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Healthy Snack Preferences in Danish and Swedish School Children

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Summary

Well balanced nutrition in childhood is important for the growth and development of the child but it might also have long-term health implications. Several studies have identified a common concern that Danish and Swedish school children eat unhealthy snack food. Children's food choices and food preferences are influenced by several factors, such as liking, food culture and the social environment. In order to promote healthy food choices there might be a need for palatable and nutritious snack products developed to suit children's preferences and food culture.

Conducted as part of a health promotion Danish project called *"OPUS - New Nordic Diet"*, this study aimed to examine 8-10 year old school children's acceptance and preference for muesli bars composed of Nordic food ingredients and to compare Danish (n=100) and Swedish (n=100) school children's acceptance and preferences for the muesli bars. A hedonic test using a smiley scale was conducted to measure the children's sensory acceptance of five muesli bars varying in composition of whole grain cereals, dried berries, nuts and seeds. A preference rank-order of the five bars was also performed.

Children's degree of acceptance varied between the five samples. Most liked were the muesli bars based on kamut and pumpkin seeds, and oat and cranberries. Least liked was the muesli bar based on pumpernickel and buckthorn. Similar results were found in both countries. The preferences were highly influenced by the sensory characteristics of the bars. Above all, the flavour and taste of the bars tended to have an important influence on children's preferences. The muesli bars have great potential to promote healthy food choices but further researches are needed to find out if they will be accepted even in the long term.

Keywords: *Acceptance, Nordic snacks, food choice, cultural differences*

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Sammanfattning

Välbalanserad kost under barndomen är betydelsefull för barnets tillväxt och utveckling, men kan även ha konsekvenser för framtida hälsa. Flertalet studier har visat att både danska och svenska skolbarn äter ohälsosamma mellanmål. Ett problem med en bred bakgrund där barns preferenser och livsmedelsval påverkas av ett flertal olika faktorer såsom personlig smak, matkultur och social miljö. För att främja hälsosamma livsmedelsval kan det finnas behov av tilltalande näringsrika mellanmål vilka tillfredställer barns preferenser.

Som en del av ett hälsofrämjande danskt projekt vid namn ”*OPUS - New Nordic Diet”*, syftade denna studie till att undersöka 8-10 år gamla skolbarns acceptans och preferens av müslibarer baserade på nordiska ingredienser, samt att jämföra danska (n=100) och svenska (n=100) skolbarns acceptans och preferens för müslibarerna. Ett hedoniskt test genomfördes där en smiley skala användes för att mäta barnens sensoriska acceptans av fem müslibarer baserade på fullkorns spannmål, torkade bär, nötter och frön. Detta fullföljdes av en ranking av barerna.

Barnens acceptansnivå varierade mellan de fem olika proverna. Mest omtyckt var müslibarerna baserade på kamut och pumpafrö samt havre och tranbär. Minst omtyckt var müslibaren baserad på pumpernickel och havtorn. Liknande resultat noterades i båda länderna. Barnens preferenser styrdes i hög grad av produkternas sensoriska karaktär. Framförallt tenderade smaken att vara av betydelse. Müslibarerna har goda förutsättningar att främja hälsosamma livsmedelsval men ytterligare undersökningar krävs för att utforska huruvida de är accepterade även på längre sikt.

Nyckelord: *Acceptans, nordiska mellanmål, livsmedelsval, kulturella skillnader*

Preface

This Master's thesis was the final project for receiving the Master of Science degree with a major in Food Service Management at Gothenburg University. It was carried out as part of a health promotion Danish project called *OPUS - New Nordic Diet*. To be a student and get the chance to work in a large health promotion project with many professionals was a great opportunity. One of the best experiences was to meet people with the same interests and ambitions searching for new knowledge. To face the truth, this searching turned out to be a never ending story, and the more I learned, the more I realised how much I did not know!

The completion of my master thesis would not have been possible without the support and encouragement of several individuals.

- First I would like to express my gratitude to my three supervisors Karin Wendin, Lena Jonsson and Wender Bredie, who have guided this project from the beginning with thoughtful and valuable advices. I would also like to acknowledge and thank the sensory team in Copenhagen, especially Helene Hausner and Helene Reinbach for all your help and support. In addition, many thanks goes to the Danish student Sandra Bjørn Nielsen who helped me to conduct the study and to Meyers Madhus who produced the muesli bars being evaluated.

- Much appreciation goes to all the children and teachers at the participating schools in Copenhagen and Malmö.

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Thank you!

Anna Holmer

Gothenburg, June 2010

How far you go in life depends on your being tender with the young, compassionate with the aged, sympathetic with the striving and tolerant of the weak and strong.
Because someday in life you will have been all of these.

- George Washington Carver -

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1 Definitions

Acceptance and acceptability refers to "the degrees of liking and disliking, as typically assessed with numerical scales" (Lawless & Hewmann, 1999, s 628)

Flavour is a sensation perceived as a combination of retro-nasal and oral stimulation (Laing & Jinks, 1996).

Hedonic refers to "the likes, dislikes, or preferences of a person" (Lawless & Hewmann, 1999, s 809)

Neophobia is the avoidance of, and reluctance to taste, unfamiliar foods (Birch, 1999).

Preference relates to "a situation of choice. One product can be preferred over another, irrespective of whether it is liked or not" (Prim, 2007, s 34).

Snack is any intake of food or beverage outside the main meals breakfast, lunch and dinner (Husby, 2008).

Taste is a sensation perceived by specialized receptors on the tongue and on the mouth surfaces. Humans can primarily identify five primary tastes; salty, sour, bitter, sweet and umami (Laing & Jinks, 1996).

Whole grain is the entire seed of a plant that contains the bran, germ and endosperm. The definition includes grain seeds from barley, oat, wheat, rye, rice, millet, maize and sorghum. It also includes grain seeds from "species, hybrids and cultivars from above mentioned genera" (Mejborn, 2008, s 11)

2 Introduction

Food choice in childhood is important for a number of reasons. Well balanced nutrition in early years promotes healthy growth and development (Alexander et al, 2004), but it might also prevent ill health in adulthood (Ebbeling, Pawlak & Ludwig, 2002). Previous studies have shown that Danish and Swedish school children eat unhealthy snack foods (Husby, 2008; Enghardt Barbieri, Pearson & Becker, 2006; Hoppe, Biltoft Jensen, Trolle & Tetens, 2009; Patterson, 2010). In order to improve children's snacking habits the present study hypothesis that that palatable and nutritious snack products developed for children might help them to make more healthy food choices. However, it is important to remember that food choices and food preferences are influenced by several factors, such as personal liking, food culture and the social environment (Shepherd, 1999). For instance, school meals are organized differently in Denmark and Sweden. In Denmark children often bring a lunch-pack from home, whereas in Sweden children are served free lunch at the school canteen (Johansson et al, 2009). Furthermore, even if the Nordic countries are following the same nutrition recommendations (Alexander et al, 2004), there are still differences in what kind of foods Danish and Swedish children eat during their meals (Enghardt Barbieri et al, 2006; Hoppe et al, 2009). Differences in food culture may influence Danish and Swedish children's acceptance and preference for snack foods. Based on this knowledge, as well as the potential value of providing children nutritious snack alternatives, the overall aim of the present study was to examine 8-10 year old school children's acceptance and preference for muesli bars composed of Nordic food ingredients and to compare Danish and Swedish school children's acceptance and preferences for the muesli bars. The study was conducted as part of a five-year (2009-2013) health promotion Danish project called *OPUS - New Nordic Diet (NND)*. The main objective of this project is "to establish a multi-disciplinary research centre to develop a healthy and palatable new food and eating concept *The New Nordic Diet*, and to examine how such a diet can affect mental and physical health". In addition, the diet will be based on appealing and environmental friendly foods that have a high potential to be grown and produced in a climate typical of the Nordic countries (Faculty of Life Science Copenhagen, 2010). By working multidisciplinary issues of food and eating can be viewed from different perspectives and professionals may reach a deeper understanding of the complexity of food choices and health in childhood.

Based on guidelines from the OPUS project that wanted to explore 8-10 year old school children's acceptance of snack foods based on Nordic ingredients, initially three snack alternatives were suggested to be produced and used for this study. These were apple chips, muffins and muesli bars. Following that the muesli bars had high potential to be produced in great varieties this was considered to be the most appropriate snack alternative in order to investigate children's acceptance and preferences for different combinations of Nordic ingredients. The outcomes of this study provide valuable feedback useful for several professionals working with children and food. Results contribute to the knowledge of children's acceptance of ingredients typically of the Nordic countries such as wholegrain cereals, seeds, nuts, fruits and berries. Moreover, it gives an indication of healthy snack alternatives that might be possible to produce in order to satisfy Danish and Swedish children's snack preferences.

3 Background

The aim of this literature review is to describe positive and negative aspects of snacking during childhood and to contribute to an understanding of the factors influencing children's food choice. Personal, environmental and social factors are described within a major focus on the human's five senses and the development of food preferences. Finally, the snacking market of today is described as well as the potentials to develop healthy snack alternatives for children composed of Nordic ingredients.

3.1 Snacking in children

Previous studies have discussed what types of food are snacks in different contexts. Mostly, the word snack is used as a synonym for "between the meals" and is defined as any intake of food or beverage outside the main meals (breakfast, lunch and dinner) (Savige, Macfarlane, Ball, Worsley & Crawford, 2007; Husby, 2008). This definition of snack foods is used in this paper.

Snack foods are often perceived as being harmful and not the best healthy eating. Though, snack foods can be important for a number of reasons. Above all, snacks have an important role in humans' diet, even more for children. When children grow and develop, snacks can help them to meet their nutrient and energy needs (Alexander et al, 2004; Gatenby, 1997). Additionally, previously studies of children's snacking in the mid-morning and the afternoon have found beneficial effect on children's attention and memory, associated with the intake of snack (Benton & Jarvis, 2007; Mahoney, Taylor & Kanarek, 2007). However, the intakes of snacks do not always contribute to a high intake of nutrients. In previously dietary studies of Danish and Swedish school children, Husby (2008) and Patterson (2010) found that a high energy intake from snacks in general was linked to its content of sugar and fat, providing lots of energy but few nutrients. This is a concern since unhealthy eating habits with an energy intake higher than needed in general is identified as a reason for weight gain. Moreover, the prevalence of overweight and obesity are linked to an increased risk for development of type 2 diabetes and heart diseases (Ebbeling, Pawlak & Ludwig, 2002; Alexander et al, 2004) Healthy food choices already in childhood can therefore be an important opportunity to prevent ill health. An exact definition of what healthy food is does not exist, only dietary recommendations that encourage humans to eat nutritious foods low in refined sugar and saturated fat (Alexander et al, 2004). Based on this knowledge, in present study "healthy snack" is defined as a food product based on nutritious ingredients that have a low contain of saturated fat and refined sugar.

Dietary recommendations

According to the Nordic Nutrition Recommendations 2004, guidelines which are based on nutrition and health science, adults and children should eat two to three in-between meals (snacks), spread evenly throughout the day. The snack foods, eaten between meals, are recommended to be of good nutritional quality and should give a maximum of 30% of daily energy intake. Food items preferable to eat are fruits, berries, vegetables, wholegrain products and low fat dairy products (Alexander et al, 2004). Most of these foods have a great content of minerals, vitamins and dietary fibers (Hallund et al, 2007; Mejborn et al, 2008; Alexander et al, 2004). Researchers have found the human health benefits from wholegrain cereals so important that today several health campaigns, inventions and projects are work-

ing in order to contribute to increase the intake of these products (Whole Grains Council, 2010; Mejborn et al, 2008). In Denmark and Sweden, the national nutrition recommendations have been changed in order to primarily choose wholegrain foods when eating bread, cereals, grains, pasta and rice (National Food Administration, 2009a; Mejborn et al, 2008).

Snacking and eating patterns in Danish and Swedish children

Previous dietary studies have found that Danish and Swedish children generally eat snack foods such as fruits, sandwiches, soft drinks, biscuits, dairy products, fast food and sweets (Hoppe et al, 2009; Enghardt Barbieri, 2006). Differences exist depending on the time of the day, i.e. mid-morning, mid-afternoon or evening. Generally less healthy items like pizza, biscuits, soft drinks and sweet are eaten in the mid-afternoon and the evening (Hoppe et al, 2009). Moreover, some of the snack foods popular in Denmark are not very common in Sweden, for example "sausage horn" and ostehaps (melted cheese). Recent years, improvements have been noted in the dietary intake of Swedish children. However, further improvements in the dietary intake are still needed since the daily intake of unhealthy snacks is common. In particular boys eat lots of sweets and have a high intake of soft drinks (Swedish National Institute of Public Health, 2010).

Differences in eating patterns between the Nordic countries have previously been reported (Kjærnes, Pipping Ekström, Gronow, Holm & Mäkelä, 2001; Johansson et al, 2009). School meals, for instance, are organized differently in Denmark and Sweden. In Sweden children are offered a free lunch at the school canteen, paid by public funds. On the contrary, in Denmark children often bring a packet lunch from home, and they eat at their desk. This lunchbox is usually split over the day, in a contain foods having for lunch as well as snacks. Danish children can also buy food at the school cafeteria (Johansson et al, 2009). Consequently, Danish children might have a greater influence on what type of food is packed in their lunch boxes, whereas Swedish children, who eat in the school canteen, are served the same food dish. The influence of the Danish children may also affect the energy and nutrients value of their meals. Moreover, this may have consequences for what types and how many snacks Danish and Swedish children usually eat during a school day. Nevertheless, Danish and Swedish children have in common that there is a need for improvement in their snacking habits. What is important to remember is that food choices are affected by several factors (Shepherd, 1999; Story, Kaphingst, Robinson-O'Brien & Glanz, 2008). These factors require great attention in order to understand the diversity of children's food preferences, and to understand what type of healthy food products that might be developed in order to satisfy children's snack preferences.

3.2 Theory of food choice

The challenge of explaining the complexity in food choices has resulted in a number of food choice models (Furst, Connors, Bisogini, Sobal & Winter, 1996; Shepherd, 1999; Story, Kaphingst, Robinson-O'Brien & Glanz, 2008). One of the models that clearly illustrate this, also used as a theoretical viewpoint in this Master thesis, is the model from Shepherd (1999) (*figure 1*). In this model, Shepherd has categorised factors influencing food choice into three groups: factors related to food, to the person making the choice and to the economical and social context in which the choice is made.

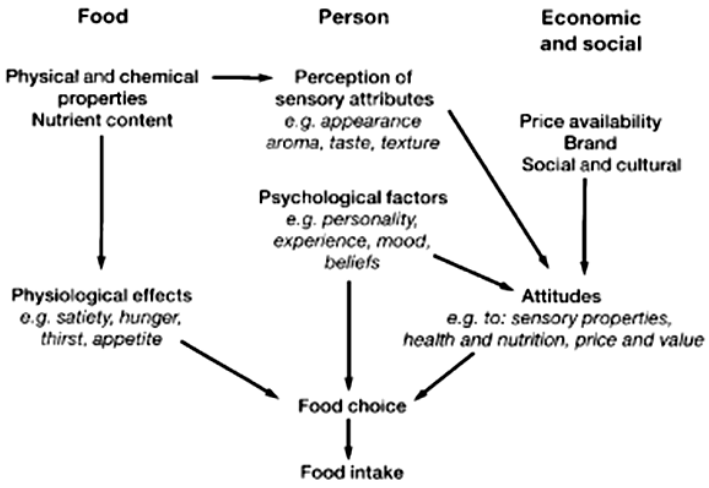

Figure 1. *Food choice model by Shepherd (1999), illustrating factors influencing food choices (s 808).*

In *figure 1* it can be seen the physical and chemical factors in the food cause the individually perceived sensory attributes of aroma, appearance, taste and texture. Depending on the individual personality and previous experiences, these experiences can be interpreted as a pleasant and positive attitude towards the product, which also can lead to an acceptance of the food. Furthermore, the attitude towards food can be affected by socioeconomic factors and the social environment. Price and accessibility of food products are two examples of factors that limit our choices. Under certain circumstances our basic physiological needs such as appetite, hunger and thirst can be so strong that they lead directly to food choices (Shepherd, 1999).

3.3 Factors influencing children's food choice

Food preferences in children are mostly affected by personal liking, but early experiences also play an important role in the establishment of food preferences (Birch, 1999). In a longitudinal study Skinner, Carruth, Bounds and Ziegler (2002) found that neophobia early in life at age 8, was positively related to the number of food disliked or never tried and it was negatively related to the number of foods liked. Additionally, researchers have found that the liking of novel food increased after repeated consumption because the novel food/taste became more familiar to the children (Wardle, Herrera, Cooke, & Gibson, 2003; Liem & dee Graaf, 2004). Sullivan and Birch (1990) shown that sweetened, salted or plain tofu required 8 to 15 exposures for preference learning to take place among children aged 3-4 years. Liem and dee Graaf (2004), however, found that 8 exposures to sweetened orange juice were enough to increase 8-11 olds' preferences.

Parents might have an important role in the development of children's food preferences, since what is purchased and served as meals affects children's access to foods as well as their intake of foods (Patrick & Nicklas, 2005). In a review of associations between the family environment and children's fruit and vegetable consumption, it was found that the family environment and the availability of fruits and vegetables was important for the promotion of healthy eating behaviours (Pearson, Biddle & Gorely, 2009). A sometimes hectic lifestyle in today's society, however, has resulted in barriers for parents to plan well balanced meals for the family. Instead, meals are easily replaced by convenient food alternatives, such as fast

food or snacks (Haerens et al, 2009; Olsen, Prebensen & Larsen, 2009). Husby (2009) have found that children were given sweets because of their handiness to be served and eaten, compared to fruits that required preparations. In addition, a study on Danish children's influences on the family decision process during food shopping showed that children had great influence on the purchasing of small and easy prepared meals, foods that were easy to prepare and unhealthy foods like sweets (Kümpel Nørgaard, Bruns, Haudrup & Romero, 2007).

