



UNIVERSITY of MILAN

FACULTY OF AGRICULTURE AND FOOD SCIENCES

Master's Degree in FOOD AND HUMAN NUTRITION

**CORRELATION BETWEEN PARENTAL PRACTICES  
AND YOUNG CHILDREN'S CONSUMPTION OF  
SUGARY EVERYDAY FOODS, SUGARY TREATS  
AND SWEETENED BEVERAGES  
AND WEIGHT STATUS**

Supervisor: Monica FERRARONI

Co-supervisor: Carola RAY

Rikka PAJULAHTI

Degree thesis by:

Alice POSENATO

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## 1. INTRODUCTION

Obesity and overweight are still today important and worldwide problems both for people's health and for public health expenditure.

Obesity is defined as an “abnormal or excessive fat accumulation that presents a health risk” by the World Health Organization (WHO). [1]

The prevalence of overweight and obesity in children and adolescents is increasing in proportion to the worldwide expansion of the obesogenic environment and behaviors. [2, 3]

Despite the growing recognition of the problem by all states, obesity continues to increase in the last few decades, and this has led the WHO to declare it a global epidemic and worldwide public health crisis. [4]

It has been discussed that the main reasons for the increase in the prevalence of overweight children and young people in Finland, which has tripled in the past 3 decades, are the change in eating habits in favor of more sugary foods, larger portions of meals along with less daily physical activity. [5]

"World Obesity Day" (WOD) [6] is held annually on the 4<sup>th</sup> of March, organized by the World Obesity Federation (WOF) in collaboration with its global members.

The main aims are to raise awareness of the problem, to work together to reduce the prevalence of obesity and overweight and associated chronic diseases, also to improve policies, and share experiences on obesity.

Figure 1 illustrates the prevalence and the consequences of obesity reported on the WOD website. It is clear that the situation is dramatic considering the data to the right of the figure: obesity in children will increase by 60% in 2030 with an estimated total number of obese children of about 250 million worldwide.



Figure 1: Image taken from: <https://www.worldobesityday.org> [6]

It is necessary to increase policies and interventions in favour of reducing this foreseeable and preventable health crisis, as Dr. Tedros, the WHO Director General, expressed in the message published on the occasion of World Obesity Day of 2021. [7]

“Everybody needs to act” was the motto of the nations’ obesity day of 2022. [8]



All countries should work together to create a better food environment in which everyone could access and afford a healthy diet.

Another key point that needs to be worked on concerns limiting certain categories of products for children such as foods and drinks rich in fat, sugar, and salt, increasing the consumption of fruit and vegetables, as well as whole grains and legumes, engaging in

regular physical activity (at least 60 minutes a day for children [9]), but also adding higher taxes to sugary drinks in favour of healthier products. [3]

Surely, along with greater nutrition education and food policies, the physical activity of individuals should also be increased through policies directly from the kindergarten to the adult population.

WHO estimates that by 2025, around 167 million adults and children will become less healthy due to being overweight or obese.

For this reason, the World Health Assembly discussed at the 75<sup>th</sup> World Health Assembly (WHA75) [10], held in Geneva (Switzerland) on 22-28 May 2022, among the many topics discussed also to develop an acceleration action plan to support member states in implementing the recommendations for the prevention and management of obesity throughout life. [11]

## 1.1 Obesity: a complex and multifactorial disease

Based on the overweight condition, there seems to be an increase in the average caloric intake and the conduct of a more sedentary life thanks to the many comforts we have today. [12]

The consequences are clear: being overweight can lead to obesity, a chronic, low-inflammatory disease that carries an increased risk of several conditions such as cardiovascular disease, high blood pressure, cancer, and type 2 diabetes. [13]

The condition of obesity is associated with genetic, environmental, psychological, social, and economic factors illustrated in Figure 2. For this reason, obesity can be considered a multifactorial pathology which means that it depends on environmental and genetic factors. [14]





Figure 2: Image taken from: <https://www.worldobesityday.org> [15]

So, when it comes to obesity, we must consider several aspects:

- certainly, the environmental factor of individuals exposed to an obesogenic environment has an important impact,
- genetic factors play a fundamental role because they predispose to obesity
- social aspects that include family habits, work and stress associated, micro and macro social environment, such as how the child grows or the adult
- incorrect eating habits with an increase in caloric intake,
- reduced energy expenditure caused by a reduction in physical activity
- mood and personality disorders that often cause eating disorders

Most of these aspects are modifiable risk factors, aside from genetic factors.

In general, modifiable risk factors are defined as factors that the environment and lifestyle can directly affect, both positively and negatively.

Among the factors that influence the risk of overweight and obesity in children, certainly, a crucial role is represented by the influence of the family in the shaping of the child's consumption.

A systematic review [16] examined the evidence of family and community factors in shaping food consumption and eating behaviour in preschool-aged children in low and middle-income countries.

The factors associated with children's healthy food consumption found in fourteen studies published in the last 30 years are:

- household food availability,
- nutritional knowledge of the parents
- socioeconomic status of the family.

The main factor associated with children's unhealthy food consumption is:

- nutritional knowledge of the family.

The results obtained therefore showed the importance of increasing family nutritional knowledge to facilitate healthy eating behaviours in children and consequently decrease the prevalence of obesity in children.

Per the WHO Technical Report n.916 on chronic disease [17] the development of obesity is influenced by individual and social factors: increased portion, shifted dietary patterns characterized by energy-rich and nutritionally unbalanced foods, technological development, as well a sedentary lifestyle, and general laziness.

The only strategy for losing and maintaining weight cannot be based solely on diet but must include other strategies aimed at changing sedentary habits and lifestyles, this consequently to the obesogenic environment in which we live today. [18]

## 1.2 Definition of BMI, obesity, and overweight in children

Lambert Adolphe Jacques Quetelet (1768-1857), a Belgian mathematician, astronomer, and statistician [19], introduced in the early 19th century the “Quetelet Index”, recalled in Body Mass Index in 1972 by the American biologist and physiologist Ancel Benjamin Keys (1904–2004). [20]

The BMI (Body Mass Index) is a useful indicator of people’s health and is simply calculated as the person’s weight in kilograms divided by the square of height in meters.

$$\text{BMI} = \frac{\text{weight (kg)}}{\text{height}^2 \text{ (m}^2\text{)}}$$

The BMI is an important tool that can be used as a screening for secondary prevention, furthermore, another use is to identify the level of fatness of the individual very quickly, considering however that there are more accurate methodologies.

In adults the weight status is divided like the class below:

- Below 18.5: underweight
- 18,5 - 24,9 normal weight
- 25,0 - 29,9 overweight
- 30,0 - 34,9 obesity class I
- 35,0 - 39,9 obesity class II
- Above 40 obesity class III

We can define an overweight adult if the BMI is at least 25 kg/m<sup>2</sup> for both sexes and ages and those with 30 or more are obese.

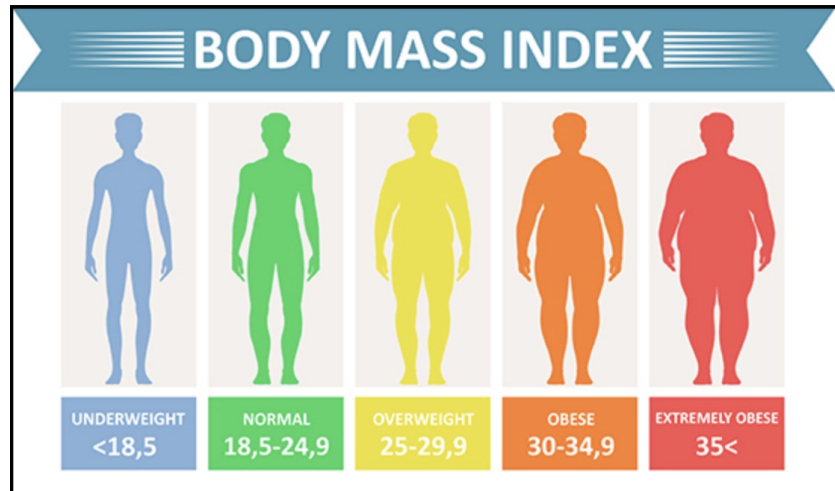


Figure 3: Standard weight status categories. Image taken from the site [https://www.cdc.gov/healthyweight/assessing/bmi/adult\\_bmi/index.html](https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html) [21]

The BMI is only an index that considers the weight and height of the individual and not also the distribution of body composition which is crucial to consider if the doctor wants to diagnose obesity.

So, it is important to make a diagnosis of overweight and obesity not only to consider the BMI but to use other more predictive and accurate tools.

