pearson's correlation coefficient was used to assess test-retest reliability. The test-retest study of the questionnaires to adolescents, mothers and fathers indicated overall acceptable to good reliability of the questions (105). The study showed moderate to high test-retest correlations for the adolescents' dietary behaviours ( $r = 0.60-0.78$ ), indicating reliable measures (87). However intake of soft drinks with sugar on weekdays was an exception ( $r = 0.46$ ), but this was suggested by Lien et al. (87) to be due to the low intake. In the analysis in this thesis the question on intake of soft drinks with sugar on weekdays was combined with the question on intake during weekends. This probably led to a higher test-retest correlation for the combined variable because of a greater variance, but this was not tested.

There were some inconsistency between questions on dietary behaviours and perceived availability. For example did the question regarding intake of fruit only include fresh fruit, and therefore may lead to an under-estimation of the general fruit intake. When measuring perceived availability it was asked about fruit in general. However, it is unknown whether this has any effect on the results.

## **5.2.2 Determinants**

### **Perceived availability**

Perceived availability of the food and drink items of interest were assessed through questions in the questionnaires for adolescents, mothers and fathers. The questions on perceived availability of sugar-sweetened beverages were similar for adolescents and parents, but the questions about fruit and vegetables differed slightly. However the answers from adolescents and parents were not compared with each other or used in the same analyses. Comparisons were only conducted for adolescent girls versus adolescent boys and for mothers versus fathers.

Certain cognitive abilities are needed for the adolescents to understand the questions on perceived availability and the terms used in the answer categories, for example

seldom/sometimes/most days. Bjelland (93) suggests that more specific answer categories may leave less room for interpretation and make it easier for the participants to answer correctly.

The questions on perceived availability of sugar-sweetened beverages, fruit and vegetables at home used in the adolescents' and parents' questionnaires have not been validated. However, this is usually not done for questions regarding determinants.

The 2-week test-retest study assessed reliability of the questions on perceived availability of sugar-sweetened beverages, fruit and vegetables at home. Pearson's correlation coefficients showed moderate to high test-retest correlation for questions on perceived availability by adolescents of sugar-sweetened beverages ( $r = 0.61-0.66$ ), by mothers of all food and drink items ( $r = 0.64-0.79$ ) and by fathers of sugar-sweetened beverages and fruit ( $r = 0.60-0.82$ ). Lower test-retest correlations were found for questions on perceived availability by adolescents of fruit and vegetables ( $r = 0.47-0.52$ ) and by fathers of vegetables ( $r = 0.42$ ) (93, personal communication: Torunn Holm Totland, University of Oslo, Norway, 2012).

### **Physical availability**

Data on physical availability of food and drink items in the home were collected through a food shelf inventory. Food shelf inventories, also referred to as home food inventories, have been used in several studies to measure the availability of food in the home, to study the relationship between food availability and intake (66, 81, 82, 106-110), to study food purchasing behaviour (111, 112), to assess the impact of intervention (113, 114) and to identify differences in food availability between low- and high-income families (115). Some of the studies only focused on certain food items, while others attempted to capture all food and drink items in the home. Two articles have reviewed the studies on food inventory methods (116, 117). When excluding studies using other measures, and also taking into account that some studies were included in both articles, a total of 22 studies using inventories completed by participants were identified in the reviews. French et al. (117) concluded that food shelf inventories seem to be feasible to complete and to in a valid way capture food and drink items self-reported by household members.

The food shelf inventory used in the HEIA study has not been validated, but it was based on a validated inventory described by Fulkerson et al. (118). Fulkerson et al. (118) tested criterion

validity by comparing inventory reports from participating adults and trained staff (gold standard), the reports were completed at the same time in the participant's home. Further, construct validity was assessed by examining correlation between the inventory and food frequency questionnaire for parents and 24-hour dietary recall interviews. Fulkerson et al. (118) concluded that the inventory was valid and participant-friendly as a measure to assess foods in the home. Furthermore, that the inventory could be useful in studies investigating contextual influences on dietary behaviour and overweight, and in developing intervention strategies and targets for public health messages.