When children start kindergarten and school, their eating patterns start to be increasingly influenced by factors other than the home environment. Pressure from friends is one factor that influences the food intake (Haerens et al, 2009; Birch, 1999; Contento, Williams, Michela & Franklin, 2006). Moreover, grocery stores and kiosks located close to schools often supply a rich selection of unhealthy food. This means that unhealthy food can easily be purchased, especially if there are no other healthier options perceived as attractive and palatable (Sylow, 2005; Haerens et al, 2009). In addition, the marketing of foods to children often highlights unhealthy food as cool and popular (Folta, Goldberg, Economos, Bell & Meltzer, 2006), or promoted as healthier by means of various rhetorical techniques (Prell, 2010).

A common strategy in order to reduce children's unhealthy snacking habits is to prohibit them to buy and eat unhealthy foods. This is usually a strategy that is not very successful. On the contrary, it has been shown that prohibition of snacks leads to a relatively higher snack consumption in school children (Jansen, Mulkens & Jansen, 2007). Moreover, a Danish field study conducted in sport halls showed that children perceived snacks, in contrast to main meals, as a domain where they had control and was identified as a community of their own culture (Sylow, 2005). In addition Husby (2008) has found that children eating unhealthy tend to snack more alone compared to children with healthier eating habits that associate the snacking of "bad food" as a shared social event and the marker of a special social occasion.

It has been argued that there are differences in food preferences between different gender and age groups during childhood (Allesen Holm, Bom Frøst & Bredie, 2008; Cook & Wardle, 2005). Therefore, it is suggested that when food choices are provided to children, gender differences should be taken into consideration (Caine-bish & Sheule, 2009). Gender differences are often found for diverse food items such as fruits and sweets (Hill, Wardle, & Cooke, 2009; Swedish National Institute of Public Health, 2010). However, in a study investigated Danish school children's preference for different types of apples, Thybo, Kühn and Martens (2004) found that girls preferred the appearance of green sour apples but preferred the taste of the red aromatic apples. The results among the boy's were the opposite.

Children's eating habits and choice of food respond to a number of different factors. However, of all these, the major influence of food preference and food choices is known as the sensory-affective response to taste, smell, appearance and texture of food. This sensory-affective response involves the five senses of human being (Lawless & Heymann, 1999).

3.4 The five human senses

When humans eat, the five senses: sight, smell, taste, touch and hearing provide information about the food. Sight provides information about the appearance (colour, shape and size) of the product and has also significant impact on how the taste, smell and texture are perceived. The appearance of the product does also create expectations induced by past experiences

(Lawless & Heymann, 1999). In fact, humans can find it difficult to identify the flavour of a product which is coloured differently (Levitan, Zampini, Li & Spence, 2008; Meiselman & Macfie, 1996). The feeling of food in the mouth is a result of the sense of touch, including texture and temperature. Furthermore, the texture of food produces different sounds when is chewed and it is known as an important factor related to the perception of food quality (Lawless & Heymann, 1999). Other factors that also influence if the food is likely to be eaten in the future are the taste, flavour and smell. Humans can primarily identify five primary tastes in the mouth; salty, sour, bitter, sweet and umami. When a person actually talks about good taste, she or he generally means good flavour. However, differences exist between these two terms. Taste is perceived by specialized receptors on the tongue and on the mouth surfaces. Flavour is a sensation perceived as a combination of retro-nasal and oral stimulation (Laing & Jinks, 1996).

Human's preferences and acceptances of foods begin early in life. In fact, it is suggested that this begin before birth. In a study where mothers were drinking carrot juice during pregnancy, it appeared that their infants liked cereals prepared with carrot juice more than infants whose mothers were drinking non-flavoured water (Mennella, Jagnow & Beauchamp, 2001). Preferences for tastes and foods changes during the lifespan as the child grow into adulthood (Birch, 1999; Desor & Beauchamp, 1987; Drewnowski, 1997). The preference for sweet foods is generally higher during childhood than adulthood (Desor, Greene & Maller, 1975; Desor & Beauchamp, 1987). However, it has also been argued that children do not necessarily prefer sweet foods and beverages. A pilot study involving more than 8 000 Danish children and adolescents, tasting soft drinks with varying sweetness and sourness, showed that 17 % of the children preferred the sample with an extreme sour taste (Allesen Holm et al, 2008). Moreover, in a study of taste-sensitivity Liem, Westerbeek, Wolterink, Kok, and Cees de Graaf (2004) found that sour taste preference was related to the willingness to try novel food; children with preferences for extremely sour tastes were more open to taste new food.

3.5 Children's preferences for healthy snack foods

Few studies have been conducted in order to examine children's sensory preferences for healthy and novel snack foods. Some of the previous studies have produced interesting results regarding children's and adolescents preferences for healthy foods. In a study where school children from Minnesota were asked about the acceptability and promotion of new food products it was showed that the most important factors, in order to accept a new product, were connected to the product's familiarity, appearance and taste. Additionally, products that looked too healthy were not desirable, since eating a healthy product in front of friends could be embarrassing (Burgess Champoux, Marquart, Vicker, & Ricks, 2006). On the contrary, it is also known that healthier varieties of products can be accepted. For instance, modified pizza product baked with 50 % white and 50% whole wheat flour, served for lunch in a school cafeteria was as accepted by elementary schoolchildren as a pizza baked entirely with refined wheat flour (Chan, Burgess Champoux, Reicks, Vickers, & Marquart, 2008). In addition, Rosen, Sadeghi, Schroeder, Reicks and Marquart (2008) have shown that American school children are willing to eat more wholegrain cereals when these are gradually introduced into their school lunches.

Ruder (2007) examined Swedish adolescent's acceptance and preference for six crispy and smooth cereals bars, flavored with apple-vanilla, blueberry-lemon and chocolate-coconut. Result showed that the two samples highly accepted were the smooth and the crispy cereals

bars flavored with chocolate-coconut. The textures of the cereals bars appeared to be less important than the flavour. This result is in line with a previous survey of healthy and unhealthy snacking behaviour in English and Scottish primary school children. In this study Bower and Sandali (2002) found that tastes of foods were the main reason for children's snack choices. Appearance was also important, but often in a negative way with a strong attitude of dislike. Least important factors were shape and colour.

Hart, Bishop and Truby (2002) have found that elementary school children of UK prefer and select appealing and attractive snacks without noticing their dietary value. This highlights the fact that, despite children's knowledge about healthy food options, they intentionally choose the products they prefer (Haerens et al, 2009; Sylow, 2005). The importance children give to the sensory attributes of foods also indicate that there is need for further understanding of children's sensory acceptance and preference for different food products.

3.6 The snacking market

Our changing lifestyle has produced new opportunities in the market of snack foods in the Nordic countries as in other parts of the world. A market which results in many different snack products, developed for adults and for children (Walker, Woods, Rickard & Wong, 2007; Nestle, 2007). Although the nutrient qualities of snack products have improved, there is still need for improvements. This is the conclusion of a report of the Consumer Association Stockholm (2009) who investigated the supply of food products aimed at children. According to the report, nutrients that have to be restricted are the flavour carriers: salt, sugar and fat. A challenge, since most of the food aimed at children, like breakfast cereals, sweet biscuits and flavoured dairy products get their special character by these flavour carriers. Similar results have been found in a research conducted by the Yale University's Rudd Center for Food Policy and Obesity (Harris et al, 2009), who studied the nutrient composition and the comprehensive marketing efforts of cereals. The results showed that cereals marketed to children, compared to those marketed to adults, contained 85 % more sugar, 65 % less fiber and 60 % more sodium. Furthermore, the least healthy cereals were the ones most marketed to children.

The supply of unhealthy snack foods is also found in a Danish report of healthy foods in sport halls (Dejgård Jensen, 2010). The report showed that there was a great interest to sell healthier food in the cafeteria, but still improvements were needed since candy, soft drinks and less healthy fast foods were a great part of the assortment. The desire for healthier snack foods, however, is not only a request from professionals. In a qualitative research where Swedish school children created their own foodscapes it was shown that they had a great preference for sweets. At the same time the children knew that this food was unhealthy and they asked for healthier alternatives (Brembeck et al, 2010). In Sylows (2005) study of Danish children's food culture in sport halls, children wanted foods that were convenient to eat and to take away.

3.7 Snack foods based on Nordic ingredients

According to WHO´s (2004) report, *Global Strategy on Diet, Physical Activity and Health*, the food industry should continue to "develop and provide affordable, healthy and nutritious choices to consumers" (s 13). What humans eat influences strongly the environment. Therefore, in the development of new food products it is not enough to be concerned only for hu-

man health. Health incorporates what humans need to stay healthy, what the earth needs to stay healthy, and how that can be possible in our governments and economies. It is a sustainable way of thinking, in which the environment and the human beings are central (Lang & Heasman, 2004). For instance, foods having a low impact on the environment compared to other food groups, are cereals and locally produced fruits and berries (National Food Administration, 2009b). These foods have a high potential to be grown in a climate typical of the Nordic countries (Bere & Brug, 2008). Moreover, wholegrain cereals, fruits, berries and nuts/seeds are foods high in nutrients and dietary fibres and could be used in a snack option in the form of muesli bars. For certain, muesli and snack bars already exist today, but these bars seem most often to be developed in order to meet adult's requirements and are often used as slimming products (Jacobsson & Lundberg, 2009). Many of the muesli bars do also have a high content of saturated fat or sugar and are more suitable as sweets, especially the chocolate bars (Kellogg's, 2009; Jacobsson & Lundberg, 2009). Some studies on children's and adolescents preferences for snack bars exist (Liem & Zandstra, 2009; Ruder, 2007), but the results are limited and there is a lack of knowledge on children's preferences for muesli bars based on different variants of wholegrain cereals and dried berries.

It is important to keep in mind that in order to develop successful products it is not enough that they are healthy to eat. Sensory characteristics of the product must appeal to the children and accomplish their attitudes. Previous studies have suggested that grey colour, bitter taste and texture of wholegrain cereals can be barriers to reach children's (Rosen, 2009; Delk & Vickers; 2007) as well as adults' (Pohjanheimo, Paasovaara, Luomala, & Sandell, 2010; Bakke & Vickers, 2007) acceptance for wholegrain products. In a study by Sadeghi and Marquart (2009), among 117 U.S. school children in the 6th grade, differences in the consumption of crackers containing high and low level of wholegrain flour were compared. The result showed that children were more sensitive to the taste and texture of crackers containing 100 % wholegrain than less wholegrain. In a study of Swedish children's breakfast intake, aged 11-15, Berg, Jonsson, Conner and Lissner (2003) have found that children perceived the refined bread as tastier than the high-fibre bread (whole-wheat or rye bread). Considering these results, there may be a great interest for further understanding of children's acceptance and preferences for different wholegrain products.

3.8 Summary of background

Well balanced nutrition in childhood is important for the growth and development of the child but it might also have long-term health implications (Alexander et al, 2004; Ebbeling, Pawlak & Ludwig, 2002). Several studies have identified a common concern that Danish and Swedish school children eat unhealthy snack food (Husby, 2008; Enghardt Barbieri et al, 2006; Hoppe et al, 2009; Patterson, 2010). Improvements in children's dietary habits are needed. However, it is not enough to suggest that children should eat more fruits, vegetables and wholegrain products. Healthy snack alternatives to suit children's taste preferences (Sadeghi and Marquart, 2009; Bower & Sandali, 2002) and food culture (Husby, 2008; Johansson et al, 2009) also need to be considered. This study hypothesis that palatable and nutritious snack products developed for children might help them to make more healthy food choices. A big challenge is that "too healthy" food may be perceived as ridiculous and embarrassing to eat by children (Burgess-Champoux et al, 2006; Haerens et al, 2009). Furthermore, food choices and food preferences are influenced by other factors, such as personal liking, food culture and the social environment (Shepherd, 1999). For instance, school meals are organized differently in Denmark and Sweden (Johansson et al, 2009). There are also

differences in what kind of food Danish and Swedish children eat during their meals (Enghardt Barbieri et al, 2006; Hoppe et al, 2009). Differences in food culture may influence Danish and Swedish children's acceptance and preference for novel snack foods.

The muesli bar is a snack product that can be produced in great varieties. Depending on what kind of ingredients the muesli bar contains, it is possible to get a product with different appearance, smell, texture, flavour and taste. Consequently, the muesli bar has a great potential to be attractive to children and at the same time being healthy to eat. Moreover, the muesli bar can be an alternative to the unhealthy snack food that is convenient to eat and to take away. Muesli bars produced on environmentally friendly Nordic ingredients such as wholegrain cereals, seeds, fruits and berries, can also be a part of the of sustainable development concept. To conclude, muesli bars composed of Nordic ingredients might be a future snack alternative to the Danish and Swedish school children. However, only the children themselves can tell if the muesli bars are snack alternatives suiting their taste preferences and food culture.

4 Aim

In this chapter the overall aim and the specific aims of this study are presented. The limitations of the study are also described.

4.1 Overall aim

The overall aim of this study was to examine 8-10 year old school children's acceptance and preference for muesli bars composed of Nordic food ingredients and to compare Danish and Swedish school children's acceptance and preferences for the muesli bars.

4.2 Specific aims

- To investigate how Danish and Swedish children respond to the appearance, smell, flavour/taste and texture of the muesli bars.
- To investigate if there are any differences in acceptance and preferences for the muesli bars between Danish and Swedish school children and between genders.
- To investigate if Danish and Swedish children would like to eat the muesli bars again.

4.3 Limitations

In order to reduce individual differences in the result, this study included a minimum of 100 school children from each country. Furthermore, non participations and non responses were expected. Therefore over recruited was considered as necessary. A number of children corresponding to approximately one school class in each country were over recruited. The number of children required in the study regulated the number of school classes being involved. Considering logistical and practical circumstances, the schools recruited for the study were placed in one local area in each country. Moreover, the number of muesli bars evaluated by the children was limited to five.

5 Material and Method

The study was conducted in the spring of 2010. In this chapter the research design, the products and the study procedures are presented, together with statistical analysis and the reliability of the method.

5.1 Research design

Consumer satisfaction can be measured through statistically based sensory evaluation methods. Lawless and Heymann (1999) define sensory evaluation as a scientific discipline used to evoke, measure, analyse and interpret reaction to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing. The sensory evaluation methods can be either objective or subjective. In the objective studies, a trained panel objectively describes the attributes of the products using defined sensory descriptors. The subjective studies are conducted with consumers in order to measure their attitudes and emotional responses towards the products (Lawless & Heymann, 1999). In this paper, a subjective study was conducted to evaluate sensory acceptability and preference for muesli bars in school children.

Generally there are two main approaches to consumer sensory tests; the measurement of preference and the measurement of acceptance. In the measurement of preference the consumer has a choice, which means one product has to be chosen over one or several products. In the measurement of accepting, the consumers are asked to rate their liking for the product on a scale (Lawless & Heymann, 1999). To evaluate Danish and Swedish children´s acceptance and preference for five different muesli bars, acceptance ratings and preference rankings were performed. If only the children's acceptability were measured, it could be a risk that the children would rate all the products samples equally. Consequently, the products most or least preferred may be difficult to identify. On the other hand, if children are asked to rank also the products from the best to the worst, these results can guide which samples are most/least preferred. In sensory tests conducted with children, it is important to remember that children have a wide range of sensory and cognitive abilities. This means that special consideration must be given to the design of methods (Guinard, 2001; Popper & Kroll, 2005). The considerations important for present study have been described in this chapter.

5.2 Subjects and recruitments

The target populations in the present study were Danish and Swedish school children, aged 8-10 years. 150 Danish children and 126 Swedish children in class 2, 3 and 4, were recruited from one primary school in Copenhagen and three primary schools in Malmö. Six school classes were recruited from each country. The school in Denmark was located rather close to the central city area, while the Swedish schools were placed in a prosperous suburb. All the school classes and children were recruited through headmasters and class teachers working at the schools. Exclusion criteria for participations were food allergy or food intolerance to any of the ingredients in the muesli bars. Additionally, since the children were minors, all children were required to have parental consent to participate.

Information on the study was given by telephone and trough information sheets sent via e-mails to headmasters and class teachers (*attachment 1*). Moreover, in Sweden, the six school classes were visited two weeks before the sensory study. During the visits, the children were verbally informed about the purpose of the research and the information sheets aimed at the parents were

handed out (*attachment 2*). The information sheet asked parental permission for the participation of the children to the study and they also request if the children were allergic or intolerant to any particular food. In Denmark, the school classes recruited to the study were not visited by the researchers themselves. Instead, a teacher working at the school, involved in the OPUS-project, was responsible for the contact with the teachers and children and for the distribution of the parental information sheets.

The ethical committees in the two countries were consulted in order to obtain permission before the study was performed. Moreover, with respect to research ethical principles set by the The Danish National Committee on Biomedical Research Ethics (CVK, 2008) and the Swedish Research Council (Swedish Research Council, 2002), all children were informed about the purpose of the study and their participation was voluntary. Additionally, the children were told that their answers were confidentially handled and that no names were revealed publicly.