Nowadays there is no single accepted way of diagnosing overweight and obesity in children from all countries, unlike adults, whose BMI has fixed cut-offs for diagnosis. [22]

In Finland, for example, the ISO-BMI is used, which is calculated for children aged 2 to 18 years old.

In particular, the children's body mass index is calculated in the same way as the adult body mass index ( $BMI = \text{weight (kg)} / \text{height (m)}^2$ ), but the body mass index number is not directly comparable with the adult body mass index.

A child's body mass index is converted into the age and sex-adjusted body mass index for (ISO-BMI), which is equivalent to adulthood body mass index. [23] This allows the

overweight and obesity limits for adults of 25 kg/m<sup>2</sup> and 30 kg/m<sup>2</sup> to be applied (the established cut-off of the adults). [24]

The difference between adults and children concerns the fact that children are constantly growing and cannot be considered fixed values in the diagnosis of overweight and obesity, in addition to the fact that it is also essential to consider age and gender.

### 1.3 Prevalence and trends of children's overweight and obesity in the world

The last data of WHO (*World Health Organization*) [25] are clear:

- *“Worldwide obesity has nearly tripled since 1975.*
- *In 2016, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 650 million were obese.*
- *39 million children under the age of 5 were overweight or obese in 2020.*
- *Over 340 million children and adolescents aged 5-19 were overweight or obese in 2016.”*

This is a worldwide problem that can be considered. The World Health Organization has called childhood obesity "one of the most serious public health challenges of the 21st century" [26] because it can be associated with a higher possibility of premature death and obesity in adults and early markers of cardiovascular disease. [27]

Figures 4 and 5 [27] show trends in the prevalence of obesity in children and adolescents aged 5 to 19 years in the Mediterranean European countries and the northern European countries respectively from 1980 to 2016.

The trends represented are clear: obesity in children aged 5-19 years in almost all European regions increased rapidly from 1980 to 2016. Mostly almost all the EU Member States showed increasing trends in the prevalence of obesity in children and adolescents during the last 40 years.

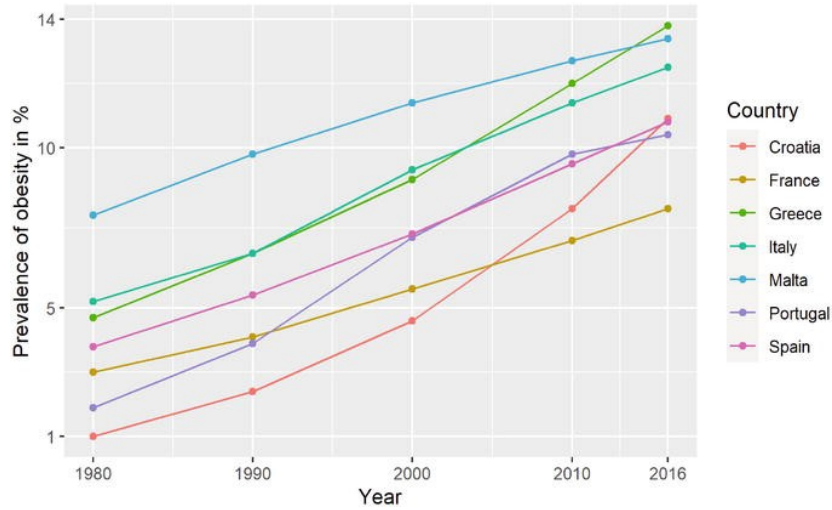


Figure 4: Trends in the prevalence of obesity in children and adolescents aged between 5 and 19 years in the Mediterranean region EU countries from 1980 to 2016.

Image taken from the article “Epidemiology of Obesity in Children and Adolescents” [27]  
<https://www.intechopen.com/chapters/73241>

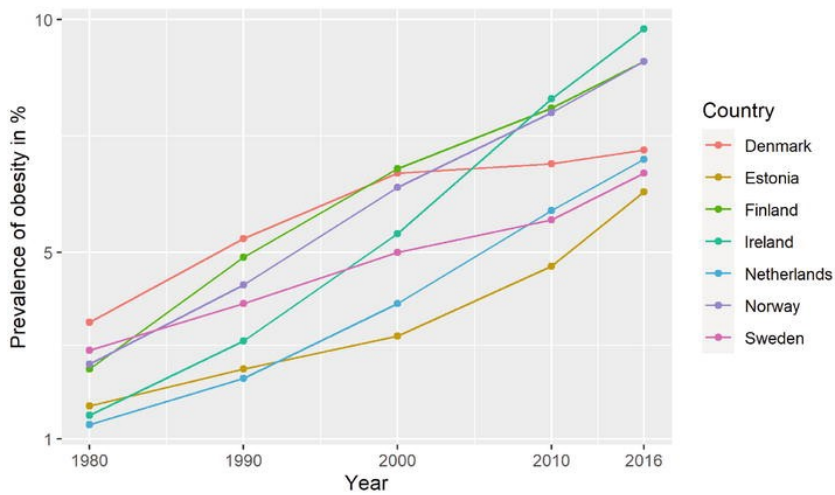


Figure 5: Trends in the prevalence of obesity in children and adolescents aged between 5 and 19 years in the northern EU countries from 1980 to 2016.

Image taken from the article “Epidemiology of Obesity in Children and Adolescents” [27]  
<https://www.intechopen.com/chapters/73241>

## 1.4 Childhood overweight and obesity in Finland

The statistics published by the THL (the Finnish Institute for Health and Welfare) in September 2020 showed that “*one in every four boys and almost one in every five girls are at least overweight*” in Finland. [28]

In particular: “across the age ranges, 24% of pre-school age boys, 28% of primary school age boys, and 29% of upper secondary school age boys were at least overweight. Similarly, 15% of pre-school age girls, 18% of primary school age girls, and 20% of upper secondary school age girls were at least overweight”.

The trend in weight gain around the world, as well as in Finland, is most likely associated with a high intake of calorie-dense foods and insufficient physical activity. [29]

Other factors that must be considered, however, are the socioeconomic status of the family, the weight (concerning height with the BMI index) of the parents which often reflects the weight of the children, education, and social aspects.

According to the THL report, the number of overweight children is higher in rural areas than in cities. There is no clear answer as to why, one hypothesis is that socioeconomic factors such as parental education levels may be lower in rural areas. [30]

This can also be seen in the graphs below (Figure 6 and Figure 7) which show the prevalence of overweight and obesity in girls and boys combined by age in 2019 in Finland. The data derived from the FinLapset register (FinLapset-rekisteri) that collected and reported information on the health and well-being of children and families living in Finland was obtained from the national registers. [31].

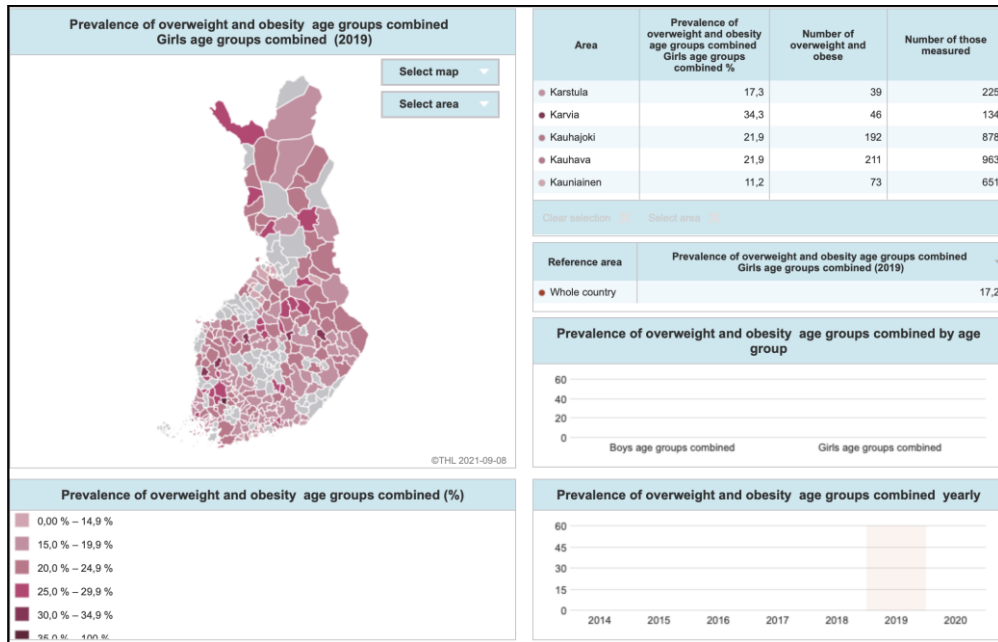


Figure 6: Prevalence of overweight and obesity in girls' age groups combined (2019) in Finland. Image taken from the site <https://terveytemme.fi/finlapset/en/index.html> [32]