The study by Fulkerson et al. (118) did not assess test-retest reliability, and could for that reason not address consistency of home availability of food and drink items over time. However, the HEIA pilot study did assess test-retest reliability for the food shelf inventory used in the HEIA study. Pearson's correlation coefficients indicated good reliability of the questions on physical availability of sugar-sweetened beverages ( $r = 0.61-0.67$ ). For fruit and vegetables Pearson's correlation coefficients were not as high ( $r = 0.33-0.37$ ) (personal communication: Torunn Holm Totland, University of Oslo, Norway, 2012). It is indeed important to notice that the food shelf inventory measures what foods that are available in the home at the moment, which may change between test and retest due to normal variation. This is also reflected in the results from the test-retest, that may indicate that the physical availability of sugar-sweetened beverages seem more stable over time than the physical availability of fruit and vegetables.

In a study by Gattshall et al. (119) a quite similar measure of the home food environment as the HEIA food shelf inventory was used. The survey was completed by parents of overweight children, and included questions on physical availability of sugar-sweetened beverages, fruit and vegetables. Gattshall et al. (119) concluded that the measure was promising as a potentially valid and reliable tool to assess the home environment.

There are some potential limitations of the HEIA food shelf inventory. The inventory did not include information on quantity of each food item. This is also pointed out by Fulkerson et al. (118), and is exemplified by the fact that households may have a high number of types of fruit and vegetables, but a low quantity. Further, other households may have a low number of types, but a high quantity, and this will not be reflected in the sum variables for fruit and vegetables. Another limitation is that the inventory was conducted only at one time point, and represents cross-sectional availability at that specific time. The inventory may therefore not

have captured the flow of foods through a home and may have been influenced by the time of the inventory in relation to food purchases (116, 117). Bryant and Stevens (116) also suggest that if the inventory is separated in time from last food purchasing, it may measure non-preferred foods rather than more desirable foods that are eaten.

## **5.3 Results**

### **5.3.1 Perceived availability**

The results showed that there was a significant difference in perceived availability measured by adolescents of fruit drinks with sugar at home, with a higher share of boys than girls reporting that they could serve themselves with fruit drinks with sugar as they pleased always/most days when it was available at home. There was an opposite pattern for fruit with girls having a borderline significant higher level of perceived availability than boys. The tendencies, however not significant, for soft drinks with sugar was a higher proportion of boys than girls answering always/most days, and for vegetables a higher proportion of girls than boys answering always/most days. The trend therefore was that girls had a higher level of perceived availability of the “healthier items”, and boys a higher level for the “unhealthier items”.

This is in line with a study on the same age group based on data from the Pro Children study (53), finding that Norwegian girls had a higher perceived availability of fruit and vegetables than boys. This was also found in a study by Pearson et al. (120) among Australian adolescents, and in addition they found that boys had a higher perceived availability of energy-dense snack foods than girls. The findings from both studies showed that girls in general persistently reported higher scores on more positive variables than boys (53, 120).

The questions on perceived availability in the study by Sandvik et al. (53) and in the study by Pearson et al. (120) were however not formulated in the same way as the questions on perceived availability in the HEIA study. The questions on perceived availability in the HEIA study included a dimension of family rules and parental norm, by asking of the possibility to serve when pleased, and the questions used in the two other studies did not include this. On

the other hand family rules have in other studies also been found to be related to adolescents' intake (121-123).

Levels of perceived availability by mothers were significantly lower for soft drinks with sugar and fruit drinks with sugar and significantly higher for fruit and vegetables compared to fathers' levels. As for adolescents the gender pattern was the same with mothers reporting higher level of perceived availability of the "healthier items", and fathers a higher level for the "unhealthier items". The social desirability bias may have influenced mothers reporting, and resulted in over-reporting for fruit and vegetables and under-reporting for sugar-sweetened beverages. No studies have to the knowledge of the master student compared mothers and fathers reporting on perceived availability at home of sugar-sweetened beverages, fruit and vegetables.

### **5.3.2 Physical availability**

The food shelf inventory showed different physical availability of the items, with almost half of families having soft drinks with sugar and fruit drinks with sugar physical available and almost all families having fruit and vegetables physical available. The mean number of different types of vegetables was almost the double of the number for fruit.

No studies have to the knowledge of the master student assessed the physical availability of food and drink items in Norwegian or Scandinavian homes using food shelf inventories. The majority of the studies identified in the reviews (116, 117) and by the master student were from the US.

