



**PREDICTORS OF FRUIT AND VEGETABLE CONSUMPTION AMONG  
SWEDISH SPEAKING SCHOOLCHILDREN IN THE CAPITAL REGION  
OF FINLAND**

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## PREDICTORS OF FRUIT AND VEGETABLE CONSUMPTION AMONG SWEDISH SPEAKING SCHOOL CHILDREN IN THE CAPITAL REGION OF FINLAND

The present Master's thesis aims to describe the predictors of fruits and vegetable consumption and investigate which factors affect the maintenance of consumption.

The study subjects were Swedish speaking schoolchildren between the age of 9-11 and data were collected as part of the Hälsoverkstaden study, a health promotion project directed to Swedish-speaking primary schools in the capital region of Finland. This was done in connection to a school intervention project carried out by Folkhälsan (Swedish NGO) in Finland. The Hälsoverkstaden Study also collaborated with the Pro Children study and used its questionnaire to collect data on fruit and vegetable intake and factors affecting their consumption in 672 children in spring 2006 and spring 2008. The questionnaire was distributed at schools and with the assistance of the staff members it was filled in by the schoolchildren.

The factors assessed for association with consumption maintenance of fruit and vegetables were analyzed with Spearman's rank correlation and binary logistic regression analysis. The factors were categorized in to personal, perceived socio-environmental, and perceived physical-environmental. Most of the factors that showed significant association with consumption maintenance of both fruits and vegetable belong to the personal factors including perceived barriers or liking when controlled for school type (intervention, control) and gender. In addition availability at home was borderline significant.

A final binary logistic regression model controlled for gender and school type was created including factors that showed significant association in previous analysis. Perceived barriers from the personal factors category was significantly associated with fruit consumption maintenance. The school children's consumption changed from baseline to follow-up and was associated with the affecting factors. On the other hand, most of the factors did not show association with consumption maintenance. Factors that were considered to affect consumption of fruit and vegetables on earlier studies played limited role to make children maintain their consumption. To conclude perceived barrier was the only significant factor on the final binary logistic regression analysis model and further studies taking in to consideration additional factors related to it and controlling for more confounders is advisable.

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## 1. INTRODUCTION

Health related researches have already demonstrated the benefits of including fruit and vegetables in daily diet. According to World Health Organization, an individual is recommended the intake of minimum of 400 g of fruit and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases. Studies had shown that in Northern European countries, the consumption of fruit and vegetables tend to be below current recommendations (Klepp, 2007). Pro Children is a project aiming to develop effective strategies to promote adequate consumption levels of fruit and vegetables of young adolescents and their parents. Folkhälsan Research center (Swedish Nongovernmental organization) cooperated with Pro children project and conducted an intervention called “Hälsoverkstaden” in the capital region of Finland. The study was to find whether there is a relationship between health and availability and accessibility of fruit and vegetables at home. In parallel to that, this study also aims to assess the important factors that play a role in maintaining the positive fruit and vegetable consumption behavior of schoolchildren in capital region of Finland. Data were collected on 2006 baseline and on 2008 follow up periods while there was an ongoing health promotion intervention program in the schools focusing on lifestyle, investigating whether it can change consumption behavior, physical activity and sleeping habits of the schoolchildren. Furthermore, the intervention tries to investigate if it can prevent excessive weight gain. This study in particular, aims to investigate the association between fruit and vegetable consumption maintenance and affecting factors.

## **2. BACKGROUND**

### **2.1 General health aspects of fruits and vegetable consumption**

Fruits and vegetables are essential part of a healthy diet. Some studies have shown that higher consumption level of fruits and vegetables has a strong correlation with better quality of life and higher life expectancy (González et al., 2008; Cai et al., 2007). Furthermore many researchers have found out that adequate amount of fruits and vegetables consumption every day is able to prevent different chronic diseases like heart disease, cancer, diabetes and obesity, as well as prevent and alleviate several micronutrient deficiencies (WHO, 2009; Ness & Powles, 1997). In addition to this, consuming a diet high in fruits and vegetables as part of an overall healthful diet can aid in weight management (Blanck et al., 2008). About 250 epidemiological studies have shown that the consumption of fruits and vegetables are associated with lower risk of some cancer types (Higdon, 2007). The risk of gastric carcinoma, oesophageal cancer and incidence of colorectal cancer is reduced among those who consume higher amounts of vegetables, fruit and fiber while as some studies also point out that breast cancer risk may be inversely related with the intake of vegetables (Joffe & Robertson, 2001).

There are biochemically active phytochemicals in fruits and vegetables, which are a large group of non-nutrient secondary metabolites which provide much of the color and taste in fresh or processed fruits and vegetables. In plant-based diets these chemicals play a significant role in the health effects by assisting in prevention of diseases, and the best way to get the benefits of these substances is to increase the variety of the consumption in day to day life (Shils et al., 2005). Earlier studies have pointed out that including these phytochemicals in the diet may protect against cancers, cardiovascular disease and even neurodegenerative disorders like stroke, Alzheimer's and Parkinson's diseases (Mattson & Cheng, 2007). This finding is supported by similar study conducted on mouse model that indicated that blueberry supplementation prevented learning and memory deficits related to Alzheimer's disease (Joseph et al., 2003). As diet plays a very important role in the etiology and prevention of several chronic diseases, most notably of cancer and cardiovascular diseases, dietary pattern characterized by higher consumption of vegetables, fruits and whole grains is also associated with reduced risk of type-2 diabetes (Van Dam et al., 2002). Even though the antioxidant property of these chemicals is well know, the correlation with type-2 diabetes still need further clarification.

Based on current experimental findings, flavonoids, carotenoids, ascorbic acid and tocopherols are the main antioxidants recommended to prevent antioxidant depletions and cardiovascular complications in diabetic patients (Pietta, 2000). Most chronic diseases have a correlation in cause or progression and share similar pathologies, for that reason prevention or health benefit of fruits and vegetables for one of the chronic disease might as well indirectly benefit as a cure or prevention for another. Similarly some studies have also indicated phytochemicals can help prevent obesity-induced inflammatory responses and pathologies (Hirai, 2010). Regardless of the repeatedly reported health benefits of fruit and vegetable, World Health Organization has presented that, due to poor consumption of fruits and vegetables, the death rate is 2.7 million which translates to 26.6 million disability adjusted life years per year due to the prevalence of chronic disease like cardiovascular disease, and cancers (including lung, stomach, colorectal and esophageal).

Stroke and myocardial infarction are major causes of mortality and morbidity in industrialized countries and diet is considered to play a great role in the etiology of the disease (WHO, 2003). A cohort study on young Finns (3-18 years of age) suggested that lifetime lifestyle risk factors, with low consumption of fruits and vegetables in particular, are related to arterial stiffness in young adulthood (Mikkilä, 2004). Similarly in a review on the association of fruit and vegetable consumption and coronary heart disease, it was found that nine of ten ecological studies, two of three case-control studies and six of 16 cohort studies found a significant protective association with consumption of fruit and vegetables or surrogate nutrients. In addition on the same study, three of five ecological studies and six of eight cohort studies found a significant protective association from stroke with consumption of fruit and vegetables or surrogate nutrients. For total circulatory disease, one of two cohort studies reported a significant protective association (Ness, 1997).

According to the 2005 Finnish nutrition recommendation, fruits and vegetables are put as one of the essential part of a dietary recommendation and the guideline aims at increasing consumption (Valsta, 1999; Finnish nutrition recommendation, 2005). Since fruits and vegetables are low energy foods, they could help mitigate and balance the over weight problems that are alarmingly growing among children and adults in Finland, where 66% of men and 49% of women are at least mildly obese ( $>BMI$  25 kg/m<sup>2</sup>) (Pietinen et al, 2006). Obesity is the major risk factor that

causes type-2 diabetes. It has been calculated that 60-80% of type-2 diabetes would never occur if the population was held at normal weight (Pietinen et al, 2006). Excess consumption of high energy foods without proper balanced diet results in the neglecting of essential nutrients that could persist as being a normal eating habit in the later stage of life that has a serious consequence, making the individual vulnerable to nutrition related chronic diseases (Bruno, 2009).

## **2.2 Fruit and vegetable consumption**

In Finland there has already been publicly funded school meal system since 1948 (Raulio, 2010). Thus all Finnish schoolchildren have lunch at school and today about 30% of the schools also offer snacks (European commission, School fruit scheme, 2009). The recommended intake of fruit and vegetables including for schoolchildren in Finland is set to five servings a day (at least 400g / day), where potatoes are excluded (Finnish nutrition recommendations, 2005). In December 2007 the Finnish Government issued a resolution concerning a strategy document which also includes a policy program on the welfare of the children, young and families to fight against the growing epidemic of obesity among children. The aim was to improve the welfare of the children by promoting healthy living habits among children and the young. The objective set down in the program is that each child will have at least one hour of physical exercise per day and their daily intake of fruit and vegetables will be 400 grams (Raulio, 2010).

Finnish Nutrition recommendation of 1999 pointed out that over the past few decades in Finland, the consumption of vegetables and fruit has increased while as there has been no change in the consumption of potatoes in recent years. In addition sugared juices and soft drinks are being used more and more. However, the Finnish nutrition recommendations have been renewed in 2005 and the recommendation still emphasizes on the need to increase consumption of fruit and vegetables by the general population. The Finnish national nutritional recommendations published are mainly based on the Nordic recommendations (Valsta, 1999).