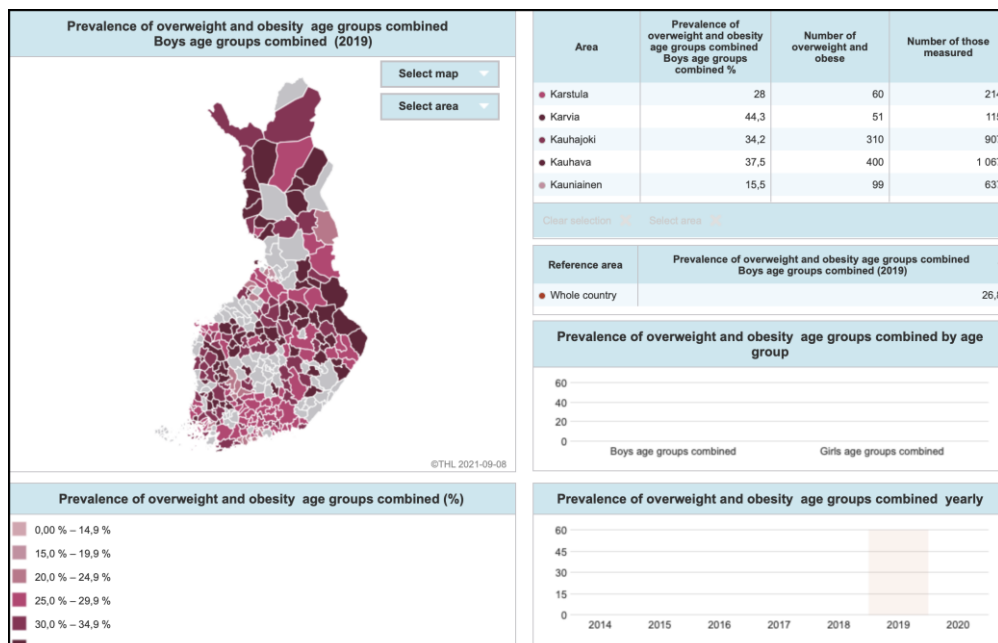


Figure 7: Prevalence of overweight and obesity in boys age groups combined (2019) in Finland. Image taken from the site <https://terveytemme.fi/finlapset/en/index.html> [32]



### 1.4.1 Sugar consumption in Finland

One of the main dietary challenges among children and adolescents in many developed countries, including Finland, lies in the high consumption of sucrose-rich drinks and snacks. [33-35] In particular, the most common sources of sucrose in Finland seem to be sugary drinks. [33]

Following the study conducted to investigate nutrient intake, food consumption, and eating patterns in over 400 Finnish children aged 6 to 8 years, the snacks provided up to 42% of the total energy input. [36]

Excess consumption of sugary drinks and sugary foods is associated with overweight and obesity by increasing overall energy intake and all the dangers related conditions, like promotion of cardiovascular disease and diabetes type II indirectly. [37] The main commercial added sugars used that have these direct effects are the consumption of sugars containing fructose, sucrose, and high fructose corn syrup (HFCS). [37]

It has been shown that sugary drinks, in particular, can be more problematic because the energy in liquid form may not provide favourable satiety effects similar to the energy consumed from solid sources in equal amounts. [38, 39]

The WHO recommends that the intake of sugars (mono and disaccharides added to foods and sugars naturally present in honey, syrups, and fruit juices) does not exceed 10% of the total energy intake of children and adults. [40]

One problem is certainly the fact that no specific recommendations are defining the frequency of consumption of sugary products when considering health outcomes other than dental health. The Finnish Dental Association, to minimize the risk of caries, recommended limiting the consumption of sweets to 1 day per week, called “candy day” as early as 1970. [41, 42]

In Finland, the annual per capita consumption of sugar decreased by 3.9 kilograms in the period from 2010 to 2019. In 2020, sugar consumption was measured at 32.1 kilograms per person. This means the consumption per person increased by 4.2 kilograms compared to 2019. [43]

On 1 January 2011, the sugar tax was introduced by the National Institute for Health and Welfare (THL) to increase revenue and reduce sugar consumption in Finland. In particular, the sugar tax applies to sweets, chocolates, soft drinks, juices, ice cream, and other added sugar products.

The Finnish government eliminated the sugar tax on the 1st of January 2017, in response to a ruling by the European Commission, according to which the sugar tax created economic problems for foreign companies that had to pay both import taxes and the sugar tax. [44]

To reduce the sugar content in meals and food products the Finnish Food Authority is introducing measures like the reduction of the content of added sugar, especially in products used frequently or daily, increase of sugar-free products, and the ones meeting the Better Choice Heart Symbol sugar criteria... [45]

## 1.5 Children's eating behaviours and food preferences

Over the years the different factors that play an important role in the creation of food preferences and eating behaviours of children have been studied.

Food preferences continue to change throughout life, which is shaped by the interplay of biological, environmental, and social factors that are strongly correlated with age. [46]

Young children showed specific positive taste preferences towards sweet taste according to the hypothesis of consequences of an evolutionary selection towards foods rich in calories, vitamin-rich mother milk, and fruits. [47, 48]

Furthermore, repeated exposure to new or initially unwanted foods at the level of a positive environment can lead to acceptance and preference for those foods. [49].

With increasing age, other factors have a greater influence: the child's peers, family, and food availability which continue to shape food preferences and eating factors. [46, 50]

The recent systematic literature review by Tija Ragelienė and Alice Grønhøj [51], based on 16 cross-sectional studies, 4 longitudinal studies, 2 randomized controlled trials, 5 focus groups, and 2 interviews, was conducted to analyse the impact of peers and siblings on healthy eating behaviours of children and adolescents.

In several studies, it has been found that the consumption of unhealthy food by children, like cookies, candies, and soft drinks, is related to peer appreciation for high-calorie foods. In other studies, however, a link was found between the choices of peers and siblings with the healthy choices of children as a preference for fruit and vegetables.

It is certainly a topic that will need to be studied more in the future, but in general, peers and siblings have an impact on the child's food choices that need to be considered, which in turn are influenced by the media, society, and social interactions.

### 1.5.1 Determinants of the preschool children's food preferences: the family environment, parental style, and parental practices

In the review "Factors influencing children's eating behaviours" written by Scaglioni et Al. [52], based on 88 articles published between 2011 and 2018, the impact of the family environment on children's eating behaviour was studied, highlighting the role of the parents.

It was shown that the family system that surrounds the child's life plays an active role in establishing and promoting behaviours [69] that will persist throughout his life [53], also based on the tendency of children to imitate the behaviours of parents, which therefore include both parental practices and parental style.

In general, each parent has a different approach to how interacting and raising their children [54]: authoritarian, authoritative, permissive, and uninvolved parents are different approaches to how parents behave with their children identified by clinical psychologist Diana Baumrind [55, 56]. The parental style could be defined as "several elements that combine to create the emotional climate in which parents communicate their attitudes and practices about childrearing with their children". [57]

In the comparative study by Rhee et Al. [58], the relationship between the 4 parenting styles mentioned above and the state of overweight in the first grade was investigated. In this study, it was shown that among the parenting styles, authoritarian parenting, which for Baumrind corresponded to high demandingness and low responsiveness [56], was associated with the highest risk of overweight among children.

According to what Vollmer and Mobley's review [59] studied, an authoritative style, that corresponded to high demandingness and high responsiveness [56], appears to be the most protective parenting style to develop children's self-regulation and moderate the intake of snack foods, while the indulgent style, low demandingness and high responsiveness [56], is associated with negative health outcomes for the children as an increase of the obesity.

Parental practices refer to specific behaviours that parents have with their children, for example imposing something, using schedules, rules, expectations, rewards... [60]

Therefore, parenting practices are the practical consequences of the parenting style implemented by parents.

It has been studied in a few articles [61, 62] that an excessively restrictive attitude of parents towards the access of their children to high-density calorie and more palatable foods is linked to a counterproductive effect for them in the short term, favouring overweight and the development of habits unhealthy food.