5.3 Products

Based on well working methods found in previous sensory studies with children, the number of muesli bars evaluated in the present study was limited to five (Léon, Couronne, Marcuz & Köster, 1999; Liem, & Zandstra, 2009). All of the muesli bar samples were produced at "Meyers Madhus" in Copenhagen, known as a gastronomic consulting firm. The food ingredients and the approximate nutritional value of the five muesli bars are shown in *table 1*. In the table, the five samples are abbreviated with two different letters of the food ingredients of each muesli bar (*PB*, *KP*, *RB*, *BS*, *OC*). The five samples were all made of Nordic ecological produced food ingredients such as wholegrain cereals, nuts, seeds and dried fruits/berries. However, the fondant powder used as a binding agent was not ecological produced. The size of each taste sample was on average 8-9 gram.

Table 1. *The ingredients and the approximate nutritional value of the five muesli bar.*

Picture of product	Abbreviation	Product	Ingredients	Nutritional contents /100 g
	PB	*Pumpernickel Buckthorn*	Pumpernickel, buckthorn, rye, egg-white, fondant powder, sugar	Energy: 1202 kJ Carbohydrates: 65 g Sugar: 16 g Fat: 1 g
	KP	*Kamut Pumkins*	Kamut wheat, pumpkin seeds, hazelnuts, egg-white, sugar, honey, butter, fondant powder	Energy: 1543 kJ Carbohydrates: 39 g Sugar: 7 g Fat: 20 g
	RB	*Rye Bilberry*	Rye flakes, bilberries, rye bread, egg-white, honey, sugar, fondant powder	Energy: 1448 kJ Carbohydrates: 78 g Sugar: 12 g Fat: 2 g
	BS	*Buckwheat Strawberry*	Buckwheat, strawberries, oat, verbena, lemon peal*, fondant powder, egg-white, butter	Energy: 1596 kJ Carbohydrates: 69 g Sugar: 19 g Fat: 8 g
	OC	*Oat Cranberry*	Oat, cranberries, hazelnuts, spelt, pumpkins seeds, fondant powder, egg-white, sugar	Energy: 1729 kJ Carbohydrates: 54 g Sugar: 14 g Fat: 19 g

*Lemon was used in order to replace some of the missing lemon Verbena.

All muesli bars were produced one to three days before they were evaluated by the first school classes in Sweden. In order to maintain the products fresh and to guarantee quality, crunchiness and microbiologic safety of the muesli bars, they were packed in a modified atmosphere of approximately 30 % CO_2. The *OC* bars were packed separately. The *KP* and *BS* bars, and the *PB* and *RB* bars, were packed together.

To give an indication of the characteristics of the muesli bars in regard to aroma intensity, fruit/berry odour, flavour intensity, sweetness, fruit/berry flavour, glossiness, redness, golden colour, crunchiness, particle size and liking, a sensory napping method was used (Pages, 2005). A napping method is a "fast" method used and simple in order to get indications of sensory characteristics of products. The results have to be regarded as indications. Five researchers involved in the study positioned the muesli bar samples according sensory perceived distances between the samples. A principal component analysis (PCA) was performed in the software program Simca-P+ v.11 (Umetrics AB) to provide a graphical display (plot) of the products (*figure 2)*. The plot shows totally 82 % of the variation, which also gives an overview. Results in the figure indicate differences in sensory attributes between the five samples, telling that the *KP* bar had a sweet taste, glossy and golden appearance as well as a large particle size. The *OC* bar was placed in the middle of all the sensory attributes. The *BS* bar was characterised by the aroma and flavour of fruit/berry, redness, some crunchiness and low sweetness. The *PB* bar had an aroma and flavour of fruit/berry, but it was not very crunchy and sweet. Finally, the *RB* bar was not crunchy, it was quite sweet and was low in both redness and flavour intensity.

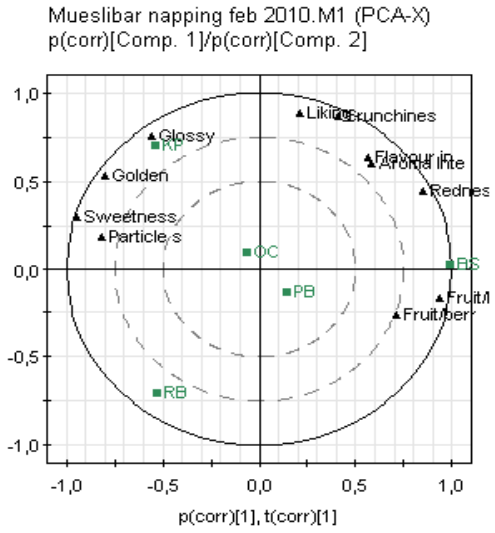

Figure 2. *Principal component analysis (PCA) of sensory data of the five muesli bars based on the napping method. The figure shows what attributes characterise the five muesli bars.*

5.4 Study procedure and questionnaires

In order to decrease the ambiguity in the questionnaires used for the evaluation of the muesli bars, a pilot study of the questionnaires was performed before the actual research was conducted. Seven children aged 7-11 answered to the three questionnaires. In respond to the children's feedback the numbers of questions were limited and the questions were rewritten in a more child-friendly way.

The acceptance and preference tests of muesli bars were conducted over three days in Denmark and five days in Sweden. In Sweden the tests took place in the classroom of every school class. In Denmark the same classroom was used for all the school classes. The five different muesli bars were tasted in one session, one session for each school class. Every session was conducted in the morning or midmorning, during approximately 60-80 minutes. The children received no information about the ingredients of the five muesli bars before or during the test. To minimise peer pressure and interpersonal influence, the children were asked not to talk to each other. In addition, the children were positioned in a way that they could not see each-other. Binders were placed between the children, illustrated in the *figure 3*.

Figure 3. *Children tasting and evaluating the five muesli bars.*

Except from the tasting of muesli bars, the children were also asked two questions about the snack food they used to, and preferred to eat. The questions asked were; *what kind of snacks do you usually eat during weekdays?* and *what would you prefer to have as a snack if you had free choice?* The children's answers were given individually in a written questionnaire by drawing a circle around two pictures of snacks representing the snacks they used to eat and their snack preferences, such as sandwiches, fruit/vegetables, muesli bars, fast food, dairy products cookies, sweets etc. In order to suit the two countries food culture, different pictures were used in the Danish and the Swedish questionnaires (*attachment 3*). The pictures were selected on the basis of previous dietary studies in Swedish and Danish children (Husby, 2008; Enghardt Barbieri et al, 2006; Hoppe et al, 2009). The questions on snacking habits and snacking preferences were asked before the sensory test of the muesli bars was performed. Results were used mainly to create a picture of the snacks the children used to and preferred to eat if they had a free choice, included their preferences for muesli bars. Furthermore, an indication of snack alternatives that satisfy children's snack preferences emerged among muesli bars.

Acceptance rating

A common scale in a sensory acceptance test is the hedonic scale, also known as a degree of liking scale. This scale can be used with pictures of facial expressions, suited for children (Guinard, 2001). Based on experiences found in previous studies of consumer sensory test conducted with children, in this study a 7-point hedonic face scale was used to measure children's liking of the five muesli bars (Popper & Kroll, 2005; Guinard, 2001). The scale, shown in *figure 4*, was graded from "really bad" to "really good".

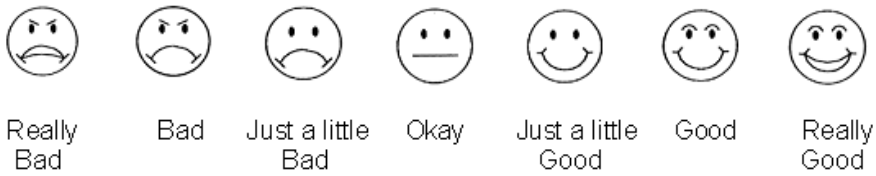

Figure 4. *7-point hedonic face scale.*

In each school class, the muesli bars were served according to a Latin square design (Meilgaard, Civille & Carr, 2007). All the samples were served one after another, resulting in six different serving orders used for the Danish and the Swedish school classes. In addition, the five muesli bars samples were coded with five different colours, one colour for each sample (*PB=yellow, KP=green, RB=red, BS=blue, OC=black*). Different colour codes for the muesli bars was used since the children probably found it easier to remember a colour instead of a three digit random number, otherwise used successfully in sensory consumer tests (Lawless & Heymann, 1999).

The muesli bars were served monadically to the children (one sample at a time), together with the hedonic face scale questionnaire marked with the specific colour code of the muesli bar. For each sample, children were asked to rate their liking of appearance, smell, flavour, texture (mouth feeling) and overall liking (*attachment 4).* This was done by colouring the smiley faces representing their answers in the specific colour code of the muesli bar. After the children had tasted the muesli bar sample, they also answered if they would consider to eat the same sample again (*yes, maybe, no*). The attribute overall liking was in this case explained as a measure of overall sensory appeal. This attribute was included in the questionnaires on the basis that perception of sensory characteristics and liking of food is caused by a complex composition of appearance, smell, taste and texture (Eertmans, Baeyens & Van den Bergh, 2001).

Preference ranking

After the acceptance ratings of the five muesli bars, children were instructed to rank the samples from the most preferred to the least preferred. A questionnaire with pictures of smiley faces was used also for this test, showed in *figure 5* and *attachment 5.* The children were asked to colour each smiley face with the specific colour representing the muesli bar (*figure 6).* By doing this the children ranked their preferences from most to least liked. Additionally, after the children finished the ranking test, they were asked to write individual comments regarding their likings for each muesli bar.

Figure 5. *Ranking questionnaire*

Figure 6. *Ranking of muesli bars.*

Information to children

Conducting sensory tests with children requires a detailed description and an introduction of the procedure (Popper & Kroll, 2005). In order to make the tasting procedure as much understandable as possible, the materials placed on the children's school desks, aimed at the sensory test, were explained to the children (*figure 7*). This included the use of coloured pencils, questionnaires, ranking scheme, glass of water and spit cup. After each muesli bar was tasted, children were also told to rinse their mouth with water before tasting the next sample.

To illustrate the testing procedure further, as well as the use of the hedonic faces scales, all children first tasted an apple each. By letting the children taste the apples, the sensory attributes asked for in the questionnaires were explained. Furthermore, the use of the smiley faces scale was clarified by showing and exemplifying the faces in the contexts of liking of different attributes. For example; *How much do you like the texture and the flavour of apples, bananas and crisps? Which smiley face corresponds to your likes/dislikes?*

In order to reduce misunderstandings, the children were given the opportunity to ask the researchers questions during the test. Additionally, children who needed extra assistance during the test were helped by teachers or researchers. In Sweden, teachers had also explained the use of the smiley faces scale once before the test day. All the information to children was given in the home language of respective countries.

Figure 7. *School desk set with the material used for the evaluation of muesli bars.*

5.5 Data analysis

Excel Microsoft 2003 software program and SYSTAT v. 10.0, SPSS Inc, were used for statistical analysis.

In Excel, the mean values and the standard deviations for acceptance ratings were calculated for the total population of children, for Danish and Swedish children respectively, and for boys and girls. The ratings were converted to a numeric score ranging from 1 (really bad) to 7 (really good). Moreover, the answers given in the snacking questionnaires were summarized for Danish and Swedish children, and for boys and girls.

In SYSTAT, analysis of variance (one-way ANOVA) was performed to examine differences in children's liking of the five muesli bars (appearance, smell, flavour/taste, texture, overall liking). Comparisons were made between Danish and Swedish children and between boys and girls. Finally, children's willingness to eat the muesli bars again was also analysed. Tukey's multiple comparison test was performed on attributes, for which effect significant differences were found in ANOVA. The significant levels were set at $p \leq 0.05$.

The ranks from the preference-ranking test were converted into a numeric score ranging from 5 (best) to 1 (worst). To analyse the results, the Friedman's test of rank sum was performed (Lawless & Heymann, 1999). The least significant ranked difference (LSRD) values were calculated to ascertain which of the samples were significantly preferred to the others. These analyses were performed using a significance level where $p \leq 0.05$.

The individual comments from the children regarding their liking of the muesli bars were compiled for each sample in order to get a picture of the children's generally liking for the different bars in respective country.

5.6 Validity and reliability of the method

There are a couple of limitations related to this research that need to be considered when interpreting the results. The first is that when a sensory consumer test is conducted in "real life", plenty of factors are involved in the decision making process, such as prices, packages of the products, time of the day, the place etc. Therefore, there might be a risk that the result could be different in another situation. Moreover there is no guarantee that all the children understood the questions in the questionnaires. Finally, since food preferences are diverse, it might be that the study results could have been different if the study were conducted in other school classes. Therefore, all these limitations should be taken into consideration before generalizing the results to other school children.

6 Results

This chapter presents the results of the study. The participating children and their snacking habits are described in the initial part of the results. Subsequently, the results of Danish and Swedish children's acceptance ratings and preference ranking of the five muesli bars are reported.

6.1 Danish and Swedish school children

Participants

The number of Danish and Swedish children participating in the study reached 134 and 109, respectively. *Table 2* shows the gender distribution for each country. The children participating in the study were expected to be aged 8-10 years. However, when the study was conducted it appeared that seven Danish boys and seven Danish girls were aged eleven. Since the children aged eleven did not differ from the other children in the acceptance ratings and preference ranking, the result from these were included in the study.

Table 2. *The number of participants in Denmark and Sweden. The numbers given in the parenthesis are percentages of the total number of children in the overall study.*

Children	Girls & Boys	Girls	Boys
Denmark ***DK***	134 (55.1)	68 (28.0)	66 (27.2)
Sweden ***SW***	109 (44.9)	63 (25.9)	46 (18.9)
Total DK & SW	**243 (100)**	**131 (53.9)**	**112 (46.1)**

Drop off /non completion

In Denmark, only the children able to participate in the study were guided by their teacher into the single class room used for the sensory tests of muesli bars. Therefore, it was not possible to report the reasons for non participation in the Danish children. In Sweden, the sensory tests of muesli bars were conducted in common classrooms, used by participants and non participants. Teachers were contacted a few days before the test in order to find out if any of the children had food allergies/intolerance or special needs. Reasons for non participation were in Swedish children (n=5) food allergy/intolerance and non parental permission. Furthermore, absence due to illness among children (n=12) was reported the day the muesli bars testing was performed.

Non completions of the questionnaires occurred in 27 of the Danish children and 10 of the Swedish children. Additionally, in Sweden two children did not complete the ranking of the muesli bars correctly. The children that completed some of the questions incorrectly were not excluded from the study, however the specific questions were not included. A summary over the non completion in the questionnaires is found in *attachment 6*.

Snacking and preferences for snacks

According to the information given by the teachers working at the recruited schools, Danish and Swedish children usually brought the snacks eaten in the midmorning from home. Con-

cerning the meals eaten in the afternoon, more or less all children in the Swedish schools were served a meal at the after school institution. In Denmark, the children had several options regarding where to eat the afternoon meal. The majority of the children were eating at home, at the youth club or at the after school institution. In the area around the Danish and Swedish schools, children were also able to buy snack foods from stores. Moreover, Danish children could purchase snack foods in the school cafeteria.

Based on the results found in the snacking questionnaires, the most common snack food to eat in Denmark were fruits and vegetables, bread/sandwiches and dairy products. Only four Danish children stated that they were used to eat muesli bars or dried fruit/nuts. When the same children were asked what snack foods they would like to eat if they had a free choice, it appeared that sweets/chocolate/ice cream, hamburgers/pizza and fruit were most preferred. Eight children preferred muesli bars or dried fruit/nuts. In a comparison between Danish boys and girls, the differences were small. However the boys preferred to eat sweets/chocolate/ice cream and hamburgers/pizza, whereas the girls also preferred fruits.

In Sweden, the children also were used to eat bread/sandwiches, dairy products and fruit/vegetables. Muesli bars or dried fruit/nuts were not typical snack foods to any of the children. Snack foods preferred by Swedish children, if they had a free choice, were soft drinks/juice, sweets/chocolate/ice cream and bread/sandwiches. Two children stated that they preferred muesli bars or dried fruit/nuts. Distinct differences between Swedish boys and girls were not observed.

6.2 Acceptance and preferences for muesli bars

6.2.1 Acceptance ratings - an overview

In *table 3* the mean values for liking scores and standard deviations are presented for every muesli bar for Danish and Swedish children all together and for Danish and Swedish children respectively. The mean rating scores showed that the *KP* and *OC* bars were the two samples Danish and Swedish children highly liked for all of the sensory attributes. Danish children, however, also rated the *RB* bar as one of the three samples they liked most for flavour/taste, texture and overall liking. Additionally, the appearance and smell of the *BS* bar was highly liked in both countries.

The *PB* bar was the sample rated significantly lowest by Danish and Swedish children (all together) for all of the sensory attributes. In addition, the *BS* bar was found among the least rated muesli bars in both countries. Except from the *PB* and *BS* bars, Swedish children also rated the *RB* bar as one of samples significantly least liked for all of the sensory attributes.

Comparing Danish and Swedish children's liking for the *BS* bar and the *RB* bar, an opposite relation was found. In Sweden, children rated their liking for the *BS* higher than the *RB* bar, whereas Danish children rated their liking higher for the *RB* bar. Though, significantly differences between the two samples were only found for smell and overall liking (Denmark) and appearance and smell (Sweden).