According to Food and Agriculture Organization (FAO) statistics on the availability of fruits and vegetables, few countries in Europe like Greece, Italy and Spain are able to meet the World

Health Organization's target of 400g ( 5 servings a day) fruit and vegetable consumption (WHO, 2003). According to 2009 European nutrition and health report, in Finland the average supply of fruit and vegetable is 195 g per person per day, which corresponds to 71 kg per person per year, whereas Greece has an average supply of 756 g per person per day (276 kg per person per year) (Elmadfa et al, 2009). Studies have shown that in Northern European countries, the consumption of fruit and vegetables of schoolchildren tend to be below current recommendations (Klepp, 2007). On the other hand similar study conducted by Pro Children project, mainly targeting parents in order to change or improve eating habits of children conducted a survey in 9 European countries that showed the fruit and vegetable intake in 11-year-old children was in all countries far from reaching population goals and food based dietary guidelines on national and international levels (Yngve et al., 2006). Finland, where women are more likely than men to meet the nutrition recommendations (Wardle et al, 2003) is also one country that there is still work to be done on improving the consumption levels by different public health nutrition interventions means. Some studies also have revealed that young people like schoolchildren are still not consuming the adequate amount of fruits and vegetables due to different underlying social and behavioral factors (Johansson & Andersen, 1998). On a recent 11 year prospective, randomized clinical trial in Finland, children followed from the age of 7 months till 11 years has shown that, the children's consumption during school age (9-10 years) is inadequate compared to the recommended amount of 400-500grams a day ( boys: 175g- 225g and girls: 175g in intervention groups) . Those in the control group showed even lower consumption. (Talvia et al, 2006). In a similar study, 21 years of follow-up of young Finns to assess cardiovascular risk also noted that, even though the consumption of fruit and vegetables has increased in recent years in comparison to 1980 (35.9 to 48.8 g/ 1000kJ for male and 42.6 to 65.1 g/ 1000kJ for females) , it is still inadequate among young Finns (Mikkila, 2004). Similarly, in a 2010 report on health behavior among Finnish population that conducted a survey on 2826 Finnish individuals between the age of 15-64 has indicated that, only 32 percent of men and 50 percent of women reported eating fresh vegetables daily, including the young Finns, which indicates that there is still prevalence of inadequate consumption among young people and that there exist a consumption difference between genders (Helakorpi et al, 2010).



### **2.3 Factors affecting fruit and vegetable consumption**

Several studies have shown that children's intake of fruit and vegetable tracks into adolescence and the food preferences and eating habits established in childhood and adolescence tend to be maintained into adulthood (Mikkilä et al., 2004). Since children's consumption behaviors are easily and permanently influenced by different social factors, in order to be able to adjust the consumption level of the whole society, it is wise and basic step to be able to determine the influencing factors. Usually children are highly influenced by the taste (Pérez-Rodrigo et al., 2005) of food that is presented for them to consume, and for that reason they might neglect the nutritious foods for those that could appear to be sweeter and better. A development of food preferences study emphasize the importance of genetic predispositions with environmental factors to influence a child's eating behavior since children get their genes from their parents and develop eating pattern at early years of a their life which will make it difficult to separate genetic and environmental factors (Birch, 1998). The choices parents make, beginning with their choice of an infant-feeding method (breast or bottle), affect their subsequent child-feeding practices and the infant's development in food-acceptance patterns, and for this reason it is possible that food preferences formed early in life persist to affect adult food selection (Birch, 1998; 1999). A concept that could relate to this notion is the fact that some comparative studies conducted on the health status of Swedish speaking minority and Finnish speaking Finns in Finland have shown that the Swedish speaking minority has a longer life expectancy and health condition (Volanen, 2006; Hyypä & Maki , 2001). Despite similar living conditions among the Finnish-speaking majority and the Swedish-speaking minority, the latter is a more advantaged group in terms of socioeconomic status and health which could relate to their consumption behavior and life style either during childhood or later stage of life.

A research conducted in nine European countries that investigated predictors affecting daily consumption of fruits and vegetables has shown that it was mainly associated with knowledge of the national recommendations, positive self-efficacy, positive liking and preference, parental modeling and demand and bringing fruit to school with personal preferences having the biggest impact on the level of consumption (Bourdeaudhuij et al., 2008).

In a quantitative study related to fruits and vegetable consumption of children in Europe and the USA, it has been emphasized that gender could have an impact on the consumption level. In a review paper of 18 studies that were conducted in the USA, stated that only six of the studies showed differences in consumption level among boys and girls. On the other hand, out of 17 studies conducted in the European countries, 14 has shown a significant difference between boys and girls consumption level which shows that gender could be a significant factor in European countries. Even among those who appear to be consuming fruit and vegetable daily, the girls were consuming more than boys. It can be illustrated by a study that showed higher number of 11-year-old Portuguese girls than boys being fruit and vegetable consumers, 58% and 52% in girls and boys, respectively in 2001/2002 and similarly in Flemish-speaking schoolchildren in Belgium 33% and 27% girls and boys, respectively. In addition, 56% and 47% of Flemish 11-year-old girls and boys, respectively reported they consume vegetables daily (Currie et al, 2004). Other researchers have revealed that as age increases consumption level decreases (Rasmussen, 2006).

Dominating behavior of parents could have a negative effect on the child's consumption behavior; creating awareness in the children after provision of adequate diet to help them choose for themselves is more effective than enforcing (Birch, 1999). In a structured review of literature conducted on 21 research papers focusing on consumption behavior of 6–12-year-old children has shown that of all determinants, the availability and accessibility of fruit and vegetables and taste preferences were most consistently and most positively related to consumption. Whereas television viewing, exposure to television advertisement, and having a snack bar at school were associated with lower intakes of fruit and vegetables (Blanchette & Brug, 2005). In another study, conducted in Canada to describe the patterns of fruit and vegetable intake and identify socio-demographic factors that were associated with the low consumption, has revealed that there is a strong positive association between fruits and vegetables consumption and total household income and highest household education. Other study has shown that gender and marital status were other important contributing factors for fruits and vegetable intake among elderly, which as a result could affect the consumption behavior of the children in the household as parental influence is quite important. On the other hand the same study showed that ethnicity did not influence fruits and vegetable intake (Riediger & Moghadasian, 2008). As most other studies also indicated 12 year old males reported to consume less fruits and vegetable than older

males (Riediger & Moghadasian, 2008). Availability of adequate amounts of fruits and vegetables at a household level can be a potential factor to influence consumption levels of children. In a Danish study aimed to investigate the influence of school environment as a predictor of the consumption level of fruits and vegetables in 11-year-old schoolchildren has shown that family level interventions could be more effective in changing the consumption level of children for the fact that parental involvement in provision and emphasis on behavioral changes of the children has a high impact on the outcome (Krølner et al., 2009). In addition children's eating behaviors are strongly influenced by determinants in the social and the physical environment (Patrick & Nicklas, 2005).

In a Pro Children project conducted on 10-11-year-old schoolchildren, it has been noted that regardless of the children's awareness of health benefits of fruit and vegetable, taste preferences were highly dominating. Besides taste, the appearance of fruit was considered important. In addition awareness or knowledge of fruits and vegetables were also questionable as for the fact that most of the children thought all kinds of soft drinks, lemonades, fruit yoghurt, milk shakes or even fruit tea could be defined as fruit juice. While as several personal barriers were also noticed to exist among the schoolchildren on their consumption of fruit and vegetables, particularly fruits being squashed in their bags and children usually not preferring to take it to school or during leisure times (Wind et al., 2005).

An earlier literature review study stated that the personal, social, and environmental determinants (Table 1) were the most significant factors to affect the consumption of fruit and vegetable of schoolchildren in 6 countries where Pro Children intervention was implemented (Pérez-Rodrigo et al., 2005). In addition it noted that, the determinants not only affect the consumption behavior individually but a mixture of environmental and individual factors could also predict consumption in children. Taste preferences basically liking, and availability were the most important determinants, while beliefs about health outcomes were regarded as less important. Similarly parents were also identified as substantial factors since their consumption behavior could be taken as role model as well as allowing family rule could affect availability and variability of fruit and vegetables at least in household level (Pérez-Rodrigo et al., 2005; Wind et al., 2007).

Table 1 Identified changeable important determinants of fruit and vegetable consumption in the Pro Children intervention (Adapted from The Pro Children Intervention: Applying the Intervention Mapping Protocol to Develop a School-Based Fruit and Vegetable Promotion Program) (Pérez-Rodrigo et al., 2005)

<b>PERSONAL DETERMINANTS</b>	<b>SOCIAL DETERMINANTS</b>	<b>ENVIRONMENTAL DETERMINANTS</b>
Awareness of importance of fruit and vegetable intake for health and well-being	Parental facilitation and direct encouragement	Availability and accessibility of fruit and vegetable at home
Positive taste preferences for different fruits and vegetables	Parental modeling behavior	Availability and accessibility of fruit and vegetable in the school
Awareness of own fruit and vegetable intake	Peer modeling behavior	A fruit and vegetable promotion school environment
Awareness of recommended intake levels	Teacher support	Neighborhood support
Self-efficacy and skills for asking for fruit and vegetable		
Self-efficacy and skills for preparing fruit and vegetable		
Self-efficacy and skills for obtaining fruit and vegetable		
Self-efficacy and skills for keeping fruit and vegetable fresh		
Familiarity with different fruits and vegetables		

## 2.4 Pro Children project

As evidenced by previous studies fruit and vegetable intake is too low among European school children. School-based health promotion strategies fostering healthy eating practices have the potential to improve health and well-being during childhood and later stages in life (Currie, 2004). It is crucial to be able to encourage children to improve on their healthy eating behaviors in order to improve health of a society. Children are at a stage when habits that could stick with them throughout their life are learned or developed, and interventions aimed at them may thus have a lifelong impact. The whole process of developing, implementing and evaluating an intervention program will be able to provide proper theoretical information on behaviors that could assist in better approach in future interventions (Klepp et al, 2005). Since healthy diet was one of the concerns in European and north American countries, projects like Pro Children was set up to develop effective strategies to promote adequate consumption levels of fruit and vegetables among 11- to 13-year-old schoolchildren in Europe aiming to initiate, develop, implement and evaluate school-based fruit and vegetable promotion. The project aimed to develop an evidence-based and theory- driven intervention package that is applicable in different European countries (Currie, 2004). The health promotion intervention had five steps which had common parts and country specific assessment for all the participating countries individually. Analysis of health and quality of life, analysis of behavior and environmental risk factors and analysis of determinants of risk factors were common for all the countries, while intervention development and implementation were country specific depending on the particular type of problem to be solved (Pérez-Rodrigo et al., 2005).