In general, the definition of restrictive parental guidance (e.g., rule-setting) is “the frequency with which parents set limits, rules, or restrictions regarding food consumption”, which is a crucial point for understanding and studying children's food shaping. [63]

### 1.5.2 Social cognitive theory: self-efficacy and self-regulation

Social cognitive theory (SCT), developed by psychologist Albert Bandura in 1986 [64], has made it possible to identify self-efficacy and self-regulation of temptation as modifiable predictors of health behaviours, such as food intake. [65]

The American Psychological Association defined self-efficacy as “an individual's belief in their capacity to execute behaviours necessary to produce specific performance attainments that exercise influence over events that affect their lives”. [66]

Self-regulation is another important concept that refers to “the ability to control one’s impulse with short-term rewarding value to achieve long-term goals”. [67] In the nutrition field, self-regulation is necessary to resist the temptation of unhealthy and high-energy foods.

It has already been shown that parental self-efficacy (PSE) affects the child’s adaptations both directly and indirectly through parenting practices, considering that the variability that is present between parents, children, and cultural-contextual factors must be considered. [68]

There is evidence to support a positive influence of PSE on children's health behaviour, including practicing more physical activity and eating healthier foods such as fruits and vegetables, as well as avoidance of unhealthy foods. [69-71]

The construct of parental self-efficacy can be considered a predictor of children's nutritional behaviours, especially for the children's intake of fruit, vegetables, and sugar-sweetened beverages. [72]

### 1.5.3 Parental importance to control and limit their children's consumption

The importance of parents for the control or limitation of what their children eat is based on different factors: surely important ones are the child's weight status and cultural and social background. [73]

For the parents who consider it important to control their child's diet, the easiest action to a child's overweight situation is to restrict access to certain types of foods or to make certain foods available only at specific times, such as in the case of underweight children to encourage him to eat more calorie-dense foods. So, the two opposing methods – forcing the child to eat and limiting their intake – are both well-documented methods of controlling children's food. [73]

However, despite the good intentions of the parents, these practices can worsen a child's eating situation. Researchers suggest that imposing strict controls can increase preferences for high-fat, energy-dense foods, possibly causing an imbalance of children's normal internal cues to self-regulate hunger and satiety, so in general self-control of the children [74], the children are more likely to have levels of higher adiposity [75] and a higher fat mass. [76]

The different situation of parental importance of the children consumption's control is the case of parents who don't recognize the situation of overweight or obesity of their children (infants and young children) and they are not sufficiently motivated to change diet and lifestyle. [77]

#### 1.5.4 Food availability and accessibility

The food environment in which children and adolescents live, particularly the home and the school environment, defines what foods are available and accessible to them [85] that could be a key factor in children's food consumption because are constantly associated with eating behaviours among young people.

Food availability is related to physical presence and includes food offered and served in different contexts. [85]

Food accessibility is defined as food that is available in a form and place that facilitates its consumption. [86]

It's demonstrated by several studies that the types of food – healthy or unhealthy foods – available and accessible at home are linked to the weight status of children of different ages and their diet quality. [84]

Many studies [80-83] have focused on the association between the availability of fruit and vegetables and their consumption demonstrating a direct relationship between the two variables in different geographical areas and at different ages of children.

The systematic review, written by Natalie Pearson, Stuart J. H. Biddle, and Trish Gorely [78] was focused on finding associations between the family environment and fruit and vegetable consumption of children (6-11 years) and adolescents (12-18 years). According to it, the availability of unhealthy foods at home was associated with lower fruit and vegetable consumption in children and a higher intake of dense calorie beverages.

In a previous cross-sectional study [79], published in 2018 by the DAGIS research group, conducted on about 850 Finnish children between 3 and 6 years old, considering the different dietary patterns, it was shown that the availability of fruit and vegetables at home allows the promotion of healthy eating of children, but having available foods high in sugar at home seemed linked to unhealthy eating behaviours, even in presence of fruits and vegetables. It would therefore seem that the availability of unhealthy foods (high-calorie foods, high-sugar foods...) at home plays an important role in the type of eating behaviours that children will have compared to the availability of fruit and vegetables.

### 1.5.5 Parents' socioeconomic status

The socio-economic status of the parents also plays a key role as the cost of a healthy diet is often higher than junk or less nutritious food.

A systematic review published in 2018 [87] focused on the associations between the dietary pattern in children and adolescents and the socioeconomic status in countries with different levels of human development (divided into high, medium, and low human development countries). The socioeconomic status of the parents or the caregivers is often considered a proxy for the assessment of the socioeconomic status of children and adolescents. The results of the review are that high parental education is associated with a healthier diet, but it's not clear the association between the medium and low human development countries.

In other studies [88-89] the correlation between low socioeconomic status and the consumption of unhealthy and high-calorie foods has been shown, considering also both social (mealtime structure) and physical aspects (food availability).

## 1.6 Health promotion and obesity prevention programs in Finland

The National Institute of Health and Welfare (THL), the research and development institute of the Finnish Ministry of Social Affairs and Health, works to promote health and well-being throughout the country to ensure that all Finnish people live healthy life. [90]

THL has therefore proposed several interventions and primary prevention programs against obesity, especially in children. Primary prevention is defined as a public health effort targeting the entire population to prevent the development (incidence) of, or to decrease, the prevalence of obesity. [91, 92]

Multisectoral collaboration and a strong commitment to long-term activities are the key elements in the prevention of childhood obesity. [93]



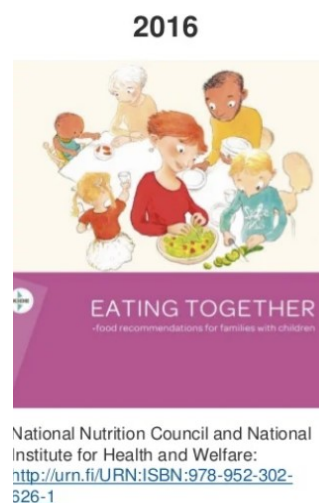
## 1.6.1 Nutrition Recommendations and Guidelines for children in Finland

The main recommendations currently used in Finland are:

1. “Eating together - food tips for families with children”. Publication of the National Institute for Health and Welfare in Finland. 2016. [94]

These are new national dietary recommendations for different categories of people: children, families with children, and pregnant and lactating women to achieve a balanced and healthy diet.

The recommendations are based on the Nordic population-level nutritional recommendations issued in 2013 and the corresponding Finnish recommendations issued in 2014, but also on scientific evidence regarding the link between diet and health.



2. “Health and Joy from Food: Meal Tips for Early Childhood Education and Care”. Publications from the National Nutrition Council, the Finnish National Agency for Education, and the National Institute for Health and Welfare. 2018 [95]

It is a general guideline on promoting child nutrition, nutritionally adequate and healthy food service, and nutrition education in early childhood education and care both in municipal settings and for private providers.

Among the objectives, there is certainly the promotion and improvement of nutrition and health of the population, but also the prevention of the development of risk factors for chronic diseases related to food.

This document is based on the Finnish nutrition recommendations (Terveystä ruoasta - suomalaiset ravitsemussuosituksset 2014) and Eating together - food recommendations for



families with children (2016). In addition, the National Nutrition Council issues instructions for organizing collective catering for specific target groups.

This is the first separate recommendation document in Finland to guide both meals and nutrition education in early childhood education and care.

Many experts and research groups collaborated in drafting these guidelines. In particular, the DAGIS research group analysed and provided the National Nutrition Council with the latest scientific evidence on children's meals in preschools.

### 1.6.2 National Obesity Program “Wellness from Healthy Eating and Physical Activity” (2012-2018)

Between 2012 and 2018, THL proposed the National Obesity Program called "Wellness from Healthy Eating and Physical Activity" [96] intending to reduce obesity nationwide.

The main points of the program were:

- Ensure that fewer children and young people become obese adults.
- Ensure that fewer people gain weight as adults
- The differences in the prevalence of obesity between population groups are small
- People at risk of obesity-related diseases lose weight or no longer gain weight.

Program objectives should be achieved primarily through nutrition and physical activity, as well as using information, communication, and collaboration.

It is a program that involved different stakeholders: municipalities, health services, schools, early education, schools, city planning, sports, employers, media, and the food industry.

### 1.6.3 Smart Family / Neuvokas perhe

Neuvokas perhe is part of the Finnish Heart Association. [97]

Smart Family is a program that provides professional lifestyle counselling tools for families with children by providing information and support on healthy lifestyle choices.



The program is implemented in families through small children's health checks, at the same time health nurses implement the Smart Family tools in the families.

The main action points are eating, physical activity, rest, screen time, and your child's body.

### 1.6.4 Joy in Motion / Liikkuva varhaiskasvatus

Joy in Motion [98] is a physical activity and well-being program for early childhood education based on "Joy, Play and Doing Together".