Table 3. *Mean values and standard deviations (m±std) of Danish and Swedish children's acceptance ratings of the five muesli bars. The results are compared horizontally for each sensory attribute. Mean values with different letters are significantly different at $p \leq 0.05$.*

Acceptance score muesli bars					
Danish and Swedish children	***Pumpernickel Buckthorn***	***Kamut Pumpkins***	***Rye Bilberry***	***Buckwheat Strawberry***	***Oat Cranberry***
Appearance	3.81± (1.76)^{a}	5.22± (1.73)^{b}	4.40± (1.76)^{c}	5.20± (1.79)^{b}	5.34± (1.61)^{b}
Smell	3.63± (1.92)^{a}	5.26± (1.80)^{b}	4.16± (1.87)^{c}	5.21± (1.95)^{b}	5.19± (1.83)^{b}
Flavour/taste	3.18± (2.13)^{a}	5.13± (2.07)^{b}	4.44± (2.21)^{c}	4.18± (2.24)^{c}	5.15± (2.06)^{b}
Texture	3.64± (1.94)^{a}	5.10± (1.84)^{b}	4.52 ± (1.91)^{c}	4.32± (1.94)^{c}	5.20± (1.88)^{b}
Overall liking	3.47± (2.09)^{a}	5.20± (1.98)^{b}	4.58± (2.07)^{c}	4.07± (2.21)^{c}	5.25± (2.01)^{b}
Eating again	1.68 ± (0.79)^{a}	2.30± (0.83)^{b}	2.11± (0.83)^{bc}	1.93± (0.92)^{c}	2.39± (0.79)^{b}
Danish children	***Pumpernickel Buckthorn***	***Kamut Pumpkins***	***Rye Bilberry***	***Buckwheat Strawberry***	***Oat Cranberry***
Appearance	3.85± (2.01)^{a}	5.12± (1.94)^{bc}	4.64± (1.86)^{c}	4.89± (1.98)^{bc}	5.37± (1.77)^{b}
Smell	3.65± (2.08)^{a}	5.26± (1.94)^{b}	4.36± (1.97)^{c}	5.19± (2.12)^{b}	4.92 ± (2.00)^{bc}
Flavour/taste	2.98± (2.21)^{a}	5.02± (2.23)^{b}	4.80± (2.27)^{bc}	4.07± (2.36)^{c}	4.92± (2.26)^{b}
Texture	3.34± (2.01)^{a}	4.94± (2.01)^{b}	4.58± (2.06)^{bc}	4.16± (2.06)^{c}	4.91± (2.16)^{b}
Overall liking	3.17± (2.16)^{a}	4.92± (2.24)^{b}	4.84± (2.21)^{b}	3.84± (2.39)^{a}	4.96± (2.27)^{b}
Eating again	1.60± (0.79)^{a}	2.23± (0.88)^{b}	2.21± (0.85)^{b}	1.87± (0.87)^{a}	2.36± (0.83)^{b}
Swedish children	***Pumpernickel Buckthorn***	***Kamut Pumpkins***	***Rye Bilberry***	***Buckwheat Strawberry***	***Oat Cranberry***
Appearance	3.75± (1.42)^{a}	5.35± (1.43)^{b}	4.11± (1.60)^{a}	5.56± (1.44)^{b}	5.31± (1.39)^{b}
Smell	3.60± (1.70)^{a}	5.26± (1.62)^{b}	3.92± (1.72)^{a}	5.22± (1.73)^{b}	5.52± (1.53)^{b}
Flavour/taste	3.42± (2.01)^{a}	5.27± (1.86)^{b}	4.00 ± (2.08)^{ac}	4.30± (2.09)^{c}	5.44± (1.75)^{b}
Texture	4.01± (1.78)^{a}	5.28± (1.60)^{b}	4.45 ± (1.72)^{a}	4.51± (1.78)^{a}	5.56± (1.38)^{b}
Overall liking	3.83 ± (1.95)^{a}	5.54± (1.57)^{b}	4.25 ± (1.83)^{a}	4.34± (1.94)^{a}	5.61± (1.56)^{b}
Eating again	1.78 ± (0.79)^{a}	2.38± (0.77)^{b}	1.98 ± (0.80)^{a}	2.00± (0.98)^{a}	2.43± (0.75)^{b}

Boys and girls

Significant differences in muesli bars acceptance between boys and girls were not observed for any of the muesli bars, in any of the two countries. However, in a comparison of liking scores between Danish and Swedish boys and Danish and Swedish girls, significant differences were noted *(attachment 7)*. In the graph on following page (*figure 8*), the ratings for overall liking of each muesli bar are shown for girls and boys in the respective countries. Results showed that Swedish boys rated the *KP* and the *BS* bars significantly higher compared to Danish boys. Moreover, Swedish girls rated the *PB* bar significantly higher than Danish girls.

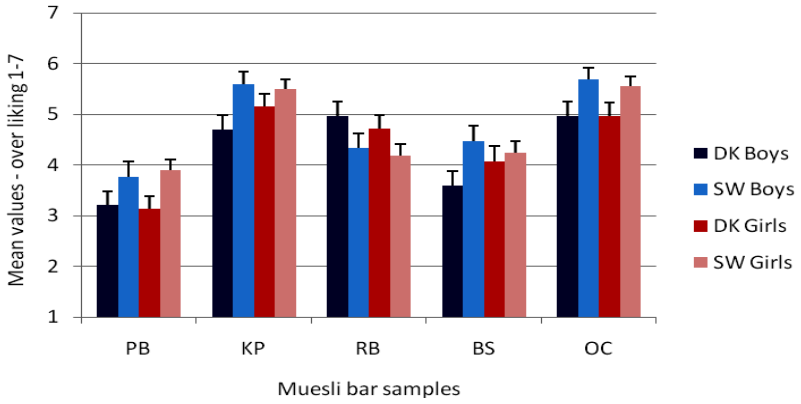

Figure 8. *Danish and Swedish boys, respectively girls ratings for "overall liking" of the five muesli bars. The graphs in the figure shows mean values and standard error means.*

Willingness to eat the muesli bars again

The muesli bars significantly reported as most wanted to eat again by Danish and Swedish children (all together) were the *KP*, *OC* and *RB* bars *(table 3).* In Sweden, however, the children wanted only the *KP* and the *OC* bars. The sample significantly rated as least wanted to eat again by Danish and Swedish children (all together) was the *PB* bar. Among Danish children also the *BS* bar was found among the least wanted samples. In Sweden, the *PB, BS* and the *RB* bars were least wanted. Significant differences between genders for "eating again" were not observed for any of the samples. The distributions of answers showing the children's willingness to eat the muesli bars again are found in *attachment 8.*

6.2.2 Ranking preferences – an overview

The muesli bars rated significantly lowest *(PB)* and highest *(KP, OC)* for overall liking in the acceptance test, were also found among the least and most preferred muesli bars in the ranking test *(table 4).* However, Danish girls and Danish boys preferred also the *RB* bar. Moreover, Swedish children ranked the *BS* bar as one of the least preferred samples.

Table 4. *Ranking results of Danish and Swedish children as well as boys respectively girls. In the table the sum of all ranks per muesli bar is displayed. The results are compared horizontally. Values with different letter are significantly different at* $p \leq 0.05$.

Ranking Muesli bars					
Danish and Swedish children	***Pumpernickel Buckthorn***	***Kamut Pumpkins***	***Rye Bilberry***	***Buckwheat Strawberry***	***Oat Cranberry***
Boys & Girls	500 [a]	906 [b]	700 [c]	597 [d]	912 [b]
Boys	247 [a]	413 [b]	314 [c]	281 [a]	395 [b]
Girls	253 [a]	493 [b]	386 [c]	316 [d]	517 [b]
Danish children	***Pumpernickel Buckthorn***	***Kamut Pumpkins***	***Rye Bilberry***	***Buckwheat Strawberry***	***Oat Cranberry***
Boys & Girls	278[a]	491[b]	422[c]	331[d]	488[b]
Boys	152[a]	238[b]	204[b]	161[a]	235[b]
Girls	126[a]	253[b]	218[b]	170[c]	253 [b]
Swedish children	***Pumpernickel Buckthorn***	***Kamut Pumpkins***	***Rye Bilberry***	***Buckwheat Strawberry***	***Oat Cranberry***
Boys & Girls	222 [a]	415 [b]	278 [c]	266 [a c]	424 [b]
Boys	095 [a]	175 [b]	110 [a]	120 [a]	160 [b]
Girls	127 [a]	240 [b]	168 [c]	146 [a c]	264 [b]

Boys and girls

The ranking preferences among Danish and Swedish boys and girls were highly similar, though some notable differences were found *(table 4)*. Compared to the boys, the girls significantly preferred the *BS* bar to the *PB* bar. However, in comparisons between two countries it appeared that this only was shown for Danish girls. Also observed were that Danish and Swedish girls, as well as Danish boys, significantly preferred the *RB* bar to the *PB* bar. A result not found among Swedish boys.

6.2.3 Acceptance ratings and preference ranking for each muesli bar

In the following pages, the results of the Danish and Swedish muesli bar ratings and ranking are presented for each of the five samples. At first, Danish and Swedish children's results are presented all together. Secondly, differences found between the two countries and genders are reported. Some of the individual comments regarding children's liking of the muesli bars are also given (*attachment 9).* An overview of the significant differences in acceptance ratings between the two countries is found in *attachment 7*. Additionally, the frequencies graphs in *attachment 10* show the distributions of ratings for each of the muesli bar.

Pumpernickel / Buckthorn

Overall

Mean values in *table 3*, of Danish and Swedish children's acceptance ratings for the *PB* bar, indicated that their liking for this sample were relatively low for all of the sensory attributes. Flavour/taste was the least liked and was frequently rated as "really bad" according to the frequencies graphs. The results of children's ranking preferences also indicated that the *PB* bar was the least preferred sample. In addition, more than half of the children reported that they would not like to eat the *PB* bar again. Examples of comments given by the children concerning their liking for the *PB* bar were; "I can not like the taste of it", "it has a bad texture", "I do not like the raisins".

Comparisons

Swedish children rated the *PB* bar significantly higher than Danish children for texture and overall liking. However, these significant higher acceptance scores were found only in comparisons between Danish and Swedish girls.

Kamut / Pumpkins

Overall

The acceptance ratings indicated that the *KP* bar was highly liked for all the sensory attributes by Danish and Swedish children (*table 3*). According to the frequencies graphs, especially the flavour/taste of the muesli bar was frequently rated as "really good". The preference ranking showed that the *KP* bar was one of the most preferred samples. In addition, more than half of the children stated that they would like to eat the *KP* bar again. Examples of comments given by the children concerning their liking for the *KP* bar were; "looks good", "tastes really good", "tastes like popcorn".

Comparisons

In comparison between the two countries, the results showed the rating scores for overall liking of the *KP* bar were significantly higher among Swedish children. However, this significant difference was found only between Danish and Swedish boys.

Rye / Bilberry

Overall

The *RB* bar was accepted by the Danish and Swedish children (*table 3*). According to the frequencies graphs, the children's likings for the sensory attributes were widely spread from "really bad" to really good". Children's willingness to eat the *RB* bar again also varied. According to result from the preference ranking the *RB* bar was the third preferred sample. Examples of comments given by the children concerning their liking for the *RB* bar were; "it has a good sweet taste, but bad texture", "It was okay", "it was gluey".

Comparisons

The *RB* bar was scored higher for all of the sensory attributes by Danish children compared to Swedish children. Significant differences were found for appearance, flavour/taste and overall liking. However, the significant differences for appearance and texture were found only between Danish and Swedish girls. Compared to Swedish children, Danish children showed a significantly higher willingness to eat the muesli bar again and they also ranked the *RB* bar higher.

Buckwheat / Strawberry

Overall

The majority of children rated their liking for appearance and smell of the *BS* bar as "really good" and "good". However, after the children tasted the *BS* bar, their ratings scores decreased in flavour/taste, texture and overall liking (*table 3*). According to the preference ranking, the *BS* bar was the second least preferred muesli bar. Approximately 40 % of the children reported that they would not like to eat the *BS* bar again. Examples of comments, given by children concerning their liking for the *BS* bar were; "too sour", "it looks fantastic but the flavour was strange", "tastes good, sour and crunchy".

Comparisons

In the comparison between the Danish and the Swedish children, the *BS* bar was significantly more liked for appearance among the Swedish children. Illustrated in *figure 8* the Swedish boys also reported a significant higher overall liking score for the *BS* bar compared to the Danish boys.

Oat / Cranberry

Overall

The *OC* bar was highly liked for all the sensory attributes by Danish and Swedish children (*table 3*). In particular, the flavour/taste of the muesli bar was frequently rated as "really good". The preference ranking showed that the *OC* bar was one of the most preferred sam-

ples. In addition, more than half of the children reported that they wanted to eat the *OC* bar again. Examples of comments, given by children concerning their liking for the *OC* bar were; "tastes fantastic", "it was perfect and it had a good texture", "the best one".

Comparisons

Comparisons between the two countries showed that the liking of smell, texture, and overall liking for the *OC* bar were scored significantly higher by Swedish children compared to Danish children. The significant differences in smell and texture were noted between Danish and Swedish boys and girls, respectively.

6.2.4 Summary of results

Table 5 gives a result overview of the Danish and Swedish children's sensory evaluation of the five muesli bars. The table shows that the *OC* and *KP* bars were highly liked for the appearance, smell, flavour/taste and texture. In addition these muesli bars were ranked as the most preferred samples and were reported as wanted to eat again. On the contrary, the *PB* bar was the sample least liked for all of the sensory attributes, lowest ranked and reported as not wanted to eat again. The muesli bars in between *(RB, BS)* were moderately liked for several attributes and ranked in the middle. Children's willingness to eat these samples again varied highly between yes, maybe and no. Comparing Danish and Swedish children's acceptance and preferences for the muesli bars similar results were obtained. Danish children, however, also rated and ranked the *RB* bar as one of the most preferred samples. Gender differences in acceptance ratings were not found in or between the two countries. The ranking preferences were also highly similar among boys and girls.

Table 5. *Result overview showing Danish and Swedish children's acceptance and preferences for the five muesli bars.*

Picture of product	Abbreviation	Product	Acceptance ratings	Ranking preferences	Wanted to eat again
	OC	*Oat Cranberry*	Highly liked for appearance, smell, flavour/taste and texture.	One of the best	Yes
	KP	*Kamut Pumkins*	Highly liked for appearance, smell, flavour/taste and texture.	One of the best	Yes
	RB	*Rye Bilberry*	Moderately liked for appearance, smell, flavour/taste and texture.	Third best	Yes Maybe No
	BS	*Buckwheat Strawberry*	Highly liked for appearance and smell. Moderately liked for flavour/taste and texture.	Second worst	Yes Maybe No
	PB	*Pumpernickel Buckthorn*	Moderately disliked for appearance, smell and texture. Highly disliked for flavour/taste.	Worst	No

7 Discussion

In the following chapter, the material and the methods used in this study have been discussed. Moreover, the main results obtained in the preceding chapter will be considered and compared with the outcomes of previous studies.

7.1 Discussion of material and methods

The total number of children participating in the sensory evaluation of the muesli bars was sufficient for this form of study (Meilgaard et al, 1999). In Sweden, the boys were underrepresented in relation to the Swedish girls, Danish girls and Danish boys. The unequal distribution should be taken into consideration analysing the results because this might affect the statistical comparisons between genders.

Recommended in previously studies, it was valuable to conduct the muesli bars sessions during the morning/midmorning since the children were alert to participate (Propper & Kroll, 2005). Each tasting session lasted between 60-80 minutes, including the time to answer to the initial snack questionnaire and the time to inform the children about the study procedure. It appeared that some of the children seemed to find it hard to concentrate during the whole session. In Sweden teachers explained the use of the smiley face scale the day before the sensory test of the muesli bars. In Denmark children familiarized with the face scale the same day as the test. This might also explain why several Danish children did not complete their questionnaires correctly. However, what seemed to be difficult to both Danish and Swedish children was to write individual comments concerning their likings for each muesli bar. This can probably be connected to limitation in cognitive abilities, but also the feeling of time pressure to complete the questionnaires. In addition, when children wrote their individual commentaries several of the children had finished their samples. Consequently, if the children did not remember the five muesli bar samples very well they might have mixed up the samples and the commentaries.

The questionnaires used for the study were tested in advance to find out if the questions or scales were too complicated for children aged 8-10 years. If the whole procedure of each session would also been tested it could probably have provided useful information about the time to conduct each session. Working with humans, however, implies the risk that some of the participants might find the testing procedure and questions harder to understand than others (Stone & Sidel, 2004). To reduce this risk, the children who needed extra assistance during the test were helped by teachers or researchers. Moreover, the researchers explained the test procedure with examples of other products before the evaluation of the muesli bars (Guinard, 2001). While watching the children during the test, the majority of children seemed not to have problem to complete their questionnaires (except from the writing of individual comments). This argues are strengthens by the fact that the children were consequent in their ratings and rankings of the muesli bars. The muesli bar samples children were given the highest and lowest acceptance scores were also the samples they ranked as most and least preferred.

During the two test weeks it turned out that the muesli bars changed slightly in texture and flavour, even though they were packed in modified atmosphere. The aroma of lemon flavour in the *BS* bar was found in the *KP* bar. What is more is that the *PB* bar was crumbled when it

was served to the children. This might also have affected the children's liking and preferences for the products.

The results of this study show what combination of ingredients in the five muesli bars has the best appeal to the children. It also give an indication of which sensory attributes that drives the children's overall liking of the bar, their ranking preferences and their willingness to eat the muesli bar again. However, this study cannot give an answer to which type of ingredients the children found attractive in the five muesli bars. Further experimental studies or qualitative methods such as individual interviews and focus group interviews could probably have contributed to this understanding. Interviews are often time-consuming methodologies, conducted with a limited number of participants. Therefore, interviews and focus groups are in regular not used in order to quantify data or to generalise results (Bryman, 2004).