An effective intervention program should have multiple components, including school-based education aimed at children's behavioral determinants, parental involvement and changes in the school environment and for that reason Pro Children project incorporated these elements (Wind, et al, 2007). Multi-component school-based interventions that combined classroom curriculum, parent and food service components showed the greatest promise for fruit and vegetable promotion among children (Blanchette & Brug, 2005). Intervention programs including Pro Children project, which had similar approach also have shown to be effective in improving the schoolchildren's fruit and vegetable consumption level (Pérez-Rodrigo et al., 2005). Similarly a

group-randomized trial among 10-11-year-old children (n=1472) from sixty-two schools was conducted to evaluate the effectiveness of Pro Children project intervention in Norway, Netherlands and Spain. It had 1 and 2 years of follow-up and has shown that children who received the lesson started consuming 57 g/day more fruits and vegetables compared with children who did not receive lessons on fruit and vegetables. The intervention combined a curriculum with efforts to improve availability of fruit and vegetable at schools and at home (Te Velde et al., 2008). Another Pro Children qualitative study on determinants of fruit and vegetable intake also concluded on the importance of including educational and motivational activities in interventions tailored to personal and environmental factors that affects fruit and vegetable intake of the children. In addition it should aim to increase fruit and vegetable accessibility that can be evaluated in quantitative research among representative samples (Wind, et al., 2005).

Factors influencing the food choices of children and adolescents need to be better understood in order to develop effective nutrition interventions to improve food consumption patterns. Pro Children project had a specific framework used to pinpoint the main factors that affect children's consumption of fruit and vegetable in the participating countries and accordingly the frame work had general four elements which were cultural environment, physical environment, social environment, and personal factors that were investigated and each elements were further focused on specific factors (Table 2) (Pérez-Rodrigo et al., 2005). In order to assess dietary habits of schoolchildren, a less complicated and non demanding methods had to be used. For this reason, a food frequency questionnaire was considered more efficient (Hammond et al., 1993). Accordingly, previous Pro Children studies suggested the importance of addressing personal factors like self-efficacy, preferences, liking and knowledge of recommendation of fruit and vegetables in interventions. In addition concerning vegetable consumption, environmental factors were found to be more correlated than personal factors (Kristjansdottir et al., 2006).

Table 2 Frame work used by Pro Children project for investigating on factors affecting children's fruit and vegetable consumption (Klepp et al., 2005)

<b>CULTURAL ENVIRONMENT</b>	<b>PHYSICAL ENVIRONMENT</b>	<b>SOCIAL ENVIRONMENT</b>	<b>PERSONAL FACTORS</b>
Country Ethnicity Socio-economic Status	<p><b>National level:</b> Dietary guidelines School food policies Price policy</p> <p><b>Community level:</b> Local food policies Local access</p> <p><b>School level:</b> Socio-economic status School food policies School meals Access at school</p> <p><b>Perceived physical environment:</b> Availability at home Availability at school and Leisure</p>	<p><b>Community level</b> Exposure to mass media and commercials</p> <p><b>School level</b> Behavioral norms among pupils</p> <p><b>Peer group</b> Subjective norms</p> <p><b>Family</b> Socio-economic status Modeling Parental encouragement Family rules Parental facilitation</p>	<p><b>Health-related behaviors:</b> Physical activity TV-viewing</p> <p><b>Specific factors</b> Knowledge Attitudes Liking FV Self-efficacy Self-rated intake Habit Preferences Perceived barriers</p>

### **3. AIM OF THE STUDY**

The aim of the study is to investigate the main predictors for maintenance of positive consumption level of fruits and vegetables among 9-11-year-old schoolchildren. Children were recruited from Swedish speaking primary schools in Helsinki region. The following questions were answered during this study.

1. What factors are associated with fruit and vegetable consumption at baseline and follow up?
2. What factors are responsible for determining maintenance of fruit and vegetables consumption?

### **4. SUBJECTS AND METHODS**

The data were collected as part of the Hälsoverkstaden study, which is a health promotion project directed to Swedish-speaking primary schools in the capital region of Finland. The aim of the research part in the project is to widen the understanding on how the social and psychosocial environment at home and at school influence school children's health behavior, i.e. sleeping pattern, food habits and physical activity. Health behavior was surveyed among Swedish-speaking children in Finland in the age groups 9-11 (minimum age of 9 at baseline and maximum age of 11 at follow up). This was done in connection to a school intervention project carried out by Folkhälsan (Swedish NGO) in Finland aiming to promote healthy lifestyle among schoolchildren. The Hälsoverkstaden Study also collaborated with the Pro Children project and used a questionnaire from that study to collect data in spring 2006 and spring 2008 on fruit and vegetable intake from 672 children among which 328 were girls and 344 were boys. The questionnaire was distributed at 27 Swedish speaking schools out of which 13 were intervention schools and 14 control schools. With the assistance of the staff members it was filled in by the schoolchildren.



## **4.1 Questionnaires**

### **4.1.1 Consumption of fruits and vegetables and maintenance of consumption**

Data from food frequency questionnaire was used from spring 2006 and spring 2008; baseline and follow-up respectively. Frequencies of consumption of cooked and raw vegetables were asked separately, but since it is quite common and usual for vegetables to be consumed raw in Finland, it was decided to analyze only questions dealing with raw vegetables. In the questionnaire children were asked their consumption frequency by “How often do you usually eat fresh fruit?” and “How often do you usually eat raw vegetables?” with given eight alternatives for consumption frequency of fruit and vegetables being 1) Never, 2) Less than one day per week, 3) One day per week, 4) 2-4 days a week, 5) 5-6 days a week, 6) Every day- once a day, 7) Every day- twice a day, 8) Every day, and more than twice a day.

For analysis the alternatives were re-coded in to “Seldom”, “Often” and Daily”. Alternatives 1-3 were renamed as “Seldom”, alternatives 4 and 5 to “Often” and Alternatives 6-8 as “Daily” for both the 2006 and 2008 food frequency questionnaire and the three categories were given the values 3, 2, and 1, respectively as a continuous variable for statistical analysis. Furthermore to create a new variable indicating maintenance of the consumption habit, maintenance was defined as those who managed to stay in daily alternative on both 2006 and 2008 food frequency questionnaire, those who stayed on “Often” on both 2006 and 2008 and on the other hand those who showed increase in consumption. Maintenance variable was coded as 0) Maintained and 1) did not maintain.

### **4.1.2 Positive predictors of consumption**

Based on previous studies by Pro Children project and other related studies (Wind et al., 2007; Te Velde, et al., 2008) factors that were found to be indicators for increased consumption of fruit and vegetables were focused in this study. The factors of interest were extracted from the questionnaire.

Personal factors assumed responsible for consumption and maintenance of fruit and vegetable among the school children, included in this study knowledge of recommendations, attitudes, liking, self-efficacy, preferences, and perceived barriers. The second element perceived socio-environmental category deals with variables that reflected children's perception towards their parental modeling and encouragement that affect consumption behavior of fruits and vegetables. As evidenced earlier on the importance of availability of fruit and vegetables for adequate level of consumption, perceived physical-environmental factors were also included in this study that basically reflected availability at school and household level. All the variables in this study were used as continuous variables in the analysis with the numerical values as indicated (Table3).

The questions that reflected family support like “ My mother or father eats fruit or vegetable every day” and “My mother or father encourages me to eat fruit or vegetable everyday” were recorded from the alternatives 1) fully agree, 2) agree somewhat, 3) neither agree nor disagree, 4) disagree somewhat, 5) fully disagree to a new dichotomous variable 1) yes my mother or father eats fruit every day or encourages me to eat everyday and 2) no my mother or father do not eat fruit every day or do not encourages me to eat everyday alternatives by recoding those who answered from alternative 1-2 as a “yes” and those who responded from 3-5 as a “no”. “Neither agree nor disagree” was recorded as the “no” alternative for the fact that if the children had actually been encouraged or the parents had been consuming often, it would have been easier to answer one of the first two alternatives. It's assumed that “the neither agree nor disagree” response merged from either not been encouraged by parents or the parents not consuming often enough which either ways will make that response fall under the “no” category according to this analysis.

Table 3 Personal, perceived socio environmental and physical environmental factors

PERSONAL FACTORS	PERCEIVED SOCIO-ENVIRONMENTAL FACTORS	PERCEIVED PHYSICAL-ENVIRONMENTAL FACTORS
VARIABLE REFLECTING KNOWLEDGE OF RECOMMENDATIONS	VARIABLES REFLECTING MODELING	VARIABLE REFLECTING AVAILABILITY AT HOME
<p><b>Question:</b> How much fruit do you think you should eat? How much vegetable do you think you should eat? <b>Answer Alternatives:</b> 1) 1-3 pieces/week, 2) 4-6 pieces/week, 3) 1 pieces/day, 4) 2pieces/day, 5) 3 pieces/day, 6) 4 pieces /day, and 7) 5 pieces /day</p>	<p><b>Questions:</b> My mother eats fruit/vegetable every day, my father eats fruit/vegetable every day, and my best friends eat fruit/vegetable every day. <b>Answer Alternative:</b> 1) fully agree, 2) agree somewhat, 3) neither agree nor disagree, 4) disagree somewhat, 5) fully disagree</p>	<p><b>Question:</b> Are there usually different kind of fruits available at home? <b>Answer alternatives:</b> 1) yes, always, 2) yes, most days, 3) sometimes, 4) seldom, 5) never</p>
VARIABLE REFLECTING ATTITUDES	VARIABLES REFLECTING ACTIVE PARENTAL ENCOURAGEMENT	VARIABLE REFLECTING AVAILABILITY AT SCHOOL
<p><b>Questions:</b> I want to eat fruit every day I want to eat Vegetable every day <b>Answer Alternatives:</b> 1) fully agree, 2) agree somewhat, 3) neither agree nor disagree, 4) disagree somewhat, 5) fully disagree</p>	<p><b>Questions:</b> My mother encourages me to eat fruit/vegetable every day, and my father encourages me to eat fruit/vegetable every day? <b>Answer Alternative:</b> 1) fully agree, 2) agree somewhat, 3) neither agree nor disagree, 4) disagree somewhat, 5) fully disagree</p>	<p><b>Question:</b> Can you get fruit at school? <b>Answer alternatives:</b> 1) yes, always, 2) yes, most days, 3) sometimes, 4) seldom, 5) never</p>

### VARIABLE REFLECTING LIKING

**Question:** Fruit tastes good? Vegetable tastes good?

**Answer Alternatives:** 1) fully agree, 2) agree somewhat, 3) neither agree nor disagree, 4) disagree somewhat, 5) fully disagree

### VARIABLE REFLECTING SELF-EFFICACY

**Question:** If I decide to eat fruit every day, I can do it?

If I decide to eat vegetable every day, I can do it?