The goal of the program, announced in 2015, is to enable every child to enjoy movement and adequate daily physical activity.

It is a free nationwide program that provides early childhood educators with tools to increase children's mobility and develop their work based on recommendations for physical activity in the early years.

The program management is the responsibility of the Ministry of Education and Culture and the National Board of Education.

## 2 DESCRIPTION OF THE AIMS OF THE THESIS

The thesis is carried out to evaluate a possible association between the following 2 aspects:

- consumption of sugary everyday foods, sugary treats, and sugary beverages by Finnish pre-school children
- any limitations and practices of parents towards the categories of food mentioned above which might affect children's consumption
  - the power to say no to the child's requests for sugary foods and drinks (parental self-efficacy)
  - the importance to limit the sugary foods and drinks in the daily life of children (parental importance)
  - the number of sugary foods and drinks accessible and available at home (availability and accessibility of the sugary foods and drinks)

Therefore, the purpose of this master thesis is to study the hypothesis according to which food parenting is associated with the diet and eating habits of children, focusing on the intake of sugary foods and drinks by the children.

When exploring the associations, the parental educational level, child's age and sex, as well as child's weight status and BMI will be taken into account.

It can be promising and interesting to study which aspects could – with further studies – lead to a greater predisposition to weight gain in the child which is one of the main goals set in recent years.

Identifying the relationship between parents' practices, nutritional knowledge, and socio-economic aspects is a fundamental starting point for the possible changes that can be made at the family level.

## 3 MATERIALS AND METHODS

### 3.1 Increased health and wellbeing in preschools: the DAGIS study

DAGIS - Increased Health and Wellbeing in Preschools Study – [99] is a research project focused on Finnish preschool children (3-6 years old).



The project studies the energy balance-related behaviours (EBRB) which is an intervention objective that encompasses physical activity, sedentary behaviours, eating and sleeping habits, and well-being of Finnish children aged 3-6, their parents, and kindergarten staff, considering socio-economic and environmental differences.

The focus of the EBRBs in this study is on fruit and vegetable intake, sugary (every day) food intake, sugary beverage intake, stress regulation and physical activity (PA), and sedentary behaviours.

The DAGIS research project has two main aims [100]:

- (1) to recognize possible socioeconomic differences in the energy balance-related behaviours (EBRBs) of preschool children and to study the different factors in the home and preschool settings
- (2) on data obtained from the study, to develop a preschool intervention to promote healthy ERBRs among all children and reduce the potential socioeconomic differences in children's EBRBs

The main goal of DAGIS is to promote a healthy lifestyle among preschool children going beyond the socio-economic differences that underlie behaviour with the use of preschool as a place for nutritional education.

### 3.1.1 Research phases

In 2014 the first step of the research group took place through the carrying out of focus group studies in preschools with personnel who work there and separate focus groups with parents of children. [101]

During this first phase, parents and preschool staff in low socioeconomic status (SES) neighbourhoods were interviewed to obtain more information about the children's EBRB, interviews on children's sedentary behaviours, dietary behaviours, and PA.

The cross-sectional study began in the autumn of 2015 in 8 municipalities in the South and Western part of Finland with a total of participants from 864 children and their parents in 66 different preschools. [102]

During this phase, the children wore an accelerometer for 7 days, a tool used to measure physical activity and to examine energy expenditure. Additionally, the children's EBRBs were measured through 3-day food records, FFQ (food frequency questionnaire), and a 7-day diary that parents kept in which they reported what their children did each time they sat down for more than 20 minutes (for example eating, reading, watching TV, playing games), where they sit still...

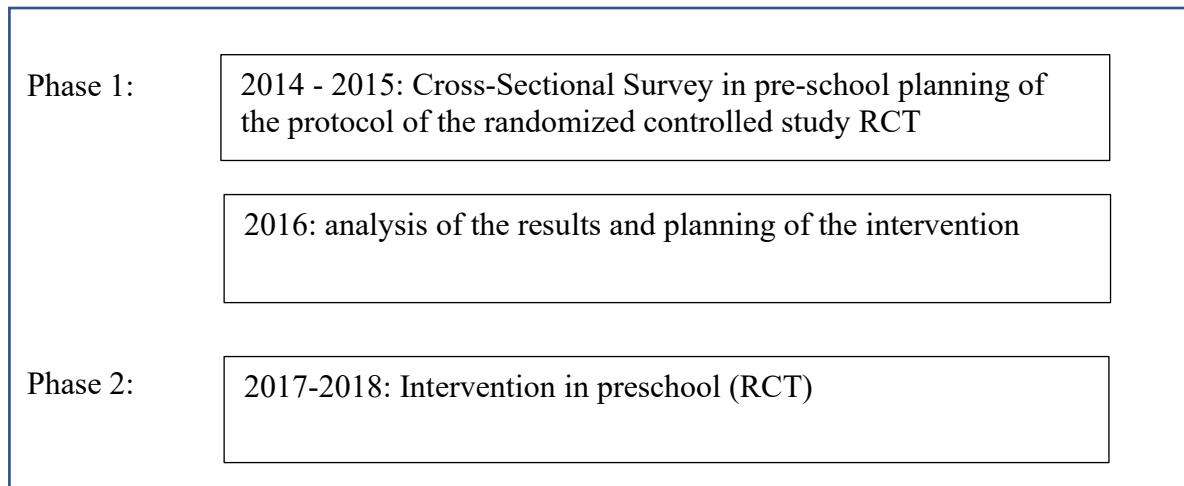
Hair and saliva samples were taken from each child to study the short time stress through the saliva samples and the long-term stress through the hair cortisol concentration.

Parents and preschool staff completed questionnaires on EBRBs, social environments, PA, and SES factors considering the parental educational level (PEL)

Subsequently, in 2016 and 2017, the randomized controlled study (RCT) was planned based on the results obtained in the cross-sectional study.

The RCT was conducted in a project that lasted 6 months between September 2017 to May 2018 in 2 municipalities with the total participation of about 800 children and parents in 30 preschools. [100] In this second phase, after the interviews and the cross-sectional

study, they focused on an intervention aimed at narrowing the SES differences in the EBRBs.



*Figure 7: The DAGIS study phases*

### 3.1.2 Validity of the Food Frequency Questionnaire

The food frequency questionnaire was evaluated in a test-retest reproducibility study as part of the larger DAGIS project in the spring of 2018 between February and May [100], because there were no available measures or tools suitable for the Finnish context, the DAGIS study developed its tools which, however, require further studies on the reproducibility of these questionnaires as it is unknown.

In this study, a sample of 69 guardians with preschool children and a sample of 61 preschool staff members were considered, who completed preschool EBRBs questionnaires, an on-screen diary, and a food attendance questionnaire. of the child completed by the guardian twice within five weeks between April and May 2018 in one municipality in Southern Finland about 50km from Helsinki.

The questionnaire correlating children's balance-related behaviours (EBRBs) demonstrated moderate to good reproducibility. [100] While the Food Frequency Questionnaire (FFQ) showed moderate reproducibility. [100]

Through this last phase of the studies, which is fundamental, it was therefore concluded that all the tools used are considered acceptable for use in future studies. [100] The validation of a questionnaire is a *conditio sine qua non* – a necessary condition without which something is not possible [108] – to be able to carry out an accurate, precise, and well-done study: it's a necessary phase of the research projects. [109]

### 3.1.3 Origin of the data used in the thesis

The data used in the thesis derive from the questionnaire results of the randomized control study (RCT) that took place between 2017 and 2018 considering only the baseline data.

Instead, the questionnaire's questions studied were carried out based on the information obtained up to that moment from previous studies by the DAGIS group, and the literature and the questionnaire were scientifically validated.

## 3.2 Study Participants

The recruitment of the participants of the study was carried out in two municipalities in Southern Finland: Salò and Riihimäki.

Eligible participants were preschool children aged 3 to 6 years from 30 different schools and their families. Of 1702 candidates meeting enrolment criteria, only 47% (802 children) agreed to participate.

During the baseline data collection (2017), the parental questionnaire was filled by parents of 698 children (a response rate of 87% of the participants).



## 3.3 Measurements and variables

### 3.3.1 Parental questionnaire

The baseline questionnaire presented by the DAGIS group to parents included questions about children's age, gender, weight and height, the highest parenting education, parents' working hours, and informative questions about the home environment concerning:

- hours spent in front of the screens;
- physical activity of children
- food consumption of children.

The questions about the home environment (n = 62) that the parents answered were evaluating both the psychosocial and physical environments of the home.

In this thesis, Finnish preschool children's food consumption was studied, focusing on everyday sugary foods, sugary treats, and sugary beverages, because in the literature there is a lack of studies in Finland on the association between these product categories and parental practices.