Food preferences are diverse (Birch, 1999) and it might be that the study results would be different if the study would have been conducted in other school classes. The environment and testing conditions might also have influenced the results. The importance of the context of meals can be strengthened. Prim (2007) showed that the social setting of a dinner had a major role in the choice of what to eat. Moreover, in present study the muesli bars were evaluated unbranded and without packages. In real life, products properties such as brands (Jones, Mannino & Green, 2010) and packages (Ogba & Johnson, 2010) are likely to have a large influence on children's food choice. Additionally, the Danish and Swedish children were served a small tasting sample of each muesli bar. It could be that the children's degree of liking of the muesli bars would have turned out differently if they were served a representative portion of the product. In an exposure study by Liem and Zandstra (2009) who investigated the influence of repeated consumption of snack bars on children's liking and wanting, it appeared that small sized snacks (1,5 gram) remained stable in liking over repeated consumption while the large sized snacks (16 gram) decreased in liking.

7.2 Discussion of results

7.2.1 Acceptance and preference for muesli bars

Sensory attributes and preferences

Two *(OC, KP)* of five muesli bars evaluated in this study were particular well accepted and preferred by the Danish and Swedish children. These samples were highly liked for the appearance, smell, flavour/taste, texture and over all liking. In previously studies and reviews of children's food preferences, taste and flavour are suggested as two of the main factors influencing children's acceptance of food (Birch, 1999). Moreover, it has been pointed out that appearance and texture play an important role in food choices (Burgess-Champoux et al, 2006; Lawless & Heymann, 1999) and are related to the perception of food quality (Lawless & Heymann, 1999). According to the distribution of ratings, especially the flavours/tastes of the *OC* and *KP* bars were frequently rated as "good" or "really good". What also supports that the flavour/taste was an important factor to children's liking, was the high attention children were given to this attribute in their individual comments to the muesli bars.

The importance given to the taste and flavour was observed also for the other muesli bar samples. The flavour/taste was the attribute rated lowest for the least preferred muesli bar (*PB)*. In addition, according to the distribution of rating scores the flavour/taste seemed to be important to children's overall liking of the *RB* bar. This suggests that if the flavour/taste of the muesli bar is not liked, the overall liking of the muesli bar is not well liked. This argue can be strengthens by the result found for the *BS* bar. The majority of children rated their liking for appearance and smell of the *BS* as "really good". However, after the children tasted the *BS* bar, their rating scores decreased in flavour/taste and overall liking. At the same time, it has to be taken into consideration that the texture of the *BS* bar was also rated low. Therefore, the texture can be an additional reason for the ratings of overall liking. However, since the children evaluated the texture of the bar after tasting it, the dislike of flavour/taste might have influenced the ratings for texture. Though, to prove which attribute that was significantly most important to the children, additional statistical analysis would be needed. The proposal that the flavour/taste was the most important attribute for children's overall liking must therefore be considered with information described above. Furthermore, the perception of sensory characteristics and liking of food is caused by a complex composition of appearance, smell, taste and texture (Eertmans, Baeyens & Van den Bergh, 2001). Therefore, all of the sensory attributes are needed to be considered when the results are interpreted. For instance, the three muesli bars highly liked for the appearance *(OC, KP, BS)* were characterised by their golden, glossy or redness colours. Also found were that the muesli bar with a crunchier texture *(KP)* appeared to be more liked for its texture than the less crunchy samples *(PB, RB).* Concerning the smell of the muesli bars it was shown that the fruit-berry odour of the *BS* bar was highly liked. All these findings can be valuable to the product development and to the food industry in order to design and produce products with suitable sensory features created especially for the preferences of children.

Nordic ingredients

Since the sensory attributes of the muesli bars were shaped by a combination of ingredients, it is not possible to identify exactly what ingredients the children perceived as attractive. Based on the findings, however, some speculations concerning the children's liking for the muesli bars could be connected to the Nordic ingredients. Previous studies have suggested that food products made of wholegrain cereals may not be accepted by children because of its bitter taste and dark colour (Rosen, 2009; Delk & Vickers, 2007; Sadeghi & Marquart, 2009). Pumpernickel, one of the main ingredients in the least accepted and least preferred muesli bar (*PB)*, is characterised by its dark colour and rye taste. However, the low acceptance and preference for the *PB* bar can also be linked to some of the other food ingredients or to a combination of these. Buckthorn in particular, is known to be a berry with a unique exotic flavour and sour taste (Jeppsson, 1998). Several of the children actually commented that they did not like the flavour of "raisins" (=buckthorn berries). Perhaps the buckthorn flavour was too unfamiliar to the children and for this reason it was not suitable as an ingredient in muesli bars developed for children. This argument is supported by Cooke and Wardle (2005) and Burgess-Champoux et al (2006), who found that the familiarity of food was an important factor that influenced children's acceptability and food choices. However, the *PB* bar tended to crumble when it was served, this might also be an additional factor contributing to the low preference for this sample.

The two most preferred muesli bars (*KP, OC*) were based on kamut wheat, oat and spelt. These wholegrain cereals are characterised by their light colour and soft taste. Together with the pumpkin seeds and the hassle nuts, these whole grains appeared to contribute to sensory

attributes attractive to the children. Considering the discussion above, this can also strengthens that wholegrain cereals, especially those dark in colour and bitter in taste, can be barriers to reach children's acceptance for wholegrain products (Rosen, 2009). However, important to remember is that the *KP* and *OC* bars, especially the *KP* bar, had a high sweetness and this might also have influenced the children's acceptance and preferences (Drewnowski, 1997; Desor & Beauchamp, 1987). On the other hand, in the individual comments of the muesli bars some of the children stated that they liked the sour and less sweet taste of the *PB* and the *BS* bars. Children's liking for foods with a sour taste has been observed also in previous studies (Allesen Holm et al, 2008; Liem et al, 2004). Moreover, it is suggested that children's preferences are negatively affected by bitter tastes (Delk & Vickers, 2007; Birch, 1999). The *BS* bar was based on buckwheat, an ingredients characterised by a smoky flavour and a little bitter taste. Together with the less sweet taste of the bar, this bitterness might have contributed to children's rather low preferences. Several of the children also commented that flavour/taste of this bar was strange. Though, at the same time a number of children rated their liking for flavour/taste for the *BS* bar as "really good" or "good. Diversities in children's liking of food and tastes observed in earlier studies are often related to children's earlier experience with food (Cooke, 2007). This may also be the reason behind the differences found in children's liking of the five the muesli bars.

7.2.2 Comparisons between Danish and Swedish children and gender

Muesli bars preferences – a question about food culture or not?

Although some differences were found between the two countries, the most notable result of this study was that the Danish and Swedish children's acceptance and preferences for the muesli bars were highly similar. Consequently, the differences in Danish and Swedish food cultures, hypothesized as a potential factor affecting children's food choices, seemed not to have influenced to differences in muesli bars preferences. Perhaps the differences between Danish and Swedish cultures were too small in order to contribute to diverse results. According to the results found in the snacking questionnaires of Danish and Swedish children's snack preferences, similar snack foods were reported in both countries. Based on the knowledge that the familiarity of foods and flavours/tastes, influences food choices and preferences (Cooke, 2007), this might also be the reason behind the similar result found in Danish and Swedish children's evaluation of muesli bars.

Danish children significantly preferred the *RB* bar to the Swedish children. Considering the discussion above, that products based on dark coloured whole grains, such as rye, may be disliked by children, the Danish children's ratings for the *RB* bar were rather unexpected. In particular, since the children disliked the *PB* bar. It might be that the flavour and taste of buckthorn berries in the *PB* bar contributed to the low acceptance and preferences for this sample, and not the flavour and taste of rye. However, these argues are just speculations and cannot be strengthened by previous findings.

Muesli bars and genders

Gender differences in the acceptance ratings were observed neither in nor between the two countries for any of the muesli bars. Moreover, the ranking preferences among boys and girls were highly similar. On the basis of these findings, this study suggests that the muesli bar is a snack that can be varied in a way that is attractive to both boys and girls. Previous studies

have recommended that gender differences should be taken into consideration when food choices are provided to children (Caine-bish & Sheule, 2009). However, in earlier studies differences between genders are often found for diverse food items such as fruits and sweets (Hill et al, 2009; Swedish National Institute of Public Health, 2010). It might be that the five muesli bars were too similar to contribute to differences between genders. On the other hand, in the study of Thybo, Kühn and Martens (2004), investigated Danish school children's preference for different types of apples, opposite results were shown for boys and girls. Moreover, the PCA-plot of the five muesli bars samples indicated wide differences in sensory attributes between the samples.

7.2.3 Muesli bars as a future snack alternative

The challenge to satisfy children's snack preferences

Snacks can make positive or negative contributions to children's diets depending on the choices that are offered. Both healthy and unhealthy snack options exist on the market, but according to previous studies children eat what they like (Søndergaard & Edelenbos, 2007; Haerens et al, 2009; Bower & Sandali, 2002). According to the snacking questionnaires in present study, the Danish and Swedish children used to snack mostly healthy food items. However if the children were given a free choice they preferred unhealthy items such as sweets, chips and chocolate. When children become adolescents they might have greater influences on their food choices and their intake of unhealthy snacks can therefore increase (Swedish National Institute of Public Health, 2010). Pattern of eating habits in childhood has also been shown to correlate with eating habits in early adult life (Nicklaus, Boggio, Chabanet & Issanchou, 2005). Present study suggests that an enlargement of healthy attractive snack options developed for children might be needed in order to promote healthier snacking behaviours at early ages. A suggestion that can be supported by previous reports, recommended that there is a need to develop and provide affordable, healthy and nutritious choices to consumers (WHO, 2004; Consumer Association Stockholm, 2009). However, it is still important to remember that food like sweets often play a central role in children's food culture and therefore should not be totally ignored (Johansson et al, 2009; Albon & Mukherji, 2008). Moreover, it is not possible to forbid children to buy unhealthy snacks in the stores. The challenge lies in having healthy snack options accepted and preferred by the children's food culture, just like sweets and fast food. Based on the results found in this study, the muesli bar was a snack liked by Danish and Swedish children. However, the results also showed that some of the muesli bars were disliked and not wanted to eat again. Clearly, the ingredients of the muesli bars influenced the sensory qualities, which in turn seemed to affect the children's wants for the product.

Shepherd (1999) described food choices as being affected by several factors. This means that the sensory perception and the sensory liking of a product are two of several things that influences if the muesli bars can be a potential snack option in the future. For instance, marketing of a product and packaging is known as important factors in order to win the consumers attention (Jones, Mannino & Green, 2010; Ogba, & Johnson, 2010). Another important factor that influences food choice is where the products are placed in the supermarket (Pettersson, Olsson & Fjellström, 2004). Today, muesli bars are often found among cereal products or among food products marketed as slimming products. However, it is not likely that children are looking for something to snack on the "diet shelves". Previous researchers found that children prefer and select appealing and attractive food products without noticing their

dietary value (Bower & Sandali, 2002; Hart el al, 2002). In addition, it is not supposed that children shall associate muesli bars as a slimming product. The muesli bars are meant as a snack alternative for all children, not only to those who prefer to eat unhealthy snack products.

Nordic snacks – a sustainable choice?

Food grown in the Nordic countries, such as cereals and locally produced fruits and berries, are known to be nutritious foods having a low impact on the environment (National Food Administration, 2009). The use of Nordic food in the food production could therefore be a way to contribute to humans and to environmental well being. This proposal is confirmed by Bere and Brug (2008) who argued that a health promoting dietary should be tailored to regional circumstances in order to promote public health and preserve the cultural diversity in eating habits, as well as contribute to more environmentally eating. The muesli bars evaluated in present study may not be an everyday alternative to fruits, dairy products and cereal foods, but still, the nutrient value of the muesli bars is better than many of the unhealthy snacks children prefer today (Hoppe, Biltoft Jensen, Trolle & Tetens, 2009; Patterson, 2010). Moreover, it is suggested that wholegrain foods have several human health benefits that can reduce the risk of metabolic syndrome related diseases (Mejborn et al, 2008). Muesli bars might also be a potential snack food to improve the preference for the flavour of different wholegrain cereals. The principle of flavour-flavour learning is that a preferred flavour is paired with a non preferred flavour in order to form a positive association between the liked flavours and the non preferred ones (Havermans & Jansen, 2007; Pliner & Stallber-White, 2002). A hypothesis is that by varying the ingredients and contain of whole grains in the muesli bars, this may contribute to children's liking for whole grain cereals or foods that otherwise are less accepted or preferred. At the same time it is important to remember that factors such appearance, temperature, crunchiness and taste all contribute to the overall perception of foods (Eertmans, Baeyens, Van den Bergh, 2001; Meiselman & Macfie, 1996). Therefore a child might accept and prefer a flavour in one form, but dislike it in another.

Based on the answers found in the questionnaires of children's snacking habits, muesli bars or dried fruit/nuts were not typical snack foods among Danish and Swedish children. However, after children tasted the muesli bars, more than half of the children in both countries stated that they wanted to eat the most preferred samples again. Consequently, it might be possible to produce other kinds of Nordic food products that children will like, but are not used to eat. Previous studies also found that the liking of novel foods increases after repeated consumption because the novel foods become more familiar to the children (Sullivan & Birch, 1990). Thus, even the least preferred muesli bar might be accepted and liked if the children have the chance to taste it several times. This confirms that exposures of nutritious foods are highly important in order to promote healthy eating habits at early stages in life (Pearson, Biddle & Gorely, 2009; Cooke, 2007). However, an issue worth to consider is, are children really helped by further food products being added to their food culture? Or are these alternatives making the food choices even more complicated? Children intentionally choose the products they prefer (Søndergaard & Edelenbos, 2007; Hart et al, 2002; Birch, 1999). If so, additional appealing snack products being at the same time healthy to eat might have great potential to contribute to healthy food choices. It is also suggested that children's intake of snacks are highly influenced by the social context (Husby, 2008). In the end it may be the children's perspectives that need to be understood further in order to make sustainable

changes. Sustainable changes important to children’s health, today as well as in their future. If the muesli bars based on Nordic ingredients are a part of these changes remains to be seen.

8 Conclusions

This study aimed to examine 8-10 year old school children's acceptance and preference for muesli bars composed of Nordic food ingredients and to compare Danish and Swedish school children's acceptance and preferences for the muesli bars. The conclusions of the study are as follows:

- Children's degree of acceptance varied between the five samples. Most liked were the muesli bars based on kamut and pumpkin seeds, and oat and cranberries. Least liked was the muesli bar based on pumpernickel and buckthorn. The preferences were highly influenced by the sensory characteristics of the bars. Above all, the flavour and taste of the bars tended to have an important influence on children's preferences.

- Despite the differences in food cultures, Danish and Swedish children's had similar muesli bar preferences. Gender differences in acceptance ratings were not found in or between the two countries. In addition, the ranking preferences were similar among boys and girls.

- More than half of the Danish and Swedish children reported that they would like to eat the most accepted and preferred muesli bars again. Likewise, the majority of children stated that they did not want to eat the sample least accepted and preferred. Clearly, the degree of liking influenced children's willingness to eat the muesli bars again. Based on these findings this study reveals that the muesli bars most preferred have great potential to promote healthy food choices.

Future outlook

The results of this study were based on children's initial liking of the muesli bars. Consequently, these results did not state if the muesli bars will be successful on the market in the long term. Only future research and exposure studies conducted during a longer period could show if the muesli bars might be successful also in the long term. Moreover, food choices are affected by several factors. Studies, however, conducted in supermarkets where children and parents are able to buy the muesli bars, could give important information about the degree of liking in "real life" situations. In other words, are the muesli bars worth their price, in terms of sensory satisfactions, packages and nutritious value? In conclusion, focus groups and interviews conducted with children in different age groups can provide valuable insights on children's specific liking of the muesli bars and the Nordic ingredients. These insights could be used in order to expand the market of nutritious and attractive snack products. Snack products that highlight and promote Nordic food specifically developed and designed in order to comply with children's taste preferences and food culture.

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Attachment 1

X/1 - 2010

GÖTEBORGS UNIVERSITET
Utbildningsvetenskapliga fakulteten
Institutionen för mat, hälsa och miljö

FACULTY OF LIFE SCIENCES
UNIVERSITY OF COPENHAGEN

Information till lärare i årsklass 2, 3 eller 4!

Vi vet att goda matvanor har stor betydelse för att barn skall må bra och klara skolarbetet. Att det finns näringsriktiga mellanmålsalternativ kan således vara av stor betydelse för att främja sunda matvanor och god hälsa. En viktig förutsättning är dock att dessa alternativ är omtyckta av barnen.

Under våren 2010 kommer avdelningen för Sensorisk Vetenskap, vid Biovetenskapliga Fakulteten i Köpenhamn, att genomföra en undersökning i vilken danska och svenska skolbarn får möjlighet att smaka på och tycka till om mellanmål. Syftet är att få ökad kunskap om barns uppfattning om näringsriktiga mellanmål, tillverkade av nordiska råvaror. Denna kunskap kan vara av stor betydelse för att utveckla produkter som både tillgodoser barnens synpunkter samt bidrar till hälsosamma matvanor.

Din skolklass (2:a, 3:e eller 4:e klass) kan här bidra till värdefull kunskap genom att medverka i undersökningen. Ett deltagande innebär att barnen vid ett lektionstillfälle kommer att smaka på en müslibar, i fem olika varianter. Till varje variant besvarar barnen några enkla frågor om vad de tycker om produkten. Detta görs enskilt skriftligt på ett enkelt sätt. Därtill kommer barnen att besvara frågor om vad de vanligtvis brukar äta till mellanmål, samt peka ut det mellanmål som de föredrar att äta. Detta val sker bland ett flertal vanliga mellanmålsprodukter.