**Answer Alternatives:** 1) fully agree, 2) agree somewhat, 3) neither agree nor disagree, 4) disagree somewhat, 5) fully disagree

### VARIABLE REFLECTING PERCEIVED BARRIERS

**Question:** It is difficult for me to eat fruit every day?

It is difficult for me to eat vegetable every day?

**Answer Alternative:** 1) fully agree, 2) agree somewhat, 3) neither agree nor disagree, 4) disagree somewhat, 5) fully disagree

### VARIABLES REFLECTING DEMAND OF USE IN THE FAMILY RULE

**Question:** Do your parents demand that you eat fruit/vegetable every day?

**Answer Alternatives:** 1) yes, always, 2) yes, most days, 3) sometimes, 4) seldom, 5) never

### VARIABLES REFLECTING SUPPORT OF USE IN THE FAMILY

**Question:** If you tell at home what fruit you would like to eat, will it be bought?

**Answer Alternatives:** 1) yes, always, 2) yes, most days, 3) sometimes, 4) seldom, 5) never

## **4.2 Statistical analysis**

Analyses were performed using SPSS V.17. Spearman's rank-correlation analysis was conducted between fruit and vegetable consumption frequency for both baseline and follow up period and consumption maintenance and predictors (personal, socio-environmental, physical-environmental) to check if the factors affecting consumption frequency or maintenance have changed during the follow up period. In addition, binary logistic regression analysis was used to determine associations between the outcome variable, maintenance and predictors of fruit and vegetable consumption controlling for gender and school type effect for both fruit and vegetable consumption. The final model of the binary logistic regression analysis included all the predictors that showed significant association in Spearman's rank-correlation and independent binary logistic regression analysis.

## **5. RESULTS**

### **5.1 Children's age, sex distribution, and family support**

The number of children who filled the questionnaire for both baseline and follow up was 672 out of which 328 were girls and 344 boys. There were 373 children in grade three, of which 180 were girls and 193 were boys; and 361 were in grade four of which 201 were girls and 160 were boys.

Family support to fruit and vegetable consumption did not change significantly during the study period (Table 4). Therefore follow-up data were used to check for association between consumption behaviors of the children.

Table 4 Family support by gender

VARIABLES INDICATING FAMILY SUPPORT	GENDER	
	BOYS (N=326)	GIRLS(N=344)
	YES, N (%)	YES, N (%)
My mother eats fruit every day		
Baseline	217 (69%)	219 (66%)
Follow-up	208 (71%)	197 (70%)
My father eats fruit everyday		
Baseline	170 (54%)	162 (50%)
Follow-up	141(49%)	135 (50%)
My mother encourages me to eat fruit everyday		
Baseline	162 (51%)	167 (50%)
Follow-up	171 (57%)	181 (64%)
My father encourages me to eat fruit everyday		
Baseline	114 (36%)	105 (33%)
Follow-up	112 (38%)	118 (42%)
My mother eats vegetable every day		
Baseline	239 (75%)	245 (75%)
Follow-up	240 (81%)	229 (80%)
My father eats vegetable everyday		
Baseline	195 (62%)	201 (62%)
Follow-up	190 (66%)	184 (66%)
My mother encourages me to eat vegetable everyday		
Baseline	159 (50%)	175 (53%)
Follow-up	164 (55%)	172 (60%)
My father encourages me to eat vegetable everyday		
Baseline	122 (39%)	111 (34%)
Follow-up	122 (42%)	135 (48%)

## 5.2 Fruit and vegetable consumption

Most of the children reported “often” consumption in relative to the other alternatives, 55% and 47% was observed for fruit and vegetable, respectively at baseline (Table 5). In the follow-up period, majority of the children still remained in the often category being 58% and 53%, for fruit and vegetable consumption, respectively. In addition in the follow up period the daily consumption of fruit increased from 24 % to 26 % while the seldom consumption decreased from 19 % to 14 %. The children who changed their consumption from seldom changed either to daily or often behavior. Children with seldom vegetable consumption decreased from 36% to 31%, and proportion of children in the often category of vegetable consumption increased from 47% to 53%. On the other hand, daily consumption of vegetables did not show much of a change.

Table 5 Fruit and Vegetable consumption at baseline and follow-up for all children

	<b>DAILY N (%)</b>	<b>OFTEN N (%)</b>	<b>SELDOM N (%)</b>
<b>FRUIT CONSUMPTION AT BASELINE</b>	163 (24 %)	369 (55 %)	131 (19 %)
<b>FRUIT CONSUMPTION AT FOLLOW-UP</b>	179 (26 %)	392 (58 %)	96 (14 %)
<b>VEGETABLE CONSUMPTION AT BASELINE</b>	104 (15 %)	313 (47 %)	240 (36 %)
<b>VEGETABLE CONSUMPTION AT FOLLOW-UP</b>	96 (14 %)	356 (53 %)	211 (31%)

Table 6 illustrates the number of children who continued their earlier fruit consumption behavior or changed. Majority or highest percentage of the children who maintained consumption on follow-up were in “often” category at the baseline. These 209 children account to 61% of the children who were in “often” group in follow-up. There were 78 children who changed from

seldom category to often consumption. 73 children managed to keep their daily fruit consumption from baseline to follow-up period and belong to the maintained group. The children who stayed in the daily consumption habit consist approximately 46% of the “daily” consumer in the follow-up period.

Table 6 Fruit consumption frequency at baseline and changes during follow-up

		FRUIT CONSUMPTION ON FOLLOW-UP				
		SELDOM N (%)	OFTEN N (%)	DAILY N (%)	TOTAL N (%)	
FRUIT CONSUMPTION AT BASELINE	SELDOM	% WITHIN FRUIT CONSUMPTION ON FOLLOW-UP	29 (35%)	78 (22%*)	14 (8 %*)	121 (20 %)
	OFTEN	% WITHIN FRUIT CONSUMPTION ON FOLLOW-UP	43 (53 %)	209 (61 %*)	70 (44 %*)	322 (55 %)
	DAILY	% WITHIN FRUIT CONSUMPTION ON FOLLOW-UP	9 (11 %)	55 (16 %)	73 (46 %*)	137 (23 %)

\*Maintained Positive Consumption

Table 7 illustrates the maintenance of positive vegetable consumption. Great number of children in the follow-up period, who managed to be in the “daily” group, came from the “often” consumers at the baseline (48%). 53% of the children who were consuming vegetable “seldom” kept their habits even on follow up.



Table 7 Vegetable consumption frequency at baseline and changes during follow-up

		VEGETABLE CONSUMPTION IN FOLLOW-UP			TOTAL N (%)	
		SELDOM N (%)	OFTEN N (%)	DAILY N (%)		
VEGETABLE CONSUMPTION AT BASELINE	SELDOM	% WITHIN VEGETABLE CONSUMPTION IN FOLLOW-UP	95 (53 %)	103, (33 %*)	11, (13 %*)	209 (36 %)
	OFTEN	% WITHIN VEGETABLE CONSUMPTION IN FOLLOW-UP	65 (36 %)	160 (52 %*)	39 (46 %*)	264 (46 %)
	DAILY	% WITHIN VEGETABLE CONSUMPTION IN FOLLOW-UP	19 (10 %)	42 (13 %)	34 (40 %*)	95 (16 %)

\*Maintained Positive Consumption

Most of the children were not aware of the daily recommendation of 5 pieces/ day of fruit and vegetable in which for fruit only 5.9% (N=39) while as for vegetable 4.2% (N= 28) responded that they know that they should consume 5 pieces of fruit and vegetable per day. Majority of the children responded 1 or 2 pieces of fruit and vegetable as their knowledge of recommendation (Appendix, Table A1). Gender and school type are variables that are considered as confounding factors. Table 8 illustrates that gender was not associated with fruit and vegetable maintenance ( $p= 0.33$  and  $p=0.81$ , respectively). The intervention program was not intensified and consequently the proportion of children who maintained did not differ in the control and the intervention group for both fruits and vegetable consumption ( $p=0.21$  and  $p=0.71$ , respectively).