### 3.3.2 Parental practices

#### *Parental self-efficacy regarding sugary foods and drinks*

The DAGIS research group regarding the concept of parental self-efficacy about sugary foods and sugary beverages formulated question number 13 based on the study "Home and Neighbourhood and BMI of Children" by Crawford et Al. [103] The questions were formulated based on the evidence that in preschool children the self-efficacy of the parents, in particular of the mother, is associated with the consumption of food.

The questions considered are asked in such a way as to ask "how confident the parent is to say no to the consumption of everyday sugary foods (13D), sugary drinks (13E), and sugary treats (13F), even when the child is having tantrums".

The answers are based on the response of how confident the parent is about the request on a 5-point scale corresponding to:

- 1 = "strongly disagree"
- 2 = "slightly disagree"
- 3 = "neither disagree nor agree"
- 4 = "rather agree"
- 5 = "strongly agree"

For the analysis, a continuous overall score describing the self-efficacy of all the variables considered was calculated by summing up parents' responses to questions 13D, 13E, and 13F with a score between 3 and 15 points.

The summary variable was named "self-efficacy".

#### *Parental importance of restricting sugary foods and drinks*

Question number 14 on the importance of parents to the consumption of sugary foods and beverages was formulated by the DAGIS group based on the results of an article regarding the time spent by children in front of the screen and the related restrictions of parents.

The importance of limiting the consumption of everyday sugary food (14D), sugary drinks (14E), and sugary treats (14F) were assessed using the element "For me, it is important to limit the consumption of ..is.." evaluated on a 5-point scale corresponding to:

- 1 = "strongly disagree"
- 2 = "slightly disagree"
- 3 = "neither disagree nor agree"
- 4 = "rather agree"
- 5 = "strongly agree"

For the analysis, a final continuous score was calculated that describes the importance of the parents to limit the consumption of the sugary foods and drinks studied by summarizing the parents' answers to questions 14D, 14E, and 14F with a score between 3 and 15 points.

The final variable was called "importance".

#### *Availability and accessibility to sugary foods and drinks*

Question number 31 of the questionnaire reflects the availability and accessibility of sugary foods and drinks at home. These are questions formulated by the DAGIS group based on information already obtained to investigate the trend toward greater consumption of sugary drinks and sugary foods by children.

The questions formulated can be divided into 3 groups based on the categories of food considered: questions from 31G to 31J refer to sugary foods of daily use, from 31K to 31N refer to sugary drinks, and finally from 31O to 31R refer to sugary treats.

Questions 31G, 31K, and 31O investigate in parallel the aspect "In our family, we limit child's consumption of ..".

Questions 31H, 31L, and 31P investigate the "We don't buy ... to our home" aspect, thus directly the availability of food.

Questions 31I, 31M, and 31Q investigate the aspect of "We have ... at home, but they are not available for the child".

Finally, question 31J, 31N, and 31R investigates "We allow only a certain amount of .. per day/week to the child".

The answers are structured according to a 5-point scale structured as follows:

- 1 = "strongly disagree"
- 2 = "slightly disagree"
- 3 = "neither disagree nor agree"
- 4 = "rather agree"
- 5 = "strongly agree"

Therefore, question 31 is composed of 12 sub-questions concerning the availability and accessibility of sugary products divided into the three categories of products considered (everyday sugary foods, sugary treats, and sugary beverages) for a total of 4 questions for the category. Adding the questions for each category results in a continuous final value for the three categories of sugary products that is between 4 (if parents answered 1 out of all 4 questions) and 20 (if parental answers were 5, which is the maximum, for all 4 questions).

The name of three final variables that are obtained is called “availability of everyday sugary foods”, “availability of sugary treats” and “availability of sugary beverages”.

### 3.3.3 Children’s food consumption

The DAGIS group designed a short Food Frequency Questionnaire (FFQ) for the family to estimate the food consumption of children after preschool, then at home, for the week before administration. [104]

The FFQ was developed to include 47 food products divided into seven items:

- vegetables, fruits, and berries;
- dairy products;
- fish;
- meat and eggs;
- cereal products;
- drinks;
- and others (sweets and snacks).

The elements included in the FFQ were based on previous studies on the key factors contributing to the consumption of fruit and vegetables and the intake of added sucrose in foods and drinks among Finnish children [105-106] and also contained other foods or group foods to cover the entire diet of children.

In the FFQ the parent or legal guardian reported how many times during the previous week the child had consumed the different foods at home.

Furthermore, the FFQ used in the study excluded food and drink consumed during preschool, because the parents were unable to reliably assess them. [100]

The FFQ is organized to choose the child's food consumption of the past week at home or in places other than school between three response columns:

- "not at all",
- "times per week"
- "times per day".

In the case of the choice "times per week" and "times per day" the interviewee was also asked to write down the number.

For this study, the food frequencies related to three categories were extrapolated from the data obtained by Korkalo et Al. in 2019 [107]: everyday sugary foods, sugary treats, and sugary drinks.

The types of food for each of these three categories are listed below.

### Sugary everyday foods

- Flavoured yogurt and quark
- Puddings
- Berry, fruit, and chocolate porridge
- Sugared cereals and mueslis

### Sugary treats

- Ice-cream
- Chocolate
- Cakes, cupcakes, buns, pies, sweet pastries
- Sweet biscuits and cereal bars
- Sweets

### Sugary beverages

- Sugar-sweetened soft drinks
- Flavoured and sweetened milk and plant-based drinks
- Sugared juice drinks
- 100% fruit juices

*Table 1: List of sugary foods and beverages considered in the study*

### 3.3.4 Covariates

The age and gender of the children requested in the questionnaire submitted to the parents were included in the analysis as covariates.

In particular, the parents reported the sex (boy or girl), the date of birth of their children, from which their age (years) was calculated, as well as the height (meters) and weight (kilograms) of the children, from which the BMI (kg/m<sup>2</sup>) expressed as ISO-BMI was calculated.

The parents reported their highest level of education with two questions to separately investigate the education level of the mother and the father. The parental educational level (PEL) is divided into three categories:

- The low category includes an educational level of middle school, vocational school, or high school
- The middle category consists of bachelor's degree or college
- The high category includes master's degree or higher degree

The highest level of parental education in the family was used for the analysis of this thesis.

## 3.4 Linear Regression Model

Linear regression [110-114] is a type of analysis used in quantitative epidemiological studies to learn more about the relationship between a dependent variable (Y) and one or more independent variable(s) (X).

The simple linear regression is the simplest form of linear regression, in which only one independent variable x and one dependent variable y are handled, and it's expressed as a linear function of x. The value y<sub>i</sub> of the variable y, for each value x<sub>i</sub> of variable x, can be expressed using the following equation:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon$$

The value  $Y_i$  corresponds to the estimated (or predicted)  $Y$  value for observation  $i$ , so the dependent variable.

$X_i$  is the value of  $X$  for observation  $i$ , so the independent variable.

The parameters  $\beta_0$  and  $\beta_1$  of the equation express the linear dependence of the dependent variable  $Y$  on independent variable  $X$ . In particular, each pair of values  $\beta_0$  and  $\beta_1$  determines a different linear relationship which can be expressed geometrically by a straight line, also known as a regression line, that is the closest to the collection of data points on an  $x$ - $y$  scatter plot, in which:

- $\beta_0$  corresponds to the intercept of the line and it's a constant value.
- $\beta_1$  estimates the regression slope: a value very close to 0 indicates little or no relationship, and large positive or negative values indicate large positive or negative relationships respectively.

The parameter  $\varepsilon$  represents the regression error, also called the random error term. It's defined as the difference between the actual value of  $Y$  and the predicted value of  $Y$ .

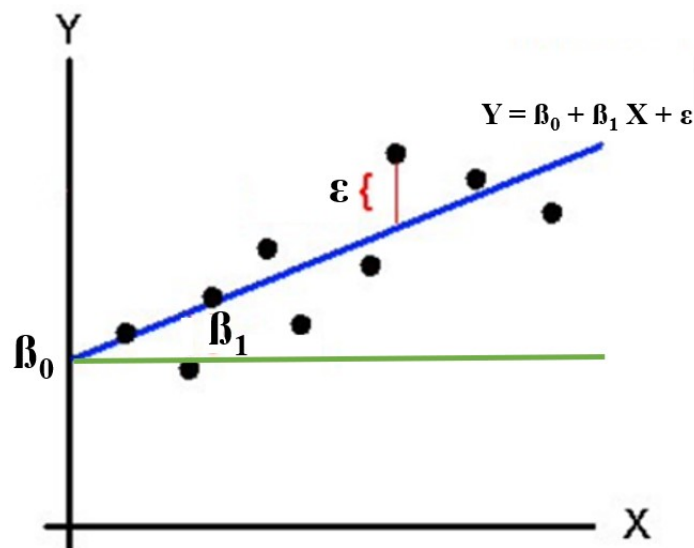


Figure 8: Representation of the simple linear regression's straight line



The nature of the relationship studied in the linear regression is linear that can be positive or negative:

- A positive relationship between two variables means that an increase in the value of one variable also implies an increase in the value of the other variable ( $\beta_1 > 0$ ).
- A negative relationship between two variables means that an increase in the value of one variable results in a decrease in the value of the other variable ( $\beta_1 < 0$ ).