In an American cross-sectional study of adolescents, Project EAT (81), household availability of soft drinks, fruit and vegetables were assessed by parent report in an inventory. The inventory however did not use yes/no responses at a specific time as in the HEIA study, but instead a 4-point scale (never, sometimes, usually or always) on usual availability. For fruit and vegetables most of the parents, 90.4%, reported it as being at least usually available in the home, and 56.9% of parents reported soft drinks as at least usually available in the home (81). These proportions correspond quite well with the findings of the HEIA study, where 97.4-

100.0% of households had fruit and vegetables available in the home and 39.4-41.7% of households had soft drinks with sugar available in the home.

An American study by Lytle et al. (113) examined the home food environment of middle school students in Minnesota participating in the TEENS study using a food shelf inventory completed by parents. The parents were asked to report if they had specific food items in the home at the time they answered the survey. The study was an intervention study, but data from the control group showed that the mean number of vegetables were higher than the mean number of fruit, as were also found in the HEIA study. The mean numbers for both fruit and vegetables, 6.5 and 9.2 respectively, were higher than the mean numbers found in the HEIA study, 3.8-4.1 and 7.5 respectively. However, Norway and the US may not be comparable regarding the home food availability in general.

### **5.3.3 Associations between perceived availability and adolescents' intake**

The results showed that the higher the levels of perceived availability of sugar-sweetened beverages were by adolescents and by parents, the higher the adolescents' intakes of the beverages were. Higher levels of perceived availability by adolescents of fruit and vegetables, by mothers of fruit for girls and boys and by fathers of fruit for girls were associated with higher intakes of the items. This is in line with the previously mentioned study by Pearson et al. (120) and also a study of American adolescents by Young et al. (74), both finding perceived availability to be related to intake. A study on 11-year-olds in Iceland by Kristjansdottir et al. (124) found that perceived availability by adolescents explained some of the variation in the adolescents' intake of fruit and vegetables.

Perceived availability by parents of vegetables for girls and boys and perceived availability by fathers of fruit for boys were not associated with adolescents' intake. This may indicate that perceived availability by parents of these items do not influence adolescents' intake. The finding that perceived availability by adolescents in these relations, in contrast were found to be associated with intake, are in accordance with a previous study by Van Assema et al. (125), finding that adolescents' intake of fruit and snacks was more highly related to adolescents own perceptions of availability than perceptions of their parents. However, the

different findings related to the perceived availability by adolescents and parents could also be a result of the slightly different wording of the questions on perceived availability to adolescents and parents.