Table 8 Consumption maintenance of fruit and vegetable by gender and intervention group

		MAINTAIN N (%)		P VALUE	
		FRUIT	VEGETABLE	FRUIT	VEGETABLES
	GROUP	FRUIT	VEGETABLE		
<b>GENDER</b>	<b>BOYS</b>	148(54%)	163(61%)	0.33	0.81
	<b>GIRLS</b>	150(49%)	184(62%)		
<b>SCHOOL</b>	<b>CONTROL</b>	140(49%)	175(62%)	0.21	0.71
	<b>INTERVENTION</b>	158(54%)	172(60%)		

### 5.3 Personal factors associated with consumption

Subcategories of personal determining factors that showed statistical correlation with fruit consumption maintenance were “liking”, “self efficacy”, and “perceived barriers” (Table 9). These variables were also significantly associated with fruit consumption on both baseline and follow up which could partially explain the projection on maintenance. All the correlations observed were positive indicating the increase in liking, self efficacy or perceived barriers associated with increased consumption in the children as well as make them maintain the good consumption behavior they had earlier. On the other hand, knowledge of recommendation did not show any association with maintenance while there was a clear significant inverse correlation with fruit consumption frequency at both baseline and follow-up.

Table 9 Correlation between personal factors and fruit maintenance and fruit consumption frequency at baseline and follow-up

<b>DETERMINANTS</b>	<b>FRUIT MAINTENANCE</b>			<b>FRUIT CONSUMPTION BASELINE</b>			<b>FRUIT CONSUMPTION FOLLOW-UP</b>		
	<b>All (N=672)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>
<b>KNOWLEDGE OF RECOMMENDATION</b>	0.04 (0.23)	0.06 (0.27)	0.03 (0.60)	-0.23 (<0.001)	0.24 (<0.001)	-0.23 (<0.01)	-0.09 (0.02)	0.15 (0.01)	0.02 0.68
<b>ATTITUDE</b>	-0.05 (0.20)	-0.01 (0.83)	-0.08 (0.12)	0.24 (<0.001)	0.29 (<0.01)	0.18 (<0.01)	0.16 (<0.001)	0.16 (<0.001)	0.16 (<0.001)
<b>LIKING</b>	0.11 (<0.001)	-0.11 (0.05)	-0.01 (0.06)	0.23 (<0.001)	0.21 (<0.001)	0.23 (<0.001)	0.21 (<0.001)	0.17 (<0.001)	0.25 (<0.001)
<b>SELF EFFICACY</b>	0.09 (0.02)	-0.16 (<0.001)	-0.04 (0.48)	0.21 (<0.001)	0.21 (<0.001)	0.22 (<0.001)	0.11 (<0.001)	-0.99 (0.09)	0.13 (0.01)
<b>PERCEIVED BARRIERS</b>	0.20 (<0.001)	-0.16 (<0.001)	-0.23 (<0.001)	0.46 (<0.001)	0.45 (<0.001)	0.47 (<0.001)	0.32 (<0.001)	0.35 (<0.001)	0.28 (<0.001)

\*Spearman's correlation, coefficient (p-value)

When the data were split by gender (table 9) most of the significant associations between the personal determining factors were with the fruit consumption at both baseline and follow up. Fruit maintenance had significant correlation with perceived barriers in both genders while self efficacy was correlated in the boys. Liking was a significant predictor without splitting the data by gender, and it remained borderline significant after splitting the data by gender. Negative correlations indicate more maintenance as the dislike of fruit increases. All the personal determining factors were significantly associated both at baseline and in follow up and still kept the significance when split by gender.

Personal factors had the same association on vegetable consumption and maintenance as observed for fruits. All the personal factors had a statistically significant correlation with consumption frequency while liking, self efficacy and perceived barriers had correlation with both maintenance and consumption frequency. The increase in liking, self efficacy and positive attitude towards perceived barriers increased consumption of vegetable in the children which as a result allowed them to maintain their positive consumption behavior within the two years study period (Table 10). On the other hand, the positive attitude towards having good feeling while consuming vegetable and knowledge of the recommendation did not seem to have an association on the maintenance of good consumption behavior but rather had correlation with consumption frequency both on baseline and follow-up.

Table 10 Correlation between personal factors and vegetable maintenance and vegetable consumption frequency at baseline and follow-up

<b>DETERMINANTS</b>	<b>VEGETABLE MAINTENANCE</b>			<b>VEGETABLE CONSUMPTION BASELINE</b>			<b>VEGETABLE CONSUMPTION FOLLOW-UP</b>		
	<b>All (N=672)</b>	<b>Boys (N=32)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>
<b>KNOWLEDGE OF RECOMMENDATION</b>	-0.04 (0.34)	-0.14 (0.02)	0.05 (0.32)	-0.23 (<0.001)	0.22 (<0.001)	-0.22 (<0.001)	-0.14 (<0.001)	-0.22 (<0.001)	0.07 (0.22)
<b>ATTITUDE</b>	0.06 (0.10)	0.00 (0.93)	0.13 (0.02)	0.20 (<0.001)	0.21 (<0.001)	0.22 (<0.001)	0.16 (<0.001)	-0.08 (0.14)	0.23 (<0.001)
<b>LIKING</b>	0.14 (<0.001)	0.07 (0.22)	0.22 (<0.001)	0.25 (<0.001)	0.23 (<0.001)	0.25 (<0.001)	0.20 (<0.001)	0.13 (0.02)	0.26 (<0.001)
<b>SELF EFFICACY</b>	0.13 (<0.001)	0.09 (0.14)	0.16 (<0.001)	0.25 (<0.001)	0.25 (<0.001)	0.26 (<0.001)	0.17 (<0.001)	0.17 (<0.001)	0.18 (<0.001)
<b>PERCEIVED BARRIERS</b>	0.18 (<0.001)	-0.14 (0.02)	0.22 (<0.001)	0.31 (<0.001)	0.26 (<0.001)	0.35 (<0.001)	0.29 (<0.001)	0.24 (<0.001)	0.33 (<0.001)

\*Spearman's correlation, coefficient (p-value)

The association between vegetable consumption and maintenance and personal factors slightly differed between boys and girls (Table 10). Knowledge of recommendation had a significant correlation with maintenance in boys, in which they happen to maintain their good consumption habit as their knowledge of recommendation increased. On the other hand, knowledge of recommendation did not have any significant association effect with maintenance in girls, but all the rest personal factors were correlated with maintenance as well as consumption.

#### **5.4 Perceived socio-environmental factors associated with consumption**

Children agreed with statements indicating perceived socio-environmental factors (Table A.2 Appendix). Children responded that they “agree somewhat” to the question asking whether or not that their mother consume fruit and vegetables daily (50% and 38%, respectively). Similarly, children gave a positive response if their peer’s had a daily fruit and vegetable consumption (44% and 42%, respectively). Enforcement on the other hand, was practiced sometimes by the parents, for fruit 39% (N= 259) and for vegetable 35% (N= 233) of the children.

Fruit consumption at baseline was significantly associated with nearly all the perceived socio-environmental factors in all children and in girls and boys separately (Table 11). The only variables that did not show significant association were demanding family rule, father’s encouragement and allowing family rule for girls while all the factors still remained significant in boys. Girls’ fruit maintenance was associated with fathers’ encouragement to eat fruit more than the boys. On the other hand, boys seem to copy their fathers’ consumption behavior more than girls do that of their mothers.

In the follow-up, fruit consumption did not show significant correlation with peers consumption, fathers encouragement or allowing family rule ( $p=0.09$ ,  $p= 0.07$  and  $p=0.59$ , respectively). When data were split by gender, none of the factors were significantly associated with girls’ consumption except mothers’ fruit consumption habit while in boys the significant correlations observed in all children remained.

Table 11 Correlation between perceived socio-environmental factors fruit maintenance and fruit consumption at baseline and follow-up

DETERMINANTS	FRUIT MAINTENANCE			FRUIT CONSUMPTION BASELINE			FRUIT CONSUMPTION FOLLOW-UP		
		Boys	Girls		Boys	Girls		Boys	Girls
	All (N=672)	(N=326)	(N=344)	All (N=677)	(N=326)	(N=344)	All (N=677)	(N=326)	(N=344)
<b>MODELING</b>	-0.07	-0.11	-0.03	0.29	0.28	0.30	0.14	0.18	0.11
<b>My Mother Eats Fruit Everyday</b>	(0.09)	(0.06)	(0.56)	(<0.001)	(0.00)	(<0.001)	(<0.001)	(<0.001)	(0.04)
<b>My Father Eats Fruit Everyday</b>	0.08	-0.18	-0.00	0.22	0.23	0.22	0.10	0.13	0.09
	(0.03)	(<0.001)	(0.92)	(<0.001)	(<0.001)	(<0.001)	(0.01)	(0.02)	(0.10)
<b>My Best Friend Eats Fruit Everyday</b>	0.10	0.15	-0.05	0.19	0.12	0.25	-0.07	0.03	0.09
	(0.01)	(0.01)	(0.36)	(<0.001)	(0.02)	(<0.001)	(0.09)	(0.58)	(0.12)
<b>ENCOURAGEMENT</b>	-0.05	-0.04	-0.06	0.17	0.24	0.10	0.09	0.11	0.07
<b>My Mother Encourages Me To Eat Fruit Everyday</b>	(0.19)	(0.50)	(0.24)	(<0.001)	(<0.001)	(0.05)	(0.02)	(0.05)	(0.22)
<b>My Father Encourages Me To Eat fruit Everyday</b>	-0.08	-0.05	-0.11	0.12	0.15	0.08	0.07	0.10	0.05
	(0.04)	(0.36)	(0.04)	(<0.001)	(<0.001)	(0.11)	(0.07)	(0.09)	(0.34)
<b>DEMANDING FAMILY RULE</b>	0.01	0.03	-0.01	0.10	0.13	0.08	0.09	0.14	0.05
	(0.81)	(0.59)	(0.83)	(<0.001)	(0.01)	(0.12)	(0.02)	(0.01)	(0.32)
<b>ALLOWING FAMILY RULE</b>	-0.02	-0.08	0.02	0.09	0.12	0.07	0.02	-0.00	0.05
	(0.61)	(0.19)	(0.63)	(0.01)	(0.03)	(0.16)	(0.59)	(0.90)	(0.33)

\*Spearman's correlation, coefficient (p-value)

Fruit consumption maintenance was significantly correlated with father's consumption, peers consumption behavior and father's encouragement (Table 11). Maintenance in boys was associated with their fathers' consumption frequency and their peers, as well. The positive correlation coefficient for these two variables indicates that as fathers consume fruits every day, the boys' consumption maintenance remains. On the other hand girls fruit consumption maintenance was inversely associated with their fathers encouragement ( $p=0.04$ ). None of the factors showed a constant association with all the three variables (consumption at baseline and follow-up, maintenance) except fathers' daily fruit consumption. The other factors were associated with consumption at baseline and follow-up and not with maintenance or vice versa. Specifically at baseline, all the perceived socio environmental factors were significantly associated with fruit consumption.