It is important to remember, however, that when linear regression analysis is done, the prediction obtained doesn't imply causality.

### 3.5 Data Analysis

Data analysis was performed using IBM SPSS (Statistical Package for Social Sciences) Statistics quantitative statistical analysis software (version 27.0).

The first step of the analysis was based on a descriptive analysis. Therefore, the frequencies, the means, the medians, and the standard deviation (SD) were calculated for all the variables surveyed and studied.

Food consumption variables were checked for normal distribution and outliers of three standard deviations (3SD) were removed from the dataset of sugary everyday food, sugary treats, and sugary beverages.

Linear regression analyses were used to examine the associations between parental practices (self-efficacy, importance, and availability) and children's food consumption of everyday sugary foods, sugary treats, and sugary beverages. Three models were made for each predictor: the first model had no adjustments, the second model was adjusted for parental education level, child's age, and gender, and the third model included the adjustments from the second model and child's BMI.

The unstandardized coefficient B will be the reported parameter. The value of B represents the slope of the line between the predictor variable, in this thesis parental practices, and the dependent variable, the children's food consumption.

The unstandardized coefficient B is studied together with the confidence interval (CI) (lower and upper bound showed Table 3) and the p-value. The 95% CI and the p-value shows whether the result reached statistically significant.

- 95% confidence interval (CI) (lower and upper bound in Table 3) for each derived B coefficient means that at the probability of 95% the "right" B coefficient will be in that interval, so it provides a significant measure of the position and the uncertainty about it [81]
- The significance level was set at a p-value  $< 0.05$ .

## 4 RESULTS

The characteristics of the children and the parents, the children's intake of sugary products, and the parents' practices are found in Table 2.

Of the parents who filled the parental questionnaire the proportions of the highest educational level of the family were 29% (n = 228) with a low educational level that included an elementary school, high school, or vocational school, 45% (n = 321) with a middle level (Bachelor), and 23% (n= 161) with a high educational level (Master or higher).

The child's gender was divided in: 46,8% (n = 375) girls and 53,1% (n = 426) boys.

The age at baseline of the children was 5,2 years with a range between 3-7 years and a standard deviation of 1,05.

The mean child BMI of baseline corresponding to the adult BMI according to the Finnish reference was 22 kg/m<sup>2</sup>, which is within the normal weight range, with a standard deviation of 4.25. However, the available data on BMI were provided by 595 parents (74% of the total), so there are many missing values (26% of the total).

The information collected regarding parental self-efficacy (question 13 of the questionnaire) was provided by a total of 697 parents. The mean obtained is a score of 13.65 with a standard deviation of 2.02.

The pooled information on the importance of parents limiting sugary products (question 14 of the questionnaire) was provided by a total of 697 parents. The mean obtained is a score of 14.05 with a standard deviation of 1.7.

Therefore, the data obtained regarding the availability of everyday sugary foods (question 31) are an average of 14.06 with a standard deviation of 2,68 (data from 697 parents). The data regarding the availability of sugary treats are a mean of 14.71 and an SD of 2.76 (data of 693 parents). Finally, the mean of availability regarding sugary drinks is 14.63 with a standard deviation of 2.49 (data from 690 parents).

*Table 2: Characteristics of the children, Education level of the parents, children's dietary intake of sugary foods, and beverages and parental practices*

	People n (%)	Mean	SD	Min	Max
Age at baseline (years)	801 (99%)	5,19	1,05	2,92	7,08
BMI (kg/m <sup>2</sup> )	595 (74%)	22,01	4,25	12,47	49,66
Child's gender	801 (99%)	1,53	0,5	1	2
Girl	375 (46,8%)				
Boy	426 (53,1%)				
Highest education level in the family	710 (89%)	1,91	0,735	1	3
Low PEL* (elementary school, high school or vocational school)	228 (28,4%)				
Middle PEL* (Bachelor Degree)	321 (40%)				
High PEL* (Master's Degree or higher)	161 (20,1%)				
Children's consumption (times per week)					
Everyday Sugary Foods	609 (76%)	4,78	3,74	0	18
Sugary Treats	605 (75%)	4	3,11	0	16
Sugary Beverages	607 (76%)	4,76	3,85	0	21
Parental practices					
Self-efficacy	697 (87%)	14,05	1,7	5	15
Importance	697 (87%)	13,65	2,02	3	15
Availability of everyday sugary foods	697 (87%)	14,06	2,68	4	20
Availability of sugary treats	693 (86%)	14,71	2,76	4	20
Availability of sugary beverages	690 (86%)	14,63	2,49	4	20

\*PEL = Parental Educational Level

The analysis of the association between the intake of the sugary products studied with the parental practices investigated through the questionnaire can be seen in table 3.

For each of the three outcomes considered, everyday sugary foods, sugary treats, and sugary beverages, three models were analysed with linear regression to study the correlation without adjustments (model 1), with the adjustments of age, gender of the child, and the highest education level of the parents (model 2) and with the adjustment of the child's BMI (model 3).

#### *Intake of Everyday Sugary foods*

In the model, without adjustments (model 1) an inverse correlation was found between the parent's behaviour (question 31) and the child's consumption of everyday sugary foods. Parents who limit the availability or consumption of sugary everyday foods more have preschool children who consume these sugary foods less frequently. No associations were found between parents' self-efficacy or importance and the child's consumption frequency of everyday sugary foods.

When the model was adjusted for the age and gender of the child and the highest education in the family (model 2), the inverse correlation between parents' limiting practices and the child's consumption frequency of sugary everyday foods was still significant.

Even after adding a child's BMI to the model (model 3) found association stayed significant.

#### *Intake of Sugary Treats*

In the no-adjustment model (model 1) an inverse correlation was found between parental self-efficacy (question 13), the importance of limiting (question 14) and food availability (question 31), and the children's consumption of sugary treats.

Also, in the other two models adjusted (model 2 and model 3) a statistically significant reduction in the intake of sugary treats can be observed in table 3 in response to the more restrictive practices of parents in comparison to these.

### Intake of Sugary beverages

Also, regarding the intake of sugary beverages, in the model without adjustment (model 1) an inverse correlation was found between the availability of those drinks (question 31) and the consumption of them by children. No associations were found between self-efficacy (question 13) and parental importance (question 14) and the frequency of the child's consumption of sugary beverages.

When the model adjusted the age and the gender of the child and the level of higher education in the family (model 2), the inverse correlation between the parents' availability of sugary drinks and the frequency of their consumption was still significant.

After adding the children's BMI to the model (model 3), the previous association found remained significant.

Table 3: Linear regression estimates, and their 95% CI, for the associations between parents' practices about Everyday sugary foods, Sugary treats, and Sugary beverages and children's consumption

	Model 1				Model 2				Model 3			
	B	95% CI		P-value	B	95% CI		P-value	B	95% CI		P-value
		Lower Bound	Upper Bound			Lower Bound	Upper Bound			Lower Bound	Upper Bound	
<u>Everyday Sugary Foods</u>												
Self-efficacy	<b>-0,11</b>	-0,287	0,67	0,224	<b>-0,126</b>	-0,303	0,052	0,165	<b>-0,157</b>	-0,346	0,033	0,106
Importance	<b>-0,056</b>	-0,204	0,091	0,453	<b>-0,063</b>	-0,21	0,084	0,401	<b>-0,067</b>	-0,223	0,09	0,402
Availability	<b>-0,25</b>	-0,363	-0,137	< 0,001	<b>-0,249</b>	-0,362	-0,136	< 0,001	<b>-0,255</b>	-0,376	-0,134	< 0,001
<u>Sugary Treats</u>												
Self-efficacy	<b>-0,494</b>	-0,639	-0,349	< 0,001	<b>-0,507</b>	-0,65	-0,363	< 0,001	<b>-0,558</b>	-0,712	-0,403	< 0,001
Importance	<b>-0,312</b>	-0,432	-0,191	< 0,001	<b>-0,306</b>	-0,426	-0,186	< 0,001	<b>-0,282</b>	-0,411	-0,153	< 0,001
Availability	<b>-0,245</b>	-0,335	-0,156	< 0,001	<b>-0,242</b>	-0,331	-0,153	< 0,001	<b>-0,258</b>	-0,354	-0,161	< 0,001
<u>Sugary Beverages</u>												
Self-efficacy	<b>-0,183</b>	-0,372	0,005	0,057	<b>-0,216</b>	-0,403	-0,028	0,024	<b>-0,19</b>	-0,396	0,016	0,071
Importance	<b>-0,116</b>	-0,273	0,041	0,15	<b>-0,12</b>	-0,276	0,036	0,132	<b>-0,107</b>	-0,275	0,061	0,211
Availability	<b>-0,309</b>	-0,438	-0,179	< 0,001	<b>-0,311</b>	-0,439	-0,182	< 0,001	<b>-0,329</b>	-0,468	-0,19	< 0,001

Model 1: no adjustments.