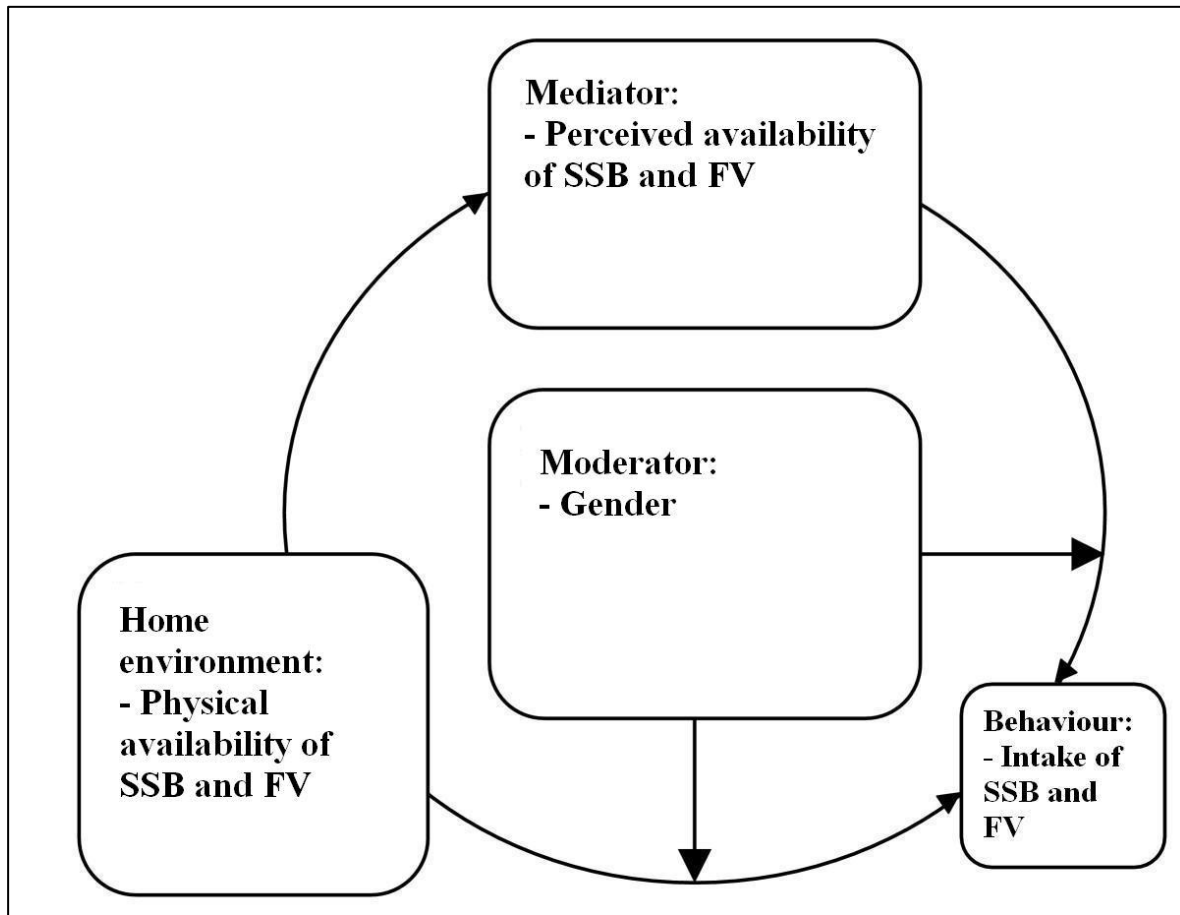
#### **5.3.4 Associations between physical availability and adolescents' intake**

The results indicate a relationship between physical availability of soft drinks with sugar and intake among girls and boys, physical availability of fruit drinks with sugar and intake among girls, physical availability of vegetables and intake among boys (borderline significant) and physical availability of fruit and intake among both girls and boys.

This is in line with previous studies using inventories that have showed an association between physical availability at home and children's/adolescents' intake (66, 82, 106). However, none of the other studies found by the master student examined the relationship between physical availability and intake of sugar-sweetened beverages, fruit and vegetables, using a food shelf inventory where availability were assessed through yes/no questions on presence in the home. Methods used in the other studies were possibly more subjective questions on usual availability (66) and presence for previous week (82, 106). In a study by Cullen et al. (65) using an inventory for presence for previous week there was found no significant association between parent-reported availability of fruit and vegetables and adolescents' intake. However, in this study intake was measured through 24-hour recalls and not food frequency questionnaires as in the HEIA study.

#### **5.3.5 The understanding of the relation between determinants and dietary behaviour by the EnRG framework**

The EnRG framework was used to guide the mediation analyses in this thesis, illustrated in figure 7. The framework proved to be a helpful instrument for assessing the various pathways for the mediation analyses.



**Figure 7:** A modified version of the Environmental Research framework for weight Gain prevention (EnRG) proposed by Kremers et al. (2).

SSB: sugar-sweetened beverages.

FV: fruit and vegetables.

The association between physical availability of soft drinks with sugar and girls' intake was mediated by perceived availability by girls and by mothers. Perceived availability by boys, by mothers and by fathers mediated the association between physical availability and boys' intake of soft drinks with sugar. The association between physical availability and girls' intake of fruit drinks with sugar was mediated by perceived availability by girls, mothers and fathers. This suggests that a higher physical availability of soft drinks with sugar for girls and boys and also of fruit drinks with sugar for girls may positively influence perceived availability, which in turn influence intake of the beverages. Further, for girls the results suggested, represented by the non-significant direct association, that there was no direct influence of physical availability of the beverages on their intake. That there was not found an association between physical availability and intake of fruit drinks with sugar for boys may be



due to suppression effects by the included mediators. Suppression effects are present when mediated effects and direct associations have opposite signs (126).