Vegetable consumption maintenance did not show correlation with any of the perceived socio-environmental factors while all the factors were significantly associated with vegetable consumption frequency at both baseline and follow-up periods (Table 12). Modeling, encouragement, demanding family rule and allowing family rule all had a positive correlation, indicating an increase in daily vegetable consumption as children show positive approach towards the factors.



**Table 12 Correlation between Perceived Socio-Environmental Factors, Vegetable maintenance and consumption at baseline and follow-up**

<b>DETERMINANTS</b>	<b>VEGETABLE MAINTENANCE</b>			<b>VEGETABLE CONSUMPTION BASELINE</b>			<b>VEGETABLE CONSUMPTION FOLLOW-UP</b>		
	<b>All (N=672)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>
<b>MODELING</b>									
<b>Mothers consumption</b>	-0.04 (0.35)	-0.03 (0.61)	-0.51 (0.39)	0.19 (<0.001)	0.14 (0.01)	0.24 (<0.001)	0.10 (0.01)	0.08 (0.18)	0.11 (0.04)
<b>Fathers consumption</b>	-0.02 (0.58)	-0.10 (0.08)	0.04 (0.45)	0.14 (<0.001)	0.02 (0.63)	0.26 (<0.001)	0.10 (0.01)	-0.01 (0.76)	0.21 (<0.001)
<b>Peers consumption</b>	-0.04 (0.34)	-0.05 (0.35)	-0.01 (0.76)	0.17 (<0.001)	0.08 (0.16)	0.26 (<0.001)	0.04 (0.29)	0.00 (0.99)	0.08 (0.14)
<b>ENCOURAGEMENT</b>									
<b>Mothers' Encouragement</b>	0.01 (0.72)	0.06 (0.30)	-0.03 (0.60)	0.22 (<0.001)	0.19 (<0.001)	0.25 (<0.001)	0.10 (0.01)	0.18 (<0.001)	0.03 (0.50)
<b>Fathers' Encouragement</b>	0.05 (0.24)	0.03 (0.61)	0.07 (0.21)	0.17 (<0.001)	0.11 (0.03)	0.25 (0.00)	0.11 (<0.001)	0.11 (0.06)	0.12 (0.03)
<b>DEMAND FAMILY RULE</b>	0.01 (0.70)	0.08 (0.16)	-0.05 (0.38)	0.17 (<0.001)	0.13 (0.01)	0.20 (<0.001)	0.08 (0.03)	0.16 (<0.001)	0.02 (0.67)
<b>ALLOW FAMILY RULE</b>	0.02 (0.49)	0.00 (0.98)	0.05 (0.34)	0.09 (0.01)	0.09 (0.11)	0.11 (0.03)	0.08 (0.04)	0.07 (0.23)	0.10 (0.08)

\*Spearman's correlation, coefficient (p-value)

When data were split by gender, it revealed more on the underlying gender differences just like the personal determining factors also appeared to be. Nearly none of the determining variables showed any correlation on follow-up consumption in boys, while only encouragement and demanding family rule showed association with baseline vegetable consumption frequency. On the contrary, demanding family rule did not have a correlation in girls on the follow up consumption while modeling and encouragement were significantly associated except peers' consumption before split by gender. At the baseline, girls' consumption frequency of vegetables shows a significant association with all the perceived socio-environmental factors. Girls changed their consumption behaviors more than boys due to the considered factors that can be seen by the discrepancy in significance between baseline and follow-up consumption association. For the boys the association between the factors and consumption on both baseline and follow-up remained mostly constant. Maintenance on the other hand did not show any correlation with the determining factors for both genders.

## **5.5 Perceived physical-environmental factors associated with consumption**

For perceived physical- environmental factors regarding household availability of fruit and vegetables, more than half of the children responded either “yes always” or “yes, most days” (Table A3 Appendix). The school children did not face problems in getting the type of fruit and vegetable they demanded at the house-hold level. Majority of the responses given for availability at school were “sometimes” or “never” alternatives (35% sometimes for fruit and 24% never for vegetables). 82% of the children responded either sometimes, seldom or never for fruit availability at school and 61% for vegetable availability at school.

Availability of fruit at household level is the main perceived physical-environmental determining factor for the children consumption frequency and maintenance of good consumption behavior (Table 13). It showed significant association with fruit maintenance, and fruit consumption frequency for both baseline and follow-up period. The positive correlation coefficient indicates the tendency for the children to increase their frequency of consumption and to maintain it as availability in the house hold level increases. On the contrary, availability at school did not show any correlation with the children's consumption behavior.

Table 13 Correlation between perceived physical-environmental factors and fruit maintenance and fruit consumption frequency on baseline and follow-up

<b>DETERMINANTS</b>	<b>FRUIT MAINTENANCE</b>			<b>FRUIT CONSUMPTION BASELINE</b>			<b>FRUIT CONSUMPTION FOLLOW-UP</b>		
	<b>All (N=672)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>	<b>All (N=677)</b>	<b>Boys (N=326)</b>	<b>Girls (N=344)</b>
<b>AVAILABILITY AT HOME</b>	0.11 (<0.001)	-0.18 (<0.001)	-0.05 (0.34)	0.25 (<0.001)	0.27 (<0.001)	0.25 (<0.001)	0.16 (<0.001)	0.03 (0.62)	0.30 (<0.001)
<b>AVAILABILITY AT SCHOOL</b>	0.01 (0.77)	0.05 (0.38)	-0.01 (0.83)	0.03 (0.35)	0.06 (0.24)	-0.00 (0.97)	0.01 (0.66)	0.01 (0.76)	0.00 (0.91)

\*Spearman's correlation, coefficient (p-value)

When analysis was conducted by gender, maintenance in girls was not associated with fruit availability at household level, while in boys there was significant association between fruit availability at household level and maintenance of fruit consumption (Table 13). On the other hand, in boys maintenance behavior was not associated with availability.

Vegetable consumption of the children, as it has been observed for the other determining variables also did not show any correlation with perceived physical-environmental factors (Table 14). Unlike personal and socio-environmental factors, when data were split by gender, availability at home was associated with consumption frequency of vegetables in boys in both follow up and baseline while only girls showed association at baseline. Similarly, maintenance was not association with both availability at school and household when split by gender.

Table 14 Correlation between perceived physical-environmental factors and vegetable maintenance and vegetable consumption frequency on baseline and follow-up

DETERMINANTS	VEGETABLE MAINTENANCE			VEGETABLE CONSUMPTION BASELINE			VEGETABLE CONSUMPTION FOLLOW-UP		
	All (N=672)	Boys (N=326)	Girls (N=344)	All (N=677)	Boys (N=326)	Girls (N=344)	All (N=677)	Boys (N=326)	Girls (N=344)
<b>AVAILABILITY AT HOME</b>	-0.02 (0.60)	0.05 (0.40)	0.02 (0.61)	-0.01 (0.71)	0.25 (<0.001)	0.32 (<0.001)	-0.04 (0.27)	0.17 (<0.001)	0.18 (<0.001)
<b>AVAILABILITY AT SCHOOL</b>	-0.04 (0.34)	-0.07 (0.29)	0.03 (0.56)	-0.00 (0.84)	0.11 (0.06)	0.06 (0.28)	-0.08 (0.05)	0.00 (0.98)	0.04 (0.44)

\*Spearman's correlation, coefficient (p-value)

## 5.6 Determinants of maintenance

### 5.6.1 Personal factors and maintenance

Table 15 shows the result of binary logistic regression conducted with personal determinants and fruit consumption maintenance by controlling for gender and school type (control and intervention). The variables that showed significant association with fruit consumption maintenance were liking, self efficacy, and perceived barriers.

Table 15 Independent binary logistic regression models between fruit consumption maintenance and personal factors controlling for gender and school type (Intervention or control)

PERSONAL DETERMINANT	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
KNOWLEDGE	1.069	0.959	1.193	0.22
ATTITUDE	0.902	0.736	1.105	0.31
LIKING	0.662	0.507	0.866	<0.001
SELF EFFICACY	0.788	0.654	0.949	0.01
PERCEIVED BARRIERS	0.610	0.497	0.750	<0.001

In order to control for all the other personal determining variables in addition to confounders gender and school type, a new model that included all the personal determining factors was created. In the new model (table 16), the only variable that remained significant in showing association with fruit consumption maintenance was perceived barriers. The factors liking and self efficacy did not show significant association with maintenance in the new model.

Table 16 Binary logistic regression model between fruit maintenance and personal factors controlling for gender and school type (Intervention or control)

PERSONAL DETERMINANTS	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
KNOWLEDGE	1.024	0.911	1.152	0.68
ATTITUDE	1.081	0.864	1.351	0.49
LIKING	0.817	0.603	1.107	0.19
SELF EFFICACY	0.932	0.756	1.149	0.51
PERCEIVED BARRIERS	0.670	0.527	0.852	<0.001

Table 17 illustrates independent binary logistic regression models of vegetable consumption maintenance with each category of personal factors controlling for gender and school type. Liking had a significant association with maintenance of vegetable consumption similar to fruit maintenance. In addition, self efficacy and perceived barriers showed a significant association as well as attitude which was of borderline significance ( $p=0.07$ ).