Undersökningen kommer att ske under vecka 5 i februari månad. Besöket planeras så att det tidsmässigt passar bra med klassens schema. En medverkan i undersökningen kan vara ett utmärkt tillfälle att prata om kostens betydelse för hälsa och välbefinnande. Naturligtvis är barnens deltagande helt frivilligt. Barnens föräldrar kommer även att få ett brev med skriftlig information om studien. Samtliga enkätsvar kommer att bearbetas i form av tabeller och diagram. Således kommer inte barnens namn att framgå i den skriftliga rapport som sammanställs efter undersökningen.

Vi hoppas att du och din klass vill medverka och därmed bidra till värdefull kunskap. Har ni frågor eller vill ha mer information är ni mycket välkomna att kontakta mig via telefon eller mail. Telefon: xxxxx Mail: xxxx

Med vänliga hälsningar

Anna Holmer

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Biovetenskapliga fakulteten
Köpenhamns Universitet

GÖTEBORGS UNIVERSITET
Utbildningsvetenskapliga fakulteten
Institutionen för mat, hälsa och miljö

Attachment 2

FACULTY OF LIFE SCIENCES
UNIVERSITY OF COPENHAGEN

Information till föräldrar och barn i klass X på Y-skolan

Vi vet att goda matvanor har stor betydelse för att barn skall må bra och klara skolarbetet. Att det finns näringsriktiga mellanmålsalternativ kan således vara av stor betydelse för att främja sunda matvanor och god hälsa. En viktig förutsättning är dock att dessa alternativ är omtyckta av barnen.

Under våren 2010 kommer avdelningen för Sensorisk Vetenskap, vid Biovetenskapliga Fakulteten i Köpenhamn, att genomföra en undersökning i vilken danska och svenska skolbarn får möjlighet att smaka på och tycka till om mellanmål. Syftet är att få ökad kunskap om barns uppfattning om näringsriktiga mellanmål, tillverkade av nordiska råvaror. Denna kunskap kan vara av stor betydelse för att utveckla produkter som både tillgodoser barnens synpunkter samt bidrar till hälsosamma matvanor. Därför vänder vi oss nu till alla barn och föräldrar i klass X på Y-skolan med en förfrågan om medverkan i denna undersökning.

Så här går undersökningen till

De barn i klassen som valt att delta i undersökningen kommer vid ett lektionstillfälle att få smaka på en müslibar, i fem olika varianter. Till varje variant besvarar barnen några enkla frågor om vad de tycker om produkten. Detta görs enskilt skriftligt på ett enkelt sätt. Därtill kommer barnen att besvara frågor om vad de vanligtvis brukar äta till mellanmål, samt peka ut det mellanmål som de föredrar att äta. Detta val sker bland ett flertal vanliga mellanmålsprodukter.

Provsmakningen kommer att ske under vecka 5 i februari månad 2010. För att undersökningen skall bli så bra som möjligt är det vår förhoppning att alla barn i klassen vill delta. Samtliga enkätsvar kommer att bearbetas i form av tabeller och diagram. Således kommer inte barnens namn att framgå i den skriftliga rapport som sammanställs efter undersökningen. Deltagandet är naturligtvis helt frivilligt och vill inte ditt barn medverka respekteras givetvis detta. Ert samtycke ges på talongen nederst på sidan. Denna lämnas åter till klassläraren, **senast torsdagen den 28 Januari.**

Har ni frågor eller vill ha mer information är ni mycket välkomna att kontakta mig via telefon eller mail. Telefon: xxxxx. Mail: xxxxx

Med vänliga hälsningar

Anna Holmer

Kostekonomstuderande
Göteborgs och Köpenhamns Universitet

SAMTYCKE TILL DELTAGANDE I UNDERSÖKNINGEN (Vänligen lämna åter till klasslärare)

Jag samtycker till att mitt barn_____ får lov till att medverka i undersökningen om hälsosamma mellanmålsprodukter.

_____
(Föräldrar/vårdnadshavares underskrift)

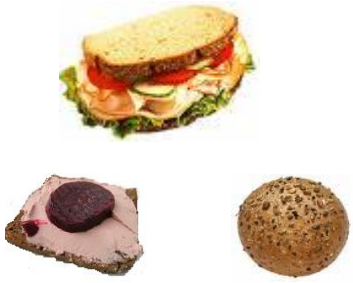
Vänligen, anteckna här om ditt barn är allergisk eller överkänslig mot något livsmedel:

Date……..
Code……..

Snacking Research

FEBRUARY 2010

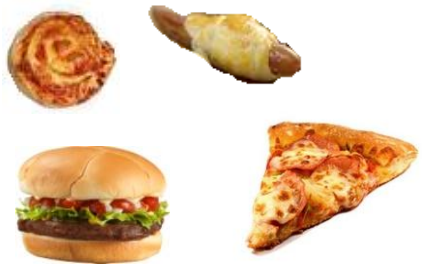
What would you prefer to have as a snack if you had free choice? Put a circle around two pictures. ***(Pictures used in Denmark)***



SANDWICH/ RYE BREAD/ BUN

CRISPS/ POPCORN

FRUITS



PIZZA/ HAMBURGER/PIZZABUN

MUESLI BAR/ DRIED FRUITS/ NUTS

VEGETABLES

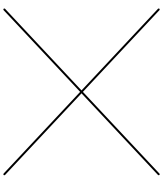
YOGHURT/ MILK CHOCOLATE DRINK

SOFT DRINK/ LEMONADE JUICE/ WATER

SWEETS/CHOCOLATE ICE CREAM

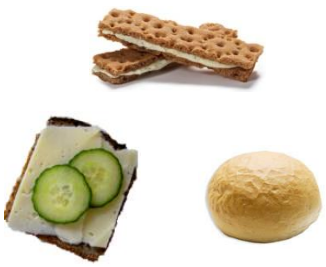
DANISH PASTORY/BISCUITS

OTHER SNACKS, WHAT?.....



NOTHING

What would you prefer to have as a snack if you had free choice? Put a circle around two pictures. ***(Pictures used in Sweden)***



SANDWICH/ CRISP BREAD/ BUN

CRISPS/ POPCORN

FRUITS

PIZZA/ HAMBURGER

MUESLI BAR / DRIED FRUITS/ NUTS

VEGETABLES

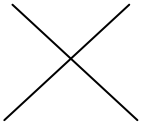
YOGHURT/ MILK
CHOCOLATE DRINK

SOFT DRINK/ LEMONADE
JUICE/ WATER

SWEETS/CHOCOLATE
ICE CREAM

BUN/ CAKES/ BISCUITS

OTHER SNACKS, WHAT?.....



NOTHING

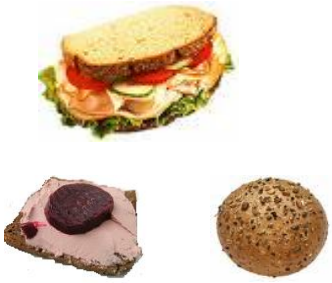
SNACK FOODS

I am a ☐ Boy ☐ Girl

How old are you?

☐	☐	☐	☐	☐
7	8	9	10	11

What would you prefer to have as a snack if you had free choice? Put a circle around two pictures. ***(Pictures used in Denmark)***



SANDWICH/ RYE BREAD/ BUN

CRISPS/ POPCORN

FRUITS

PIZZA/ HAMBURGER/PIZZABUN

MUESLI BAR/ DRIED FRUITS/ NUTS

VEGETABLES

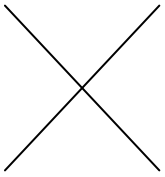
YOGHURT/ MILK
CHOCOLATE DRINK

SOFT DRINK/ LEMONADE
JUICE/ WATER

SWEETS/CHOCOLATE
ICE CREAM

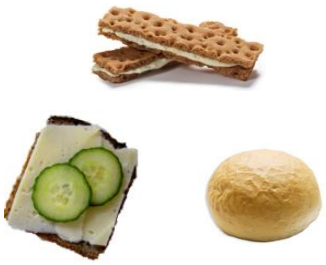
DANISH PASTORY/BISCUITS

OTHER SNACKS, WHAT?.....



NOTHING

What would you prefer to have as a snack if you had free choice? Put a circle around two pictures. ***(Pictures used in Sweden)***



SANDWICH/ CRISP BREAD/ BUN

CRISPS/ POPCORN

FRUITS

PIZZA/ HAMBURGER

MUESLI BAR / DRIED FRUITS/ NUTS

VEGETABLES

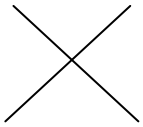
YOGHURT/ MILK
CHOCOLATE DRINK

SOFT DRINK/ LEMONADE
JUICE/ WATER

SWEETS/CHOCOLATE
ICE CREAM

BUN/ CAKES/ BISCUITS

OTHER SNACKS, WHAT?.....



NOTHING

Date:_____ Code:_____

Product:_____

MUESLI BARS TASTING

You are going to taste five different muesli bars. This one is muesli bar_____. Answer to the questions on the following pages. Colour the smiley face that corresponds to how much you like this muesli bar. If you do not understand the questions please ask for help.

How much do you like the appearance of this muesli bar?

Really Bad | Just a little Bad | Bad | Okay | Just a little Good | Good | Really Good

---

How much do you like the smell of this muesli bar?

Really Bad | Just a little Bad | Bad | Okay | Just a little Good | Good | Really Good

---

How much do you like the taste this muesli bar?

Really Bad | Just a little Bad | Bad | Okay | Just a little Good | Good | Really Good

How much do you like the texture of this muesli bar?

Really Bad | Just a little Bad | Bad | Okay | Just a little Good | Good | Really Good

---

Overall, how much do you like this muesli bar?

Really Bad | Just a little Bad | Bad | Okay | Just a little Good | Good | Really Good

---

Would you like to eat this muesli bar again?

No | Maybe | Yes

☐ I did <u>not</u> taste the muesli bar.

Date_____
Code_____

MUESLI BARS

RANKING

Now you have tasted all of the muesli bars. Which one did you like the most? Which one did you like the least? Use the coloured pencils and colour each smiley face that corresponds to your likes.

	Best of them all
	Second best
	Third best
	Second worst
	Worst of them all

Non completion - acceptance ratings

The tables show the questions not completed by the Danish and Swedish children. Non completions of the questionnaires occurred in 27 of the Danish children (38 questions), and 10 of the Swedish children (13 questions).

Danish children	***Appearance***	***Smell***	***Flavour/taste***	***Texture***	***Overall liking***	***Eating again***
Pumpernickel Buckthorn		1	3		4	2
Kamut Pumpkins		1	1	2	3	1
Rye Bilberry	2	1	2	2	1	1
Buckwheat Strawberry	2		5		1	
Oat Cranberry	1	1	1			

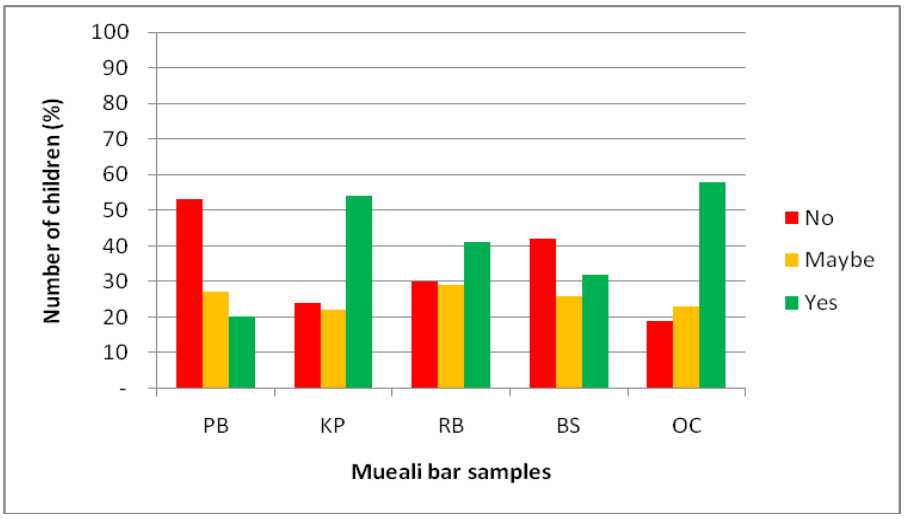
Swedish children	***Appearance***	***Smell***	***Flavour/taste***	***Texture***	***Overall liking***	***Eating again***
Pumpernickel Buckthorn			1			
Kamut Pumpkins					1	1
Rye Bilberry	1				1	1
Buckwheat Strawberry					1	1
Oat Cranberry	1		1	1	1	1

Acceptance scores muesli bars

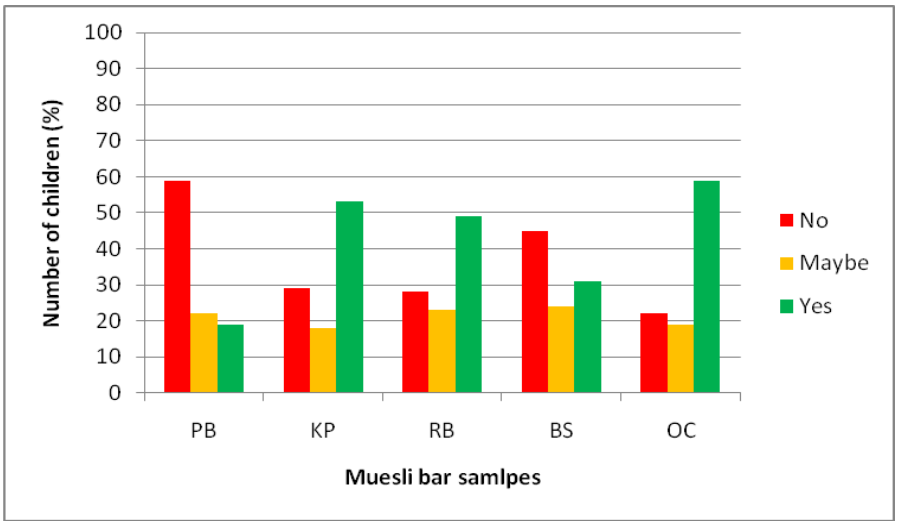
The table shows the mean values and standard deviations *(m±std)* of Danish and Swedish children's liking of the five muesli bars. The results are compared horizontally for each sensory attribute for Danish and Swedish children and for boy and girls, respectively. Mean values with different letters are significantly different at $p \leq 0.05$.

Pumpernickel Buckthorn	**Danish children n=134**	**Swedish children n=109**	**Danish boys n=66**	**Swedish boys n=46**	**Danish girls n=68**	**Swedish girls n=63**
Appearance	3.85± (2.01)[a]	3.75± (1.42)[a]	3.74± (2.16)[a]	3.67± (1.46)[a]	3.96± (1.86)[a]	3.81± (1.39)[a]
Smell	3.65± (2.08)[a]	3.60± (1.70)[a]	3.80± (2.06)[a]	3.52± (1.89)[a]	3.51± (2.11)[a]	3.65± (1.56)[a]
Flavour/taste	2.98± (2.21)[a]	3.42± (2.01)[a]	2.95± (2.25)[a]	3.49± (2.12)[a]	3.00± (2.18)[a]	3.37± (1.95)[a]
Texture	**3.34± (2.01)[a]**	**4.01± (1.78)[b]**	3.23± (2.11)[a]	3.89± (1.96)[a]	**3.46± (1.92)[a]**	**4.10±(1.65)[b]**
Overall liking	**3.17± (2.16)[a]**	**3.83± (1.95)[b]**	3.21± (2.21)[a]	3.76± (2.15)[a]	**3.13± (2.13)[a]**	**3.89±(1.80)[b]**
Eating again	1.60± (0.79)[a]	1.78± (0.79)[a]	1.58± (0.79)[a]	1.76± (0.87)[a]	1.61± (0.80)[a]	1.79± (0,72)[a]
Kamut Pumpkins						
Appearance	5.12±(1.94)[a]	5.35±(1.43)[a]	5.27± (1.91)[a]	5.41± (1.54)[a]	4.97± (1.96)[a]	5.30± (1.35)[a]
Smell	5.26±(1.94)[a]	5.26±(1.62)[a]	5.11± (2.02)[a]	5.48± (1.53)[a]	5.40± (1.86)[a]	5.10± (1.67)[a]
Flavour/taste	5.02±(2.23)[a]	5.27±(1.86)[a]	4.88± (2.29)[a]	5.41± (1.81)[a]	5.15± (2.17)[a]	5.16± (1.90)[a]
Texture	4.94±(2.01)[a]	5.28±(1.60)[a]	4.78± (2.02)[a]	5.33± (1.56)[a]	5.09± (2.01)[a]	5.25± (1.64)[a]
Overall liking	**4.92±(2.24)[a]**	**5.54±(1.57)[b]**	**4.69± (2.34)[a]**	**5.60±(1.62)[b]**	5.15± (2.13)[a]	5.49± (1.54)[a]
Eating again	2.23±(0.88)[a]	2.38±(0.77)[a]	2.18± (0.89)[a]	2.41± (0.72)[a]	2.28± 0.87)[a]	2.35± (0.81)[a]
Rye Bilberry						
Appearance	**4.64±(1.86)[a]**	**4.11±(1.60)[b]**	4.33± (1.89)[a]	4.13± (1.83)[a]	**4.93± (1.80)[a]**	**4.10±(1.42)[b]**
Smell	4.36±(1.97)[a]	3.92±(1.72)[a]	4.52± (2.04)[a]	3.89± (1.91)[a]	4.21± (1.90)[a]	3.94± (1.58)[a]
Flavour/taste	**4.80±(2.27)[a]**	**4.00±(2.08)[b]**	4.91± (2.31)[a]	4.22± (2.15)[a]	**4.71± (2.24)[a]**	**3.84±(2.03)[b]**
Texture	4.58±(2.06)[a]	4.45±(1.72)[a]	4.55± (2.02)[a]	4.65± (1.73)[a]	4.60± (2.13)[a]	4.30± (1.71)[a]
Overall liking	**4.84±(2.21)[a]**	**4.25±(1.83)[b]**	4.97± (2.24)[a]	4.33± (1.98)[a]	4.72± (2.18)[a]	4.19± (1.74)[a]
Eating again	**2.21±(0.85)[a]**	**1.98±(0.80)[b]**	2.29± (0.86)[a]	2.09± (0.86)[a]	2.13± (0.85)[a]	1.90± (0.74)[a]
Buckwheat Strawberry						
Appearance	**4.89±(1.98)[a]**	**5.56±(1.44)[b]**	**4.89± (2.04)[a]**	**5.61±(1.60)[b]**	**4.90± (1.94)[a]**	**5.52±(1.33)[b]**
Smell	5.19±(2.12)[a]	5.22±(1.73)[a]	5.33± (2.02)[a]	5.30± (1.80)[a]	5.06± (2.22)[a]	5.16± (1.70)[a]
Flavour/taste	4.07±(2.36)[a]	4.30±(2.09)[a]	4.11± (2.31)[a]	4.39± (2.22)[a]	4.03± (2.42)[a]	4.24± (2.01)[a]
Texture	4.16±(2.06)[a]	4.51±(1.78)[a]	4.15± (2.08)[a]	4.52± (1.72)[a]	4.16± (2.05)[a]	4.51± (1.83)[a]
Overall liking	3.84±(2.39)[a]	4.34±(1.94)[a]	**3.60± (2.32)[a]**	**4.48±(2.06)[b]**	4.07± (2.45)[a]	4.24± (1.85)[a]
Eating again	1.87±(0.87)[a]	2.00±(0.98)[a]	1.85± (0.88)[a]	2.11± (0.88)[a]	1.88± (0.86)[a]	1.92± (1.04)[a]
Oat Cranberry						
Appearance	5.37±(1.77)[a]	5.31±(1.39)[a]	5.29± (1.82)[a]	5.20± (1.58)[a]	5.44± (17.4)[a]	5.40± (1.24)[a]
Smell	**4.92±(2.00)[a]**	**5.52±(1.53)[b]**	**4.94± (2.01)[a]**	**5.78±(1.19)[b]**	4.91± (2.01)[a]	5.33± (1.72)[a]
Flavour/taste	4.92±(2.26)[a]	5.44±(1.75)[a]	4.86± (2.30)[a]	5.35± (1.66)[a]	4.99± (2.24)[a]	5.50± (1.83)[a]
Texture	**4.91±(2.16)[a]**	**5.56±(1.38)[b]**	4.95± (2.12)[a]	5.52± (1.36)[a]	**4.87± (2.21)[a]**	**5.58±(1.40)[b]**
Overall liking	**4.96±(2.27)[a]**	**5.61±(1.56)[b]**	4.97± (2.33)[a]	5.69± (1.58)[a]	4.96± (2.23)[a]	5.56± (1.56)[a]
Eating again	2.36± (0.83)[a]	2.43± (0.75)[a]	2.38± (0.86)[a]	2.41± (0.80)[a]	2.34± (0.80)[a]	2.44± (0.72)[a]