Tak et al. (85) found in their study among Dutch adolescents that the association between availability at home and intake of soft drinks (defined as carbonated and non-carbonated sugar-sweetened beverages) was partly mediated by intention and habit strength. They also found a direct association between home availability and intake of soft drinks, in contrast to the findings for girls in the HEIA study. This study however used self-reported data from the adolescents to measure home availability.

No significant mediated effects were found for either fruit or vegetables between physical availability and intake with perceived availability by adolescents, mothers and fathers as the potential mediators. Further, there were found no significant overall association and no significant direct association between physical availability and intake of fruit for boys and of vegetables for both girls and boys. This indicates that physical availability at home does not influence the intake for these dietary behaviours. There may instead be other determinants influencing these dietary behaviours. However, the findings could also be because almost all households had fruit and vegetables physical available, and the variables used in the mediation analyses were based on  $\leq$  or  $>$  the median number of fruit and vegetables and not yes or no as for sugar-sweetened beverages. Median numbers were quite high and may therefore not be a good way to distinguish the participants.

In a study by Wind et al. (89) there was found an association between home availability of fruit and intake of fruit among Norwegian adolescents, and the association was found to be mediated by liking and self-efficacy. However this study differed to the HEIA study as they used self-reported data from the adolescents to measure home availability, and the answer categories to the question on availability were on a 5-point scale.

No studies have to the knowledge of the master student examined the mediating role of perceived availability in the relationship between physical availability and intake. However Tak et al. (85) did explore parental norm as a potential mediator in the relation between home availability and intake of soft drinks, but did not find it to be a significant mediator.

## 5.4 Strengths and limitations

A limitation of the HEIA study was the low participation rate of schools. However, among the participating schools there was a quite high participation rate of adolescents and there was also a large sample size at a narrow age-range, representing a strength. Among mothers and fathers the participation rate was not as high as for adolescents, representing only a moderate participation rate.

A strength of the study was the collection of data from both mothers and fathers, allowing for a comparison of their answers. Berge (127) argues that using multiple informants from one family would be beneficial and present a more systematic overview of the family functioning.

Using cross-sectional data from the baseline survey only, means that changes over time cannot be detected. Neither can conclusions on causality be made. Measurements were based on self-reported data, and it is therefore a risk of reporting bias and social desirable answers. Single-item measures were used to assess the determinants, and it has been argued that multiple-item measures are more reliable and valid (128).

When data are collected in a defined group, for example a school, the participants may be more similar to each other than individuals in another group. This is referred to as a clustering effect, and it should be taken into account when performing statistical analyses (129).

However Bjelland (93) found that dietary behaviours were more linked to family and home than school among the adolescents in the HEIA study, and therefore that adjusting for the clustering effect was not necessary. This notion is also supported by previous studies showing adolescents' dietary behaviours to be independent of school (85, 130, 131).

Using single mediation analyses instead of multiple mediation analyses was a limitation of this study. This means that the mediators were not adjusted for each other, and therefore it cannot be identified which one is the most important. The mediators are probably overlapping and may explain the same, and this was clearly seen when the percentages became higher than 100% for each behaviour.

## 6 Conclusion

This study showed that the perceived availability of fruit and vegetables was high, while the perceived availability of sugar-sweetened beverages was considerably lower among both adolescents and parents. There was a significant difference in perceived availability of fruit drinks with sugar at home measured by adolescents, with a higher level for boys than girls. Levels of perceived availability measured by mothers were significantly lower for soft drinks with sugar and fruit drinks with sugar and higher for fruit and vegetables compared to the perceived availability measured by fathers. The food shelf inventory showed that of the families around 40% had soft drinks with sugar, almost 50% had fruit drinks with sugar and nearly all had fruit and vegetables physical available at home.

Higher levels of perceived availability by adolescents and by parents of sugar-sweetened beverages were associated with higher intake of the beverages among the adolescents. Higher levels of perceived availability by adolescents of fruit and vegetables, by mothers of fruit for girls and boys and by fathers of fruit for girls were associated with higher intakes of these items. There was an association among both girls and boys between physical availability and intake of soft drinks with sugar and also between physical availability and intake of fruit. Further there was an association between physical availability and intake of fruit drinks with sugar among girls.