Table 17 Independent binary logistic regression models between vegetable maintenance and personal factors controlling for gender and school type (Intervention or control)

PERSONAL DETERMINANT	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
KNOWLEDGE	0.950	0.851	1.062	0.37
ATTITUDE	1.164	0.982	1.379	0.07
LIKING	1.356	1.149	1.600	<0.001
SELF EFFICACY	1.338	1.132	1.580	0.01
PERCEIVED BARRIERS	1.556	1.272	1.903	<0.001

In the model, that consisted of all the personal factors and controlled for gender and school type (table 18), the only variable that showed significant association with vegetable consumption maintenance was perceived barriers. The significant association between perceived barriers and maintenance indicates that the children's consumption was affected by what they perceived could hinder them from consuming vegetables more than their personal interest or liking in the particular vegetables that could be available either in household or school level.

Table 18 Binary logistic regression model between vegetable maintenance and personal factors controlling for gender and school type (Intervention or control)

PERSONAL DETERMINANTS	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
KNOWLEDGE	1.017	0.905	1.143	0.78
ATTITUDE	0.942	0.768	1.156	0.56
LIKING	1.135	0.915	1.407	0.24
SELF EFFICACY	1.114	0.907	1.368	0.30
PERCEIVED BARRIERS	1.410	1.080	1.841	0.01

### 5.6.2 Perceived socio-environmental factors and maintenance

There were no significant associations between fruit consumption maintenance and perceived socio-environmental factors in, independent binary logistic regression models (Table 19). As encouragement and modeling were correlated with maintenance in the Spearman's correlation analysis, none of the factors under the perceived socio-environmental subcategory were significant except best friend, which was borderline significant. A model that included all the factors simultaneously controlling for gender and school type was created (table 20). The only factor with borderline significance was demanding family rule.



Table 19 Independent binary logistic regression models between fruit maintenance and perceived socio-environmental factors controlling for gender and school type (Intervention or control)

<b>DETERMINANT</b>	<b>ODDS RATIO</b>	<b>95% CONFIDENCE INTERVAL</b>		<b>P VALUE</b>
		<b>LOWER</b>	<b>UPPER</b>	
<b>MODELING</b>				
<b>Mother consumption</b>	0.940	0.766	1.153	0.55
<b>Father consumption</b>	0.907	0.762	1.079	0.26
<b>Best friend consumption</b>	0.811	0.655	1.006	0.05
<b>ENCOURAGEMENT</b>				
<b>Mother encouragement</b>	0.993	0.834	1.183	0.93
<b>Father encouragement</b>	0.881	0.739	1.049	0.15
<b>DEMANDING FAMILY RULE</b>	1.027	0.882	1.196	0.73
<b>ALLOWING FAMILY RULE</b>	0.917	0.740	1.136	0.43

Table 20 Binary logistic regression model between fruit maintenance and perceived socio-environmental factors controlling for gender and school type (Intervention or control)

<b>DETERMINANT</b>	<b>ODDS RATIO</b>	<b>95% CONFIDENCE INTERVAL</b>		<b>P VALUE</b>
		<b>LOWER</b>	<b>UPPER</b>	
<b>MODELING</b>				
<b>Mother consumption</b>	0.901	0.717	1.132	0.37
<b>Father consumption</b>	0.931	0.765	1.134	0.47
<b>Best friend consumption</b>	0.837	0.670	1.046	0.11
<b>ENCOURAGEMENT</b>				
<b>Mother encouragement</b>	0.933	0.745	1.168	0.54
<b>Father encouragement</b>	0.930	0.754	1.148	0.50
<b>DEMAND FAMILY RULE</b>	1.227	0.998	1.508	0.05
<b>ALLOW FAMILY RULE</b>	0.934	0.738	1.183	0.57

In similar manner, the same method was used to check for association between maintenance of vegetable consumption and perceived socio-environmental factors. Tables 21 and 22 show that, none of the determining factors appeared to be significant with vegetable maintenance of the children controlled for gender and vegetable.

Table 21 Independent binary logistic regression models between vegetable maintenance and perceived socio-environmental factors controlling for gender and school type (Intervention or control)

<b>DETERMINANT</b>	<b>ODDS RATIO</b>	<b>95% CONFIDENCE INTERVAL</b>		<b>P VALUE</b>
		<b>LOWER</b>	<b>UPPER</b>	
<b>MODELING</b>	0.923	0.768	1.110	0.39
<b>Mother consumption</b>				
<b>Father consumption</b>	0.971	0.836	1.128	0.70
<b>Best friend consumption</b>	0.919	0.751	1.126	0.41
<b>ENCOURAGEMENT</b>				
<b>Mother encouragement</b>	1.016	0.885	1.165	0.82
<b>Father encouragement</b>	1.075	0.943	1.227	0.27
<b>DEMAND FAMILY RULE</b>				
<b>ALLOW FAMILY RULE</b>	1.020	0.871	1.195	0.80
	1.065	0.882	1.287	0.51

Table 22 Binary logistic regression model between vegetable maintenance and perceived socio-environmental factors controlling for gender and school type (Intervention or control)

DETERMINANT	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
<b>MODELING</b>	0.962	0.741	1.248	0.76
<b>Mother consumption</b>				
<b>Father consumption</b>	0.966	0.775	1.205	0.76
<b>Best friend consumption</b>	0.926	0.743	1.154	0.49
<b>ENCOURAGEMENT</b>	0.883	0.690	1.131	0.32
<b>Mother encouragement</b>				
<b>Father encouragement</b>	1.185	0.948	1.481	0.13
<b>DEMAND FAMILY RULE</b>	1.021	0.820	1.272	0.85
<b>ALLOW FAMILY RULE</b>	1.076	0.870	1.329	0.50

### 5.6.3 Perceived physical-environmental factors and maintenance

Binary logistic regression conducted by controlling for gender and school type shows that household availability is significant factor for fruit maintenance. Availability at school, on the other hand, seems to remain insignificant even when controlled for the confounders gender and school type (Table 23).

Table 23 Independent binary logistic regression models between fruit maintenance and perceived physical-environmental factors controlling for gender and school type (Intervention or control)

DETERMINANT	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
<b>AVAILABILITY AT HOME</b>	0.744	0.607	0.911	<0.001
<b>AVAILABILITY AT SCHOOL</b>	1.062	0.923	1.223	0.39

Availability of fruit in the household remained a significant determining variable indicating that children's consumption behavior maintenance was affected by the availability of fruits in the house during the two years study period (Table 24).

Table 24 Binary logistic regression model between fruit maintenance and perceived physical environmental factors controlling for gender and school type (Intervention or control)

<b>DETERMINANT</b>	<b>ODDS RATIO</b>	<b>95% CONFIDENCE INTERVAL</b>		<b>P VALUE</b>
		<b>LOWER</b>	<b>UPPER</b>	
<b>AVAILABILITY AT HOME</b>	0.745	0.601	0.923	<0.001
<b>AVAILABILITY AT SCHOOL</b>	1.094	0.947	1.264	0.22

However, vegetable consumption maintenance was not associated with any perceived physical-environmental factors. Tables 25 and 26 illustrate independent models and inclusive model of both the physical-environmental variables, respectively. The binary logistic regression analysis confirmed there was no association between maintenance of vegetable consumption and availability in both household and school levels.

Table 25 Independent binary logistic regression models between vegetable maintenance and perceived physical-environmental factors controlling for gender and school type (Intervention or control)

<b>DETERMINANT</b>	<b>ODDS RATIO</b>	<b>95% CONFIDENCE INTERVAL</b>		<b>P VALUE</b>
		<b>LOWER</b>	<b>UPPER</b>	
<b>AVAILABILITY AT HOME</b>	1.070	0.882	1.297	0.49
<b>AVAILABILITY AT SCHOOL</b>	0.983	0.867	1.114	0.78

Table 26 Binary logistic regression model between vegetable maintenance and perceived physical-environmental factors controlling for gender and school type (Intervention or control)

DETERMINANT	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
AVAILABILITY AT HOME	1.112	0.904	1.367	0.31
AVAILABILITY AT SCHOOL	1.006	0.886	1.143	0.92

### 5.7 Full model of factors and maintenance

A new model that consisted of personal, socio-environmental, and physical-environmental variables that showed significant association with maintenance in the earlier analysis controlling for confounding factors, gender and school type was created (Table 27). The children's fruit consumption maintenance was associated with perceived barriers from the personal factors subcategory. Apart from that, no other variable significantly associated with maintenance, with the exception of borderline significance for availability at home (OR=0.8, p=0.07).

Table 27 Binary logistic regression model between fruit maintenance and all consumption determining factors

DETERMINANT	ODDS RATIO	95% CONFIDENCE INTERVAL		P VALUE
		LOWER	UPPER	
LIKING	0.879	0.640	1.207	0.42
PERCEIVED BARRIERS	0.641	0.494	0.833	<0.001
SELF EFFICACY	0.954	0.755	1.206	0.69
MODELING	0.995	0.832	1.191	0.95
Father consumption	0.909	0.725	1.140	0.40
Best friend consumption				
ENCOURAGEMENT	0.964	0.829	1.121	0.63
Fathers encouragement				
AVAILABILITY AT HOME	0.810	0.640	1.025	0.07

Concerning vegetable consumption maintenance, it was not necessary to construct a new model for the fact that the only variables that were found to be significantly associated with vegetable consumption of the children were the personal factors. The only factor that remained associated with children's vegetable consumption maintenance was perceived barriers from the personal factors subcategory.