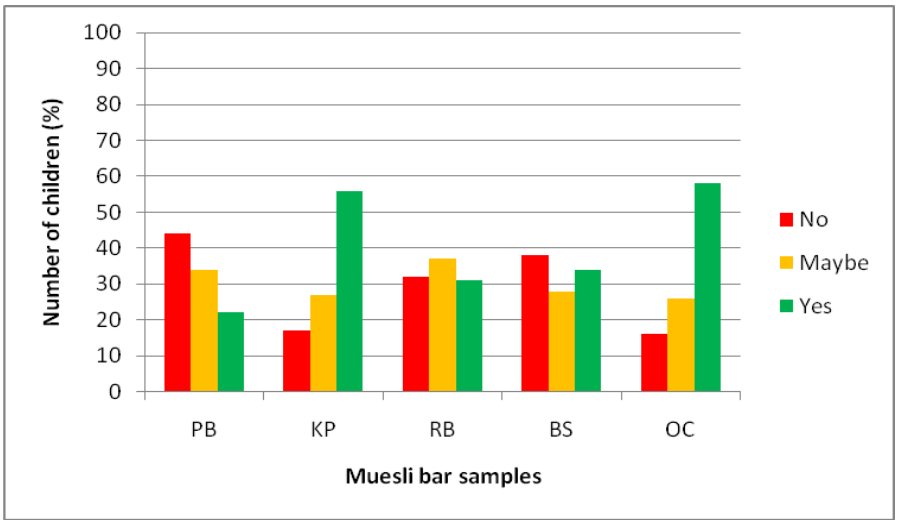
Willingness to eat the muesli bar again



The graph shows the distribution of answers (%) concerning *Danish and Swedish children* willingness to eat the muesli bars again.



The graph shows the distribution of answers (%) concerning *Danish children* willingness to eat the muesli bars again.



The graph shows the distribution of answers concerning (%) *Swedish children* willingness to eat the muesli bars again.

Individual commentaries – Danish children

Pumpernickel – Buckthorn

Dårlig smag
Den smager af jord
Synes virkelig dårligt om alt ved baren
Den var sur
OK
Ikke så god
God smag
Smagen ikke god
God smag
Den har en god smag
Hade en underlig smag
Den smager bare OK
Den er blød indimellem . Den ser lidt god ut.
Den smager mærklig
Den smager dårligt
Dårlig, rigtigt hård, man kan ikke tygge den.
Dårligt utseende
Den er ikke så god
Godt, fint
Den smager dårligt
Dårlig, hård
Dårlig eftersmag
En dårlig smag
Godt den smage af fine
Dårligt konsistens
Dårligt for den smager riftige mærklig
Den smager mærklig
Den hade en god smag
Den var for hård
Dårlig smag
Den gule, lide den var muggen
Den havde en let smag
Buu!
Dårligt for lidt salt
Udsende var god
Meget god
Den var ok
Let for mange rusiner
Den smagt rugbrød
Smagt dårligt
Er dærlig
Er dårlig, udseende og med frugtstykker
Den var okay, lidt hård
Alt var dårligt
Den kunne jeg slet ikke lide
Virkelig dårlig
Smager af rosiner
Den smager dårligt
Dårlig konsistens
Den var bare dårlig
Den er god
Den er dårlig fordi den smager af noget jeg ikke kan lide.
Godt den var sur, dårligt den smagte af rugbrød.
Pisse dårlig bar!!
Den gule bar var god
God fordi den var meget knasende
Den var skod
God
Dårlig smag
Den havde en dårlig konsistens
Så klamt udseende og smag, ikke for godt.
Noget i baren smager godt, noget andet gør ikke.
Jeg kan ikke lide rosiner
Lugten var ikke så god
Dårlig konsistens
Dårligt, den var for blød.
Dårlig bar, den smager af rosin.
Dårligt, rosinerne.

Kamut-Pumkins

God smag
Smager godt
God smag + ser lækker ud
Den var fin, men lidt let
God smag
Godt den var med nødder
Den var okay, dårligt den var hærd.
Den var meget hård, lidt god
Virkelig god
God smag
God
God
God smag
God, den er lidt sød og der er også nødder på og det gør den god
God
Lugter godt
God smag
Smager rigtig godt
Smagte markeligt
Smager lidt konstigt
Dårlig eftersmag
Rigtigt god, men eftermagen dårlig
God, den smager gulkorn

Den smagt af mandler
Den var god, man kunne få den till morgen mad
God, karamellaktig farg og smag
Den smager rigtigt godt
Smager godt
God for den smager gulkorn
Den såg god ut og var god
Dårlig lugt
God utseende
Den blå var god i starten af smagen, men så blev den lidt mindre god
Den smager som cornflakes
Den var god
God smag
Den har en mærklig smag for den smagar lidt brend
Den smager lidt dårlig og lidt godt
Lidt god og lidt dårlig
Den var rigtigt god og ville spise igen
Smag knas
God smag og udseende
Meget god
Lidt dårlig
Har dårlig smag men rigtigt flot udsende
God smag
Dårlig eftersmag
God smag
Blandingen var god
Den er god
God, den smager af kanel.
Den var rigtig lækker, men lidt melet.
Virkelig god
Dårlig fordi den var for blød
Var ikke så god og den smagte skidt.
Den smagte af møgbanan!
Den brydder jeg mig ikke om.
Den var ikke min stil
Smager godt
Den var god fordi den var sprød
Den var rigtig god
Godt den smagte af jordbær
God, den smager lidt af guldkorn
Godt den er sur, uden frugtstykker, ensfarvet
Dårligt, den smager for meget af nød.

Rye-Bilberry

Dårlig smag
Jeg elsker den
Den søde var rigtig god
Dårligt med rosiner
Lidt klam
God smag, dårlig konsistens
Meget god
Den var god
For sød
Rusin smag
Dårlig konsistens
For sød
Riktigt godt
God men klistret
Den var alt før blød
God smag
Lidt god
God smag
God smag
God, sød i smagen, men selve smagen er dårlig
Den smager aller best
Den er god og den er dårligt
Den smagt lidt godt
Den smagt af rugbrød
Den er god fordi den er sød
Har smagt bedr
Den smager god
Den er god
God for den smager helt godt
Den smagte rigtig godt
God smak, men den skal smager af lidt mer
God smag
Dårligt den var hård
God smag
Den er god
Lidt kedelig
Den var meget klistret
God smag og udsende
Meget god
Jeg kunne godt lide den
Jeg synes den var fedtet
Den var rigtigt god
Super god
Dårligt
God og smager af rugbrød
Baren er dårlig
Den var for syrlig, dårligt
Den smagte af rugbrød
Dårlig, fordi der er rosiner i.
Den var dejlig, men lidt for sur.
God fordi den var sej i konsistensen
Rigtig god, har ikke mere tilbage.
Der var noget i den jeg ikke kan lide.
Den smagte både af rugbrød og sødt - ikke godt
Den smagte af rugbrød, dårligt.
Perfekt!
Ikke min smag
Den var rigtig god
Godt, den smagte af rugbrød
Ok bar, smager lidt af rosin – dårligt.
Lidt for hård

Buckwheat-Strawberry

Dårlig smag
Smager dårligt, den var rød
Den gik op og ned
God start smag, dålig eftersmag
For dårlig smag
Godt, den var sur
For stark smag
Dårligt, lidt sur
Dårligt, for falsk i smagen
Dårligt, sur
Den var god
Sød
Den var røv
Den smagte lidt af sand
God smag i starten, men dålig eftersmag
Dålig smag
God smag
Den var god
Den smagte made markelig/saltede
Dålig, den smagte af prut og fordi, den hvar sur
God smag
Den så flot ud, men smagen var underlig
Den smager falskt/konstigt
Den smagt godt
Den er smager tredje bedst og den er lidt sur och lidt dårligt
Jag syndes den var god den smagte af jordbær
Jag syned den var lidt sur, godt
Jag kunne ikke lide den
Dårligt den er sur i smagen
Den smagt dårligt
Dårligt for den er sur
Dårligt for den var hård
Dårligt den var sur og stark
Dårligt den var sur
Den dofter bedst af de alle men smager ikke så godt, den var sur
Godt men den havde en lidt sur smag
Den er dålig
Dårligt for den var sur
God konsistens
Sårligt smag og lugt
Dårlig smag og udsne
Jag kan ikke lide smagen
Meget god
God, smager cirtus
God at den smager af jordbær
Den var dårlig
God, let sur
God lugt, dårlig smag
God den er syrlig
Dårlig, falsk
Godt, syrlig og sprød
Godt den var lyserød. Dårligt den ikke var så god
Dårligt den var lidt sur, mem den er god og har en flot farve.
Blandingen er mærkelig
Dårligt med for meget citron
Dårlig, den er for syrlig
Godt den smagte af citron
Den smager af jordbær, godt.
Den så lækker ud.
Den var dårlig, dog godt den var sprød
Den var god at have i munden
Den var lækker
Den smagte ikke særlig godt.
Den smagte bare dårligt
Godt, den knaser lidt
Baren smagte fint, især citronsmagen.
Den kunne godt være mindre knasende
God smag af jordbær
Godt med jordbærsmag
Godt den smagte af hindbær, men lidt for sød.
Godt den er sød og tør

Oat-Cranberry

Dårlig smag
Hader den
Den var værst af alle
Godt: god smag og hård
Fantastisk, ikke noget dårligt
Alt er godt
Den smagte lidt godt, ikke så meget
Den er okay, men smager ikke så godt
Den er dårlig
Helt vildt god
Også god
God smag
Lidt god
Jeg kunne best lide den fordi den smugte og mest
God smag
God eftersmag
God, knasende konsistens
God smag
Den var helt perfekt og den havde en god konsistens
Den knaser og smager godt
Den var også god
Den smagte ikke så godt
Den smagte godt
Dårlig konsistens

Den smagte bare markelig
Den er rigtigt god
Dårligt for den var sur
Den så god ud og var god
Godt utseende og smag
Dårligt utseende
Den var meget god
Den beste
Helt vild godt
Den har en god konsistens
Den var faktisgt ret god og god
Dårligt lugt
God smag
God smag og udsende
Meget god
Extremt god
Rigtigt rigtigt god
Rigtigt godt
Den smagt best
Hade en god smag og var knasende
Den hade en god smag
God, den var sur
Smag godt
God smag
Den var ikke god
God blanding
God, den kan jeg godt lide.
Alt var godt
God smag
For mange nødder
Super!
Smager okay, ikke rigtig noget dårligt.
Den var rigtig god
Den var ikke god
Dårlig!
Lidt gummiagtig og lidt sur.
Kedelig

Individual commentaries – Swedish children

Pumpernickel - Buckthorn

Blä
Ganska dålig
Den var bra
Bra eftersmak, dålig lukt
Dålig
Knepig
Äcklig
Den smakade jätte äckligt
Dålig för att den var klibbig
Den är god sur
För äcklig
Smakar inte gott
Sur smak, inte god
Inte fin
Ganska god
Den smaka äckligt
Jätte dålig
Konstig smak
Den smakade inte så jättebra
Den var bra
Dålig för russinen
Vill jag inte äta igen
Dåligt utseende
Bra
Bra smak
Dålig

Kamut-Pumkins
Den var toppen!
Den var blä
Ganska bra
Den var god
Den var bra
Allt var bra
Bra
Den var god
Den var jätte god
Den smaka bra!
Bra smak
Den var sådär
Den var mycket god
God smak
Den var jätte god
Ganska god
Bra
För citronaktig
Jätte god
Smakar god
Bra, smakade popcorn
Jätte bra
Jättebra
Bra
Knaprig och god
Den var så god!!!!!!!
Bra smak

Rye-Bilberry

Blä
Ganska bra
Den var dålig
Usch för den
God
Bra utseende, dålig smak
Dålig
Sådär
Vill kanske äta igen
Den var jätte god!
Smakar god
Lite klibbig men god
Dålig för att den var klibbig
Dålig
Ganska bra
Sådär
Ganska bra
Nej inte jättegod
Dålig, för seg
Bra smak
Dålig smak
Den var jättegod, dåligt klibbig

Buckwheat-Strawberry

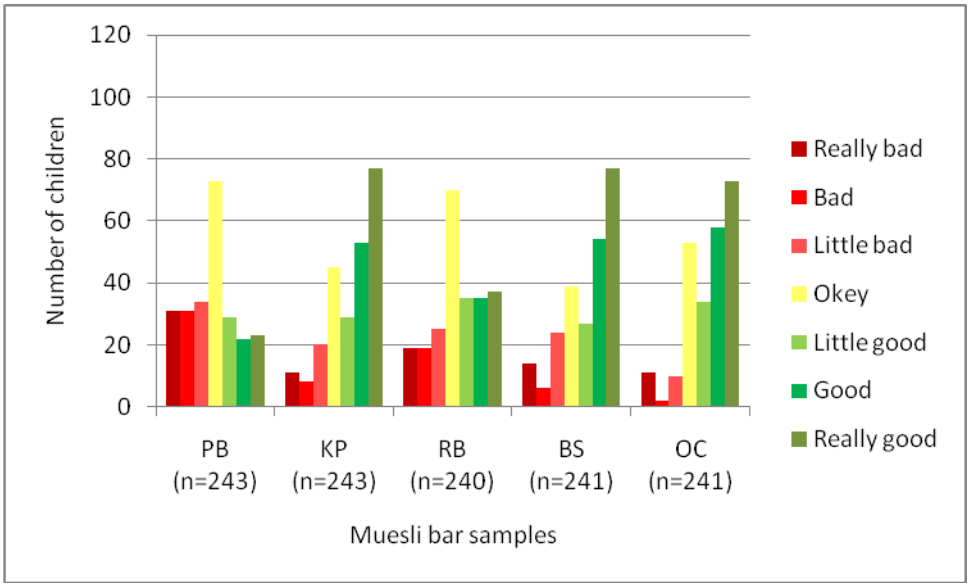
Den var blä
Den luktade pencelin
Blä den var sur
God smak, dålig eftersmak
Först var den god men sedan blev den jätte äcklig
Dålig
Det var först gott och sedan var det ogott!
Den var cool

Den var god
Ooooogod
Dålig för den var sur
Bra
Jag mådde illa
Bra utseende, dålig smak
Blä
Bra
Konstig smak
Den var bäst och godast, fanns jordgubbs smak
Dålig
Inte god
Dålig för pulvret
Den var god
Smakat äckligt!
Bra utseende, dålig smak
Den smakade blä
Dålig