Perceived availability by girls and by mothers mediated the association between physical availability and girls' intake of soft drinks with sugar. The association between physical availability and boys' intake of soft drinks with sugar was mediated by perceived availability by boys, mothers and fathers. Perceived availability by girls, by mothers and by fathers mediated the association between physical availability and girls' intake of fruit drinks with sugar. There was found a significant direct association between physical availability and intake of fruit for girls. Between physical availability and intake of fruit drinks with sugar and fruit for boys and of vegetables for both girls and boys there were found no overall associations and no mediated effects. The findings from the mediation analyses suggest that physical availability may influence adolescents' intake both directly and indirectly through perceived availability for some food and drink items.

The findings of this study indicate that both perceived and physical availability may be determinants to target in interventions aiming to decrease intake of sugar-sweetened beverages and increase intake of fruit and vegetables. More studies are however needed to identify other determinants, especially for intake of fruit and vegetables. The study also support that determinants may influence girls and boys differently, and therefore that different intervention strategies are needed to reach both.

Future research should further explore the mediators of the association between physical availability and dietary behaviours, and a broader range of determinants and mediators should be included. The mediators should be tested using multiple mediation analyses to be able to identify which mediators are the most important, and by this guide which determinants to target in interventions.

This study only used cross-sectional data, and longitudinal and experimental studies are needed to further study the relationship between home availability and dietary behaviours and to test the findings of this study.

The home availability was suggested by the findings to influence dietary behaviours, and may thus influence overweight. This supports that including intervention components aimed at parents and the home environment are important. Further studies are needed to investigate other influences in the home environment than home availability. Studies are also needed on the wider environmental determinants to explore their influence on dietary behaviours and overweight.

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# Appendices

**Appendix 1:** Consent form (including items on parental educational level)

**Appendix 2:** Adolescent questionnaire – relevant survey items

**Appendix 3:** Mother/father questionnaire – relevant survey items





# Appendix 1



## CONSENT FORM (including items on parental educational level, in Norwegian)

### SAMTYKKEERKLÆRING FOR "HEIA-PROSJEKTET"

Jeg/vi har mottatt og lest informasjonen om datainnsamlingene. Deltakelsen er frivillig og mitt/vårt barn kan til enhver tid trekke seg uten å måtte oppgi noen grunn. Det er en forutsetning for deltakelsen at all informasjon som gis behandles strengt konfidensielt. Hvis mitt/vårt barn trekker seg fra undersøkelsen kan vi kreve at alle persondata blir slettet.

**Jeg/vi samtykker i at mitt/vårt barn KAN DELTA:**

_____ Elevens navn (blokkbokstaver)		
_____ Skole	_____ Klasse/gruppe	
_____ Sted	_____ Dato	_____ Underskrift foresatt(e)

Vi ber om svar på de følgende spørsmålene, da det erfaringsmessig er vanskelig for elevene å svare på spørsmål om foresattes utdanningsnivå.

#### Foresatte 1:

*1a. Hvilken relasjon har denne foresatte til barnet som blir med i undersøkelsen?*

- Moren til barnet
- Faren til barnet
- Stemoren til barnet
- Stefaren til barnet
- Barnets kvinnelige foresatte
- Barnets mannlige foresatte

*1b.*

*Hva er denne foresattes høyeste fullførte utdanning?*

- Mindre enn 7 års utdanning
- Folkeskole/grunnskole/ungdomsskole (7-9 år)
- Gymnas/yrkesskole e.l. (inntil 12 år)
- Universitet/høyskoleutdanning (inntil 4 år)
- Universitet/høyskoleutdanning (mer enn 4 år)

#### Foresatte 2:

*2a. Hvilken relasjon har denne foresatte til barnet som blir med i undersøkelsen?*

- Moren til barnet
- Faren til barnet
- Stemoren til barnet
- Stefaren til barnet
- Barnets kvinnelige foresatte
- Barnets mannlige foresatte

*2b.*

*Hva er denne foresattes høyeste fullførte utdanning?*

- Mindre enn 7 års utdanning
- Folkeskole/grunnskole/ungdomsskole (7-9 år)
- Gymnas/yrkesskole e.l. (inntil 12 år)
- Universitet/høyskoleutdanning (inntil 4 år)
- Universitet/høyskoleutdanning (mer enn 4 år)