## **6. DISCUSSION**

The Pro Children Project was set up to develop effective strategies to promote adequate consumption levels of fruit and vegetables among schoolchildren. Despite the availability of different techniques for assessing habitual dietary intakes, a simpler questionnaire was developed to describe consumption levels of fruit and vegetables of children across 9 participating European countries and to measure the effect of the intervention (Klepp et al., 2005). For this study the same questionnaire was used and based on earlier studies by Pro Children in Denmark, Norway, Iceland, Belgium, Portugal and Spain, the validity and reproducibility of the questionnaire was found to be satisfactory for the part of the questionnaire that was used in this study (Haraldsdóttir et al., 2005). Despite the approval of the validity of the questionnaire used for this study, the representativeness of the result to the general Finnish community is quite questionable. The school children that participated in this study were from a homogenous society, Swedish speaking Finnish children who have considerably similar socio economic status. In addition to earlier comparative studies between the Swedish speaking minorities and the Finnish speaking people in Finland have shown that despite the similarities of the living environment, economically and political situations, the Swedish speaking people in Finland showed a better health status and longevity than the Finnish speaking people (Hyyppä & Maki, 2001) . For this reason and due to small number of study subjects involved in this study it is difficult to generalize the findings to the Finnish children.

The variables included in this study were collected using Pro Children questionnaire and the factors were assumed to affect maintenance or consumption of fruit and vegetables during the two year study period. Out of several variables in the questionnaire, limited number of variables were selected and categorized in to three different groups; personal, socio-environmental, and

physical-environmental. These variables were assumed to have the highest effect in the consumption of fruit and vegetable or on their maintenance of good consumption habit for the schoolchildren based on earlier studies. Furthermore, few of the variables that were picked out of the raw data had to be recoded to new variables for ease of analysis. Frequency of fruit and vegetables that had initially eight alternatives were recoded to three, which reduces the variation of the observed alternatives and as a result might have had an impact on the outcome of the analysis, and so should be taken in to consideration.

Maintenance variable was created based on the recoding of the food frequency variable to daily, often and seldom category. This variable was further used to create the maintenance variable that indicates positive maintenance if there was progress or consumption remained in above seldom category. One crucial point to be remembered is that this study had a short follow-up period and both, those who maintained and did not maintain could still be in the process of behavioral transition, which the questionnaire might not have been able to measure. Nevertheless the children's change in consumption frequency was still observable as they got older. In order to make the results of the statistical analysis between consumption maintenance and considered factors more reliable, Spearman's correlation analysis was first conducted to check for any associations. Based on that result binary logistic regression was further conducted to filter out the significant associations already observed.

According to earlier studies, availability and accessibility and taste preferences for fruit and vegetables are the most important determinants in children (De Bourdeaudhuij et al., 2008). In this study, it was observed that most of the variables were not strongly influential on vegetable consumption or maintenance of the children, but rather on fruits consumption and maintenance. Since maintenance variable, which was the main interest of this study, was a derivative from the consumption frequency variable; it will be wise to critically observe the changes in it. In tables 6 and 7 on both fruit and vegetable consumption, the children showed more changes in the "often" and "seldom" category of the consumption frequency than "daily". The decrease in the children from "seldom" category on the baseline of the fruit consumption happen to be concentrated on the increase in the "daily" and "often" fruit consumption category on follow-up. Similarly for vegetables, the decrease in "daily" and "seldom" category on baseline also seems to be

concentrated on the “often” consumption” behavior on follow-up. In general, this implies that the children had more tendencies to increase their consumption behavior in this short period of study. Even though the effect of the ongoing intervention program was not found to be a statistically significant factor for the consumption and maintenance behavior of fruit and vegetables, it still should be under consideration that it might be influencing a certain group of children to have a positive attitude towards consumption in the long run. Similarly, gender was not significant, but it is potential factor on the consumption frequency and maintenance based on earlier studies on the significance of gender on consumption (Blanchette & Brug, 2005).

Looking at the consumption determining factor categories individually, personal factors like attitude, liking, and self efficacy were associated with consumption. On the other hand when it comes to knowledge of recommendation of fruit and vegetable use, majority of the children responded mostly by the alternative indicating the minimum amount of fruit and vegetable which is below the recommended level. Similarly majority of the children agreed with the statements indicating socio-environmental factors. Children who choose the alternative “neither agree nor disagree” for parents related questions, it could be because there is a possibility that the children might be living with only one parent at that time and could have made the correlation of maintenance or consumption frequency less reliable depending on the number of children who responded to that alternative. In the socio-physical category emphasizing on availability of vegetable at school, it was noticeable that it was not associated with consumption while all Finnish schools serve a school meal which should include vegetable. The children’s responses are an indication of their understanding of the term vegetables, which could be limited to raw vegetables and they might not have considered cooked or prepared vegetables. For that reason, the reliability of that particular variable might be questionable.

According to earlier studies, perceived barrier was one of the factors that were inversely associated with high consumption of fruit and vegetable (Wolf et al, 2008; Bruening et al, 2010). In the final model created to test for association between fruit maintenance and the variables that showed correlation with Spearman’s rank correlation analysis and independent binary logistic regression, it was noticed that perceived barrier was the only variable that remained significantly associated with maintenance. Regardless of the availability of fruit and vegetables at school or



household level, or children's knowledge of recommendation, children's perception of barriers is an important factor that hinders them from continuing on the higher consumption level they had as they grew older, at least significantly for fruit.

## **7. CONCLUSION**

Only few factors were associated with maintenance of fruit and vegetable consumption. The variable that can be concluded to have a significant association with the maintenance of both fruit and vegetable consumption is perceived barriers from the personal factor category. Availability at home was also borderline significant for fruit consumption maintenance. In addition liking of fruits consumption should also be underlined. Concerning the consumption frequency on both baseline and follow-up periods for fruit and vegetable, literally all the variables on all the three categories personal, socio-physical and physical–environmental factors with an exception of availability at school showed significant association. This study might have certain limitations during the coding of the variables, but the results could further be investigated by considering additional factors that could affect either consumption frequency or maintenance. One of the variables that could be of a crucial factor to be looked in to would be perceived barriers, since it could have multiple causes based on the children's living condition. In future studies, it should be attempted to investigate further on all the possible barriers perceived by the children to mitigate the problem of low consumption. One approach could be allowing the children to list down conditions that they presume are barriers for them and deduce additional factors based on it.

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## 9. APPENDIX

Table A1 Personal (fruit and vegetables knowledge of recommendations, attitudes, liking, self-efficacy, preferences, and perceived barriers) frequency distribution on follow-up

	<b>FULLY AGREE(1)</b>	<b>AGREE SOME WHAT(2)</b>	<b>NEITHER AGREE NOR DISAGREE(3)</b>	<b>DISAGREE SOMEWHAT(4)</b>	<b>FULLY DISAGREE(5)</b>
<b>If I decide to eat fruit every day I can do it</b>	56.9%	27.8%	10.5%	3.3%	1.5%
<b>Fruit tastes good</b>	71.9%	22%	4.4%	1.1%	0.6%
<b>I want to eat fruit ever day</b>	35%	34%	23%	4%	2%
<b>It is difficult for me to eat fruit everyday</b>	3%	8%	14%	27%	47%
<b>If I decide to eat vegetables Every day I can do it</b>	46%	30%	16%	6%	2%
<b>Vegetables tastes good</b>	43%	34%	15%	6%	3%
<b>I want to eat vegetables every day</b>	22%	32%	30%	9%	5%
<b>It is difficult for me to eat vegetable everyday</b>	5%	8%	21%	25%	40%



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**How Much Fruit Do You Think You Should Eat?**

<b>1-3</b>	<b>4-6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>PIECES/WEEK</b>	<b>PIECES/WEEK</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>
8%	18%	30%	22%	12%	4%	6%

**How Much Vegetable Do You Think You Should Eat?**

<b>1-3</b>	<b>4-6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>PIECES/WEEK</b>	<b>PIECES/WEEK</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>	<b>PIECES/DAY</b>
17%	24%	27%	15%	10%	4%	4%

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Table A2 Perceived socio-environmental factors (demand family rule, modeling) distribution on follow-up

	<b>FULLY AGREE</b>	<b>AGREE SOME WHAT</b>	<b>NEITHER AGREE NOR DISAGREE</b>	<b>DISAGREE SOMEWHAT</b>	<b>FULLY DISAGREE</b>
<b>My mother eats fruit everyday</b>	26%	42%	22%	9%	2%
<b>My mother eats vegetables everyday</b>	37%	38%	18%	6%	1%
<b>My father eats fruit everyday</b>	15%	36%	26%	15%	6%
<b>My father eats vegetable everyday</b>	28%	34%	23%	12%	3%
<b>My best friend eats fruit everyday</b>	14%	44%	34%	7%	2%
<b>My best friend eats vegetable everyday</b>	14%	42%	36%	7%	2%
<b>My mother encourages me to Eat fruit everyday</b>	19%	32%	22%	13%	14%
<b>My mother encourages me to Eat vegetable everyday</b>	20%	31%	23%	14%	12%
<b>My father encourages me to eat fruit everyday</b>	9%	25%	25%	19%	20%
<b>My father encourages me to eat vegetable everyday</b>	12%	24%	28%	17%	19%
	<b>YES, ALWAY</b>	<b>YES, MOST DAYS</b>	<b>SOMETIMES</b>	<b>SELDOM</b>	<b>NEVER</b>
<b>Do your parents demand that you eat fruit</b>	9%	23%	39%	19%	10%
<b>Do your parents demand that you eat vegetable</b>	13%	28%	35%	17%	7%

Table A3 Perceived physical-environmental factors (availability) distribution on follow-up

	<b>YES ALWAYS</b>	<b>YES, MOST DAYS</b>	<b>SOMETIMES</b>	<b>SELDOM</b>	<b>NEVER</b>
<b>If you tell at home what kind of fruit you like would it be bought</b>	30%	51%	19%	2%	1%
<b>If you tell at home what kind of vegetable you like would it be bought</b>	29%	42%	23%	5%	1%
<b>Are there usually different fruits available at home</b>	29%	46%	20%	4%	1%
<b>Are there usually different vegetables available at home</b>	33%	43%	20%	3%	2%
<b>Can you get fruit at school</b>	9%	9%	35%	23%	25%
<b>Can you get vegetables at school</b>	22%	18%	20%	16%	24%