Model 2: adjusted for child's gender (boy or girl), highest education level of the parents (low, middle, and high), children's age at baseline (years)

Model 3: adjusted for child's gender (boy/girl), highest education level of the parents (low, middle, high), children's age at baseline (years), and BMI (corresponding adult BMI according to Finnish references; kg/m<sup>2</sup>)

## 5 DISCUSSION

The purpose of this master thesis was to study the hypothesis according to which food parenting practices are associated with the diet and eating habits of the children, especially this thesis is focused on the intake of sugary foods and drinks by the children.

The hypothesis was verified through three different models:

- model 1: the crude model of the association between parental practices and the categories of foods or drinks studied
- model 2: adjusted model by age at the baseline of the children, highest education of the family, and gender of the child
- model 3: adjusted model by age at the baseline of the children, highest education in the family, gender of the child and corresponding adult BMI of the children

The three models were studied for the three categories of foods and drinks that were explored in the questionnaire: intake of sugary beverages, everyday sugary foods, and sugary treats of preschool children.

The aim is therefore to determine if there is a positive or a negative association that is statistically significant between parental practices and the intake of these products and if this correlation persists even with the adjustments for the variables considered.

The results showed, as can be seen in table 3, with statistical significance, a correlation between a reduced intake of preschool children in all three outcome categories considered, everyday sugary foods, sugary treats, and sugary beverages, and a lower availability and accessibility of these at home. Furthermore, there is a significant correlation between self-efficacy and the importance to limit only in the case of sugary treats and not for the other two categories.

The statistical significance of the correlations persists even with the adjustments made in models 2 and 3 (Table 3), confirming the initial hypothesis of the thesis.

Therefore, in the case of sugary sweets, it can be deduced from the result obtained that more parental practices – generally involve both a lower purchase of these products, but



also a lower availability and accessibility of these products at home, as well as the greater importance of parents to limit them to children and a greater parental-self-efficacy – are consequently associated with a noticeable reduction in the intake of sugary treats.

The results can be considered interesting in the general perspective of the increase in the incidence of childhood obesity worldwide as it has been suggested that sugar may play an important role in the obesity epidemic, in fact, the prevalence of obesity has increased at the same time as sugar consumption. [121]

It seems like that greater attention by parents to the type of diet that children eat could be a winning factor within the family in the reduction of an obesity pandemic that has been trying to combat for many years with various external interventions such as taxes, advertising, laws, industry quality standards...

In literature, studies suggest that the use of at least some parental practices, such as parental monitoring, availability, and rulemaking, may be more useful for reducing children's consumption of added sugars in foods and beverages in children of different ages compared to coercive control which is a set of parental practices considered to have a negative impact on children's food choices. [116-118]

The results obtained in this thesis are in line with an older similar study conducted on children aged 6 to 10 years in Portugal, in which the parents had a negative perception of sugar, and some strategies such as restriction, explanation, or negotiation were proposed to control the intake of sugary foods. [119]

A randomized controlled trial made in New Zealand [120] focused on dietary intake and parental feeding practices of overweight children aged 4-8 years and showed that the higher intake of unhealthy foods was associated with a lack of parental control, even if in this study the parental guidance and monitoring of healthy eating correlated with consuming fewer unhealthy foods.

The problem is since inconsistencies continue to exist in the measurements of dietary parenting practices, in fact, there is a lack of clarity on what is understood by the different concepts of food parenting practices. [115]

Through the studies already published and further studied that will be done in the future, it is hoped to provide support to families in promoting the healthy growth of the children and thus prevent the possible weight gain of the children with negative consequences both in the short and long term when they become adults. The goal is to have a general framework for action with the best parenting practices to reduce as soon as possible the overweight and obesity of children, but also to educate health nurses on an organization working with health promotion, as well as writing new nutritional guidelines.

Age and food cultures must be also considered in dietary intervention and advice to parents on best food practices as considerable changes have been observed for both age and country. [34]

## 5.1 Strengths and Limitations of the study

Data on children's food consumption were collected using a Food Frequency Questionnaire which is a dietary assessment tool (Rodrigo et al., 2015) [122] used to estimate habitual food intake.

A strength of the study is certainly that previous valuations of the validity and reproducibility of the FFQ were carried out and showed moderate and good results.

In addition, through the questionnaire with specific questions, formulated based on previous studies, it was possible to separate the treats from the sugary everyday food and sweetened beverages to obtain more precise results. Furthermore, each identified and well-specified category, based on Finnish eating habits, was studied concerning parenting practices in detail.

Finally, a further strength of the thesis is the number of parents who participated in the questionnaire allowing them to obtain a more significant result.

A limitation of the study is that the measures of children's family habits are mainly based on reports from the parents themselves and not on an objective evaluation by the researchers. As well as the fact that important information such as the weight and the height of the children are self-reported by the parents, some data used in the study, like the BMI, is not completely reliable.

The accuracy of the data on children's food consumption is based entirely on the food frequency questionnaire filled by the parents, so a bias of the study could be over-reporting or under-reporting of the food consumption, which cannot be detected and eliminated in this method. [123]

A further important point to consider is that the frequencies obtained from the FFQ don't detect the exact quantities consumed that can differ from many factors and are subject-dependent.

A recent study that was conducted in Finland [124] showed that parental role models (maternal and paternal roles) have different effects on children's food consumption. In this study, a difference between the role of the mother and the father wasn't evaluated, but the questionnaire could rather be filled by one of the two parents indiscriminately and the results could be different.

Furthermore, only the data of the highest level of education of a parent is considered, it could be interesting to study the correlation with both levels of education because parents can have a different influence on the child's eating habits.

A comparative study by Darcy and Neil Johannsen and Bonny Specker [125] was conducted to investigate the effects of mothers' and fathers' eating habits separately related to infant feeding practices and BMI of their children aged 3 to 5 years. The study showed a different influence between mothers and fathers: mothers appear to exert a

strong influence on their children's weight and to be more concerned about their children's eating behaviors, while fathers play a role in enforcing feeding practices for the children.

## 5.2 For future studies

Surely further analysis on a longer follow-up of a randomized controlled study within the DAGIS study can provide more information regarding the correlation between the reduction in the intake of sugary drinks and foods in school-age children and better wellness of the children.

Through the extension of the study time, it is possible to identify if the association persists or if other external factors may have a greater role in growth.

Furthermore, intervention studies can be carried out through which it's possible to determine with a sufficiently long follow-up if there is indeed a significant difference between a restrictive behaviour with a diet that includes quantitatively fewer sweet products and a less restrictive behaviour that the intake of children's drinks and sugary foods.

## 6 CONCLUSION

The DAGIS study is expected to identify and investigate effective methods for early childhood obesity intervention in the future.

The study carried out in this thesis laid the foundations to determine the relationship between parental practices and the consumption of sugary foods and beverages of children to be able to act in the direction of reducing the consumption of sugary products that are indirectly linked, if consumed, in excessive quantities, to reduce the obesity.

The results showed a correlation between a reduced consumption of everyday sugary foods, sugary treats, and sugary beverages and restrictive parental behaviours including the importance of saying no to their children to consume sugary products, as well as buying fewer sugary products at the market or don't make them available to children if present at home...

In future studies, the researchers should clarify the correlations found and compare the results obtained in this study with data on healthier foods such as fruits, vegetables, cereals, and legumes. Eventually, the pool of questions present in the questionnaire could be increased and the analyses repeated also in areas of Finland where the prevalence of obesity is higher than in the South.



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