**Samtykkeerklæringen returneres snarest til kontaktlærer via eleven i konvolutten brevet kom i.**



# Appendix 2



## ADOLESCENT QUESTIONNAIRE – relevant survey items (in Norwegian)

### Demographic variables

**Er du jente eller gutt? \***

- Jente
- Gutt

**Hvilket år er du født? \***

- 1994
- 1995
- 1996
- 1997

Annet år:

**I hvilken måned har du fødselsdag? \***

- Januar
- Februar
- Mars
- April
- Mai
- Juni
- Juli
- August
- September
- Oktober
- November
- Desember

## Intake of sugar-sweetened beverages, fruit and vegetables

### Nå kommer noen spørsmål om hva du drikker på HVERDAGER.

Senere spør vi om hva du drikker i HELGEN.



På HVERDAGER (mandag til og med fredag):  
Hvor ofte drikker du vanligvis følgende typer drikke?

Sett ett kryss for hver linje

	Aldri/ sjeldent	1 dag	2 dager	3 dager	4 dager	Hver hverdag
Brus, med sukker (f.eks. Cola, Solo)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Brus, uten sukker (f.eks. Cola light, Pepsi Max)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Saft, med sukker (f.eks. husholdningssaft, appelsinsaft)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Saft, uten sukker (kunstig søtet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Når du drikker brus MED sukker på hverdager, hvor MYE pleier du å drikke?  
(1/2 liter = 3 glass)

- 1 glass
- 2 glass
- 3 glass
- 4 glass eller mer

Når du drikker saft MED sukker på hverdager, hvor MYE pleier du å drikke?  
(1/2 liter = 3 glass)

- 1 glass
- 2 glass
- 3 glass
- 4 glass eller mer



## Nå kommer noen spørsmål om hva du drikker i HELGEN.



### **I HELGEN:**

Hvor mye drikker du vanligvis av følgende drikker? (1/2 liter = 3 glass)

Legg sammen det du drikker lørdag og søndag, og sett ett kryss for hver type drikke.

Sett ett kryss for hver linje

	Aldri/sjeldent	1 glass	2 glass	3 glass	4 glass	5 glass	6 glass	7 glass eller mer
Brus, med sukker (f.eks. Cola, Solo)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Brus, uten sukker (f.eks. Cola light, Pepsi Max)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Saft, med sukker (f.eks. husholdningssaft, appelsinsaft)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Saft, uten sukker (kunstig søtet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### **Hvor ofte spiser du vanligvis FRISK FRUKT?**

- Aldri/sjeldent
- Mindre enn 1 gang i uken
- 1-2 ganger pr uke
- 3-4 ganger pr uke
- 5-6 ganger pr uke
- 1 gang pr dag
- 2 ganger pr dag
- 3 ganger eller mer pr dag

### **Hvor ofte spiser du vanligvis RÅ GRØNNSAKER (f.eks. gulrot, tomat, salat)?**

- Aldri/sjeldent
- Mindre enn 1 gang i uken
- 1-2 ganger pr uke
- 3-4 ganger pr uke
- 5-6 ganger pr uke
- 1 gang pr dag
- 2 ganger pr dag
- 3 ganger eller mer pr dag

**Hvor ofte spiser du vanligvis VARME GRØNNSAKER (IKKE poteter)?**

- Aldri/sjeldent
- Mindre enn 1 gang i uken
- 1-2 ganger pr uke
- 3-4 ganger pr uke
- 5-6 ganger pr uke
- 1 gang pr dag
- 2 ganger pr dag
- 3 ganger eller mer pr dag

## Perceived availability

**Når det finnes brus MED sukker hjemme hos deg, kan du drikke når du vil?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri
- Har ikke brus MED sukker hjemme hos meg

**Når det finnes saft MED sukker hjemme hos deg, kan du drikke når du vil?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri
- Har ikke saft MED sukker hjemme hos meg

**Når det finnes grønnsaker som du liker hjemme hos deg, kan du spise når du vil?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri
- Har ikke grønnsaker hjemme hos meg

**Når det finnes frukt som du liker hjemme hos deg, kan du spise når du vil?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri
- Har ikke frukt hjemme hos meg



# Appendix 3



**MOTHER/FATHER QUESTIONNAIRE – relevant survey items (in Norwegian)**

**Perceived availability (in both mother and father questionnaires)**

**42. Når det finnes brus MED sukker hjemme hos dere, kan barnet ditt drikke når han/hun vil?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri
- Har ikke brus MED sukker hjemme hos oss

**47. Når det finnes saft MED sukker hjemme hos dere, kan barnet ditt drikke når han/hun vil?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri
- Har ikke saft MED sukker hjemme hos oss

**58. Kan barnet ditt spise grønnsaker når han/hun vil hjemme?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri

**72. Kan barnet ditt spise frukt når han/hun vil hjemme?**

- Alltid
- De fleste dager
- Av og til
- Sjelden
- Aldri



## Physical availability (in mother questionnaire)

Til slutt noen spørsmål om hvilken mat og drikke dere har hjemme akkurat nå

Nedenfor er en liste over mange forskjellige matvarer. Vi ber deg ta en titt i alle kjøleskap/-rom, skuffer og skap (inkludert mat-/kjellerbod), og krysse av i JA-boksen dersom du har mat/drikke det spørres om. Kryss av i NEI-boksen dersom du ikke har mat/drikke det spørres om. Husk å se alle steder der du oppbevarer mat og drikke. **Ikke regn med frossen mat eller hermetisert mat dersom det ikke spørres spesifikt om dette.**

84. Hvilken ukedag er det i dag? \_\_\_\_\_

85. Hvis dere har en fast handledag, hvilken dag er det? \_\_\_\_\_

### 86. Drikke

Sett ett kryss for hver linje	Ja	Nei
Juice (f.eks. ren appelsinjuice, ren eplejuice)	<input type="checkbox"/>	<input type="checkbox"/>
Nektar (juice tilsatt sukker)	<input type="checkbox"/>	<input type="checkbox"/>
Saft, med sukker (f.eks. husholdningssaft)	<input type="checkbox"/>	<input type="checkbox"/>
Saft, kunstig søtet (f.eks. Fun Light)	<input type="checkbox"/>	<input type="checkbox"/>
Brus, med sukker (f.eks. Cola, Solo)	<input type="checkbox"/>	<input type="checkbox"/>
Brus, kunstig søtet (f.eks. Pepsi Max, Fanta Free)	<input type="checkbox"/>	<input type="checkbox"/>
Annen sukret leskedrikk (f.eks. Iste, Kjeft)	<input type="checkbox"/>	<input type="checkbox"/>
Hel melk	<input type="checkbox"/>	<input type="checkbox"/>
Lett melk	<input type="checkbox"/>	<input type="checkbox"/>
Ekstra lettmeik	<input type="checkbox"/>	<input type="checkbox"/>
Skummet melk	<input type="checkbox"/>	<input type="checkbox"/>
Sjokolademelk (f.eks. Litago, Milkshake)	<input type="checkbox"/>	<input type="checkbox"/>

## 92. Frukt

<i>Sett ett kryss for hver linje</i>	<b>Ja</b>	<b>Nei</b>
Eple	<input type="checkbox"/>	<input type="checkbox"/>
Appelsin	<input type="checkbox"/>	<input type="checkbox"/>
Banan	<input type="checkbox"/>	<input type="checkbox"/>
Pære	<input type="checkbox"/>	<input type="checkbox"/>
Mandarin/klementin	<input type="checkbox"/>	<input type="checkbox"/>

Hvor mange andre typer frukt/bær har du? \_\_\_\_\_ (noter antallet)

## 93. Grønnsaker

<i>Sett ett kryss for hver linje</i>	<b>Ja</b>	<b>Nei</b>
Tomat	<input type="checkbox"/>	<input type="checkbox"/>
Agurk	<input type="checkbox"/>	<input type="checkbox"/>
Grønn salat	<input type="checkbox"/>	<input type="checkbox"/>
Gulrot	<input type="checkbox"/>	<input type="checkbox"/>
Løk	<input type="checkbox"/>	<input type="checkbox"/>
Frosne grønnsaker/grønnsaksblandinger	<input type="checkbox"/>	<input type="checkbox"/>

Hvor mange andre typer grønnsaker har du? \_\_\_\_\_ (noter antallet)