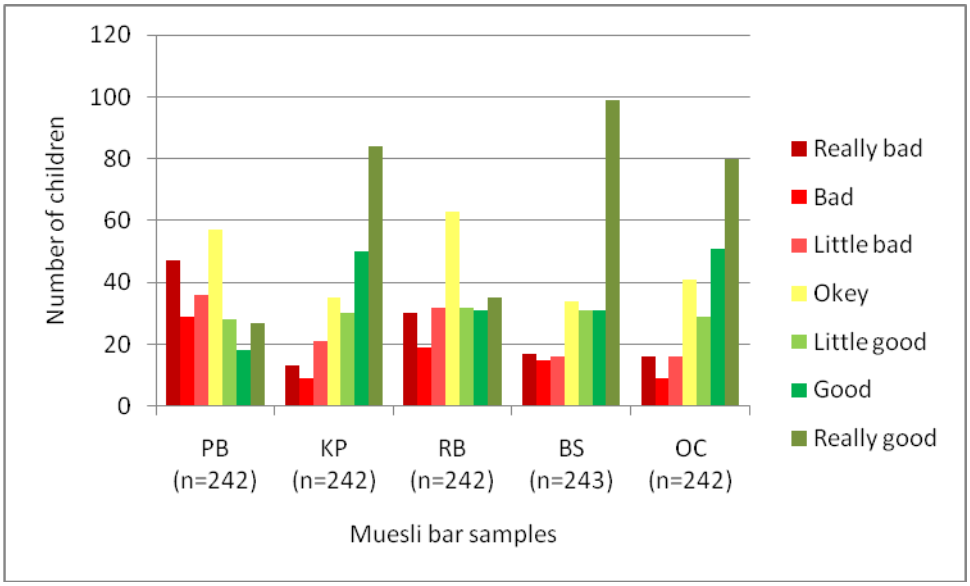
Oat-Cranberry

Bäst i världen!
Jätte bra!
Den var god
Bra smak, dåligt att jag inte sparade en bit
Bra
Okej
Den var jätte god och fin
Ganska bra
Bra
Toppen god
God
God smak
Bra
Lite dålig
Dålig
Den var jättegod
Ganska god
Jätte bra
Bra smak
Inte så god
God
Vill äta igen
Bra för knaprig
Bra smak, lukt
Bra
Jätte god

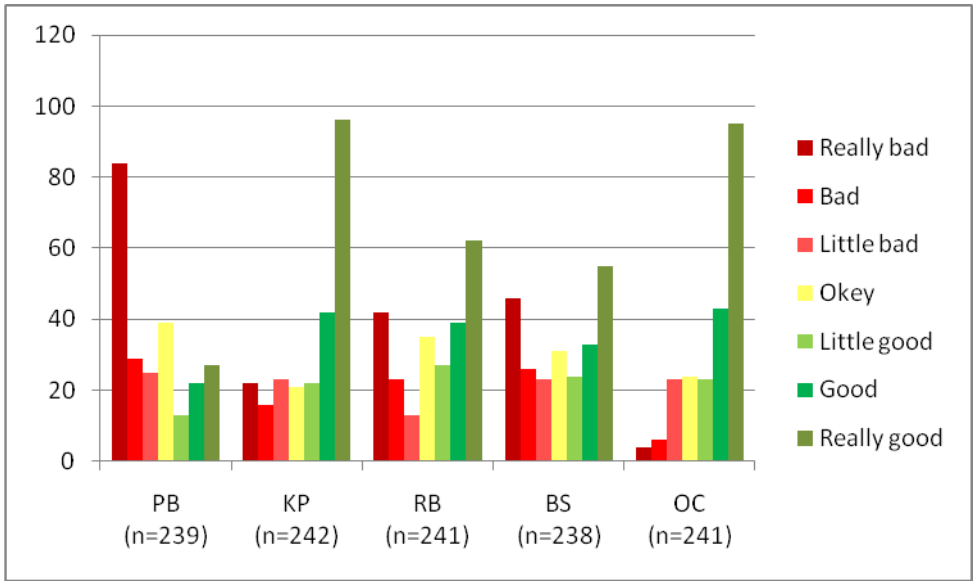
The graphs show Danish *(DK)* and Swedish *(SW)* children's (all together) distribution of ratings for the appearance, smell, flavour/taste and texture of each muesli bar.



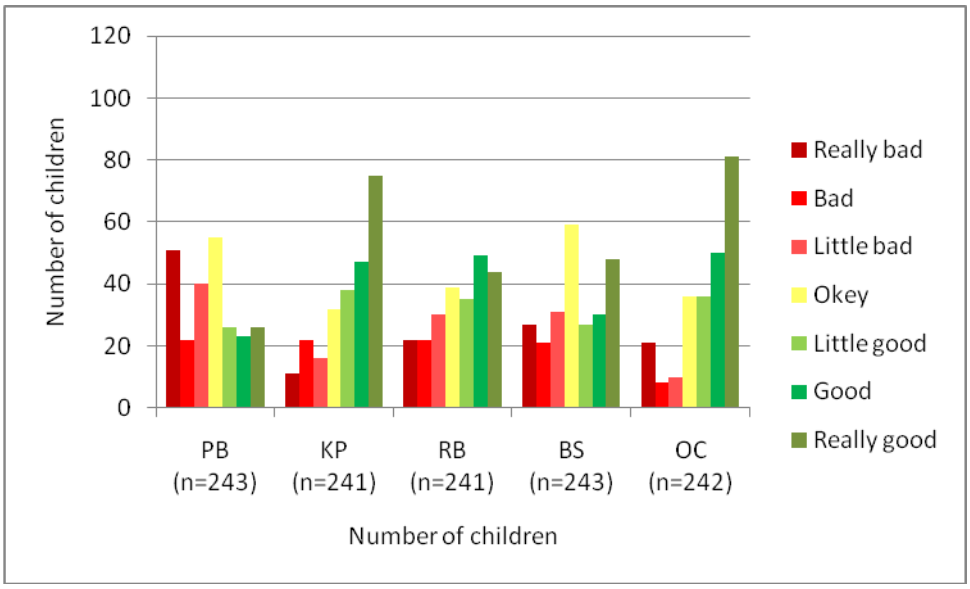
APPEARANCE (DK & SW children)



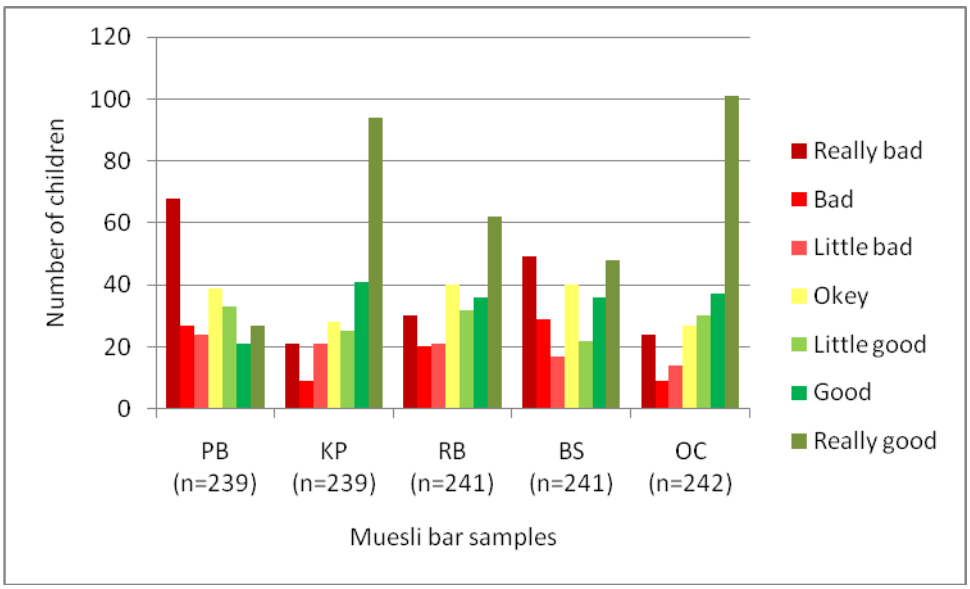
SMELL (DK & SW children)



FLAVOUR/ TASTE (DK & SW children)



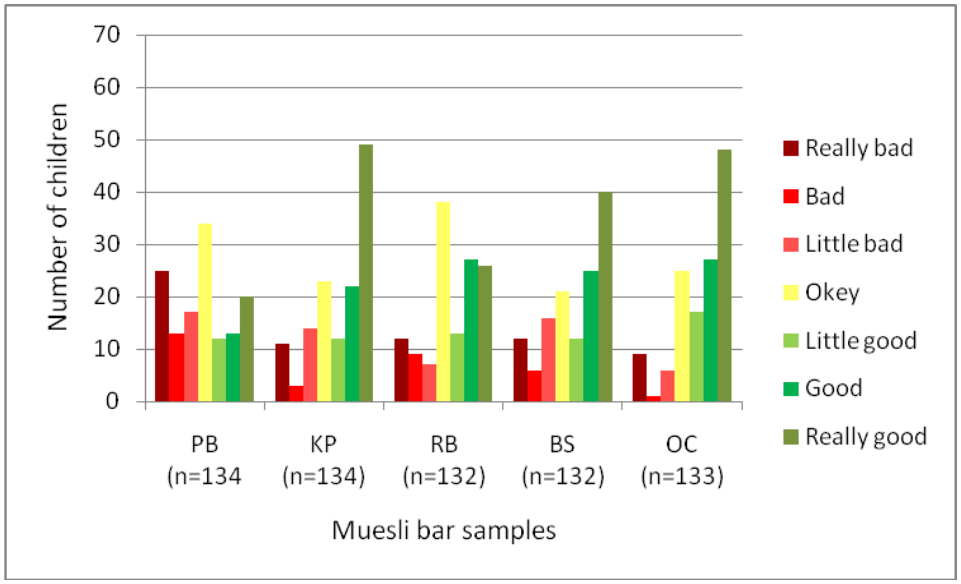
TEXTURE (DK & SW children)



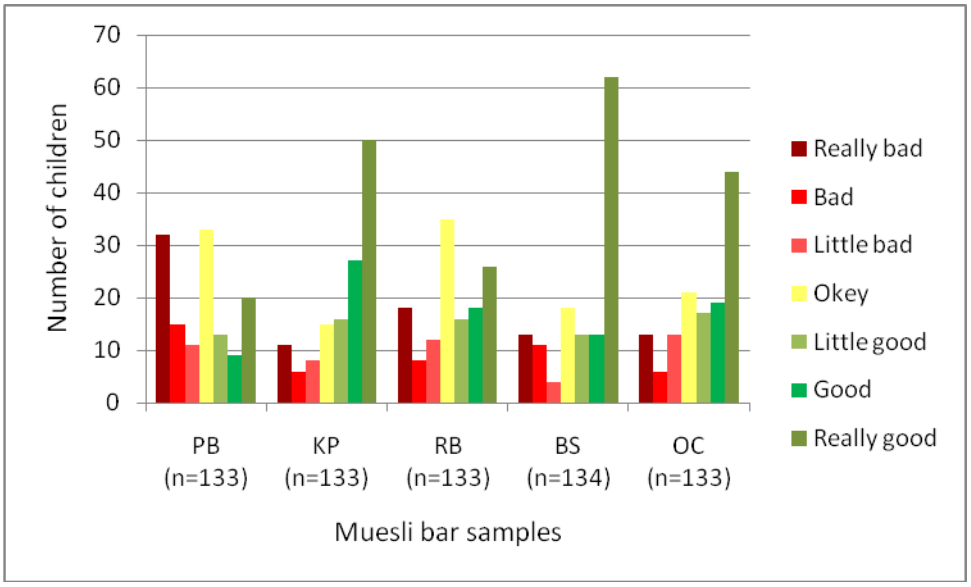
OVERALL LIKING (DK & SW children)

Frequency graphs - Danish children

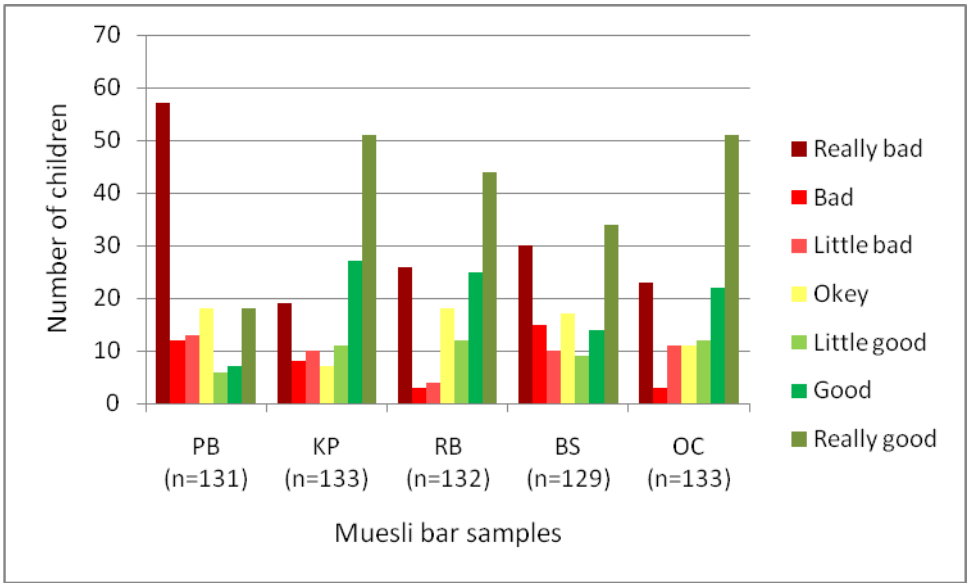
The graphs bellow show Danish *(DK)* children's distribution of ratings for the appearance, smell, flavour/taste and texture of each muesli bar.



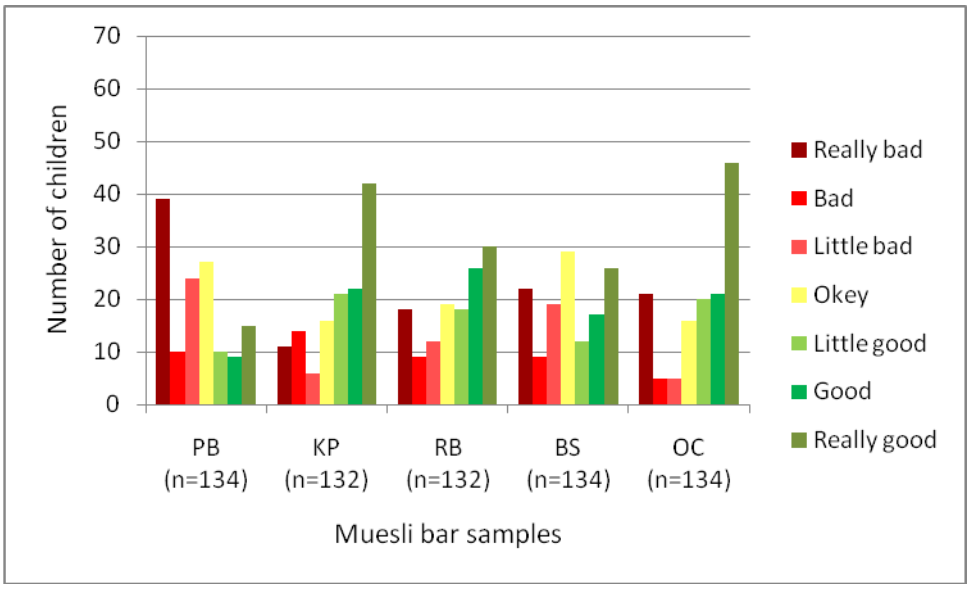
APPEARANCE (DK children)



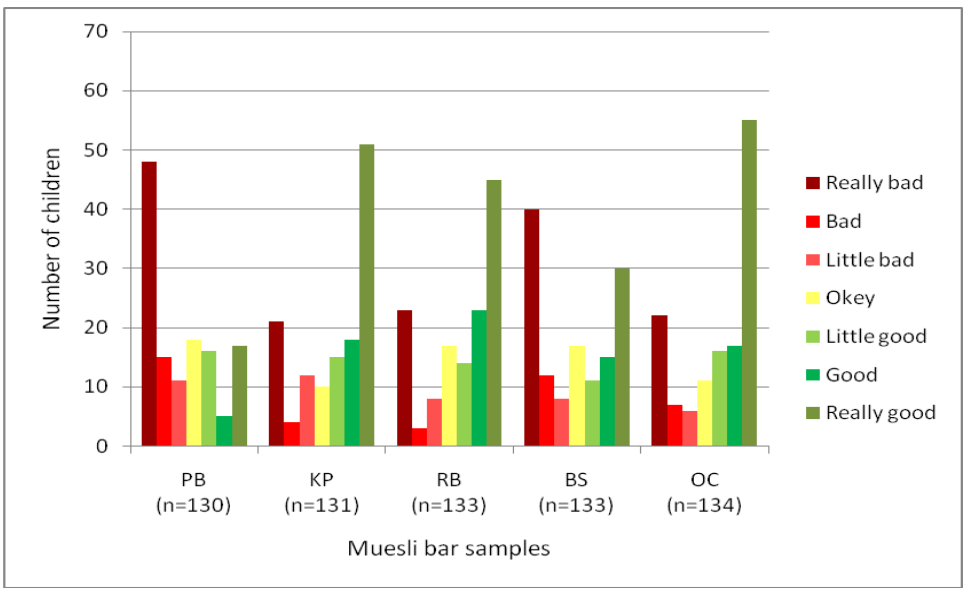
SMELL (DK children)



FLAVOUR/ TASTE (DK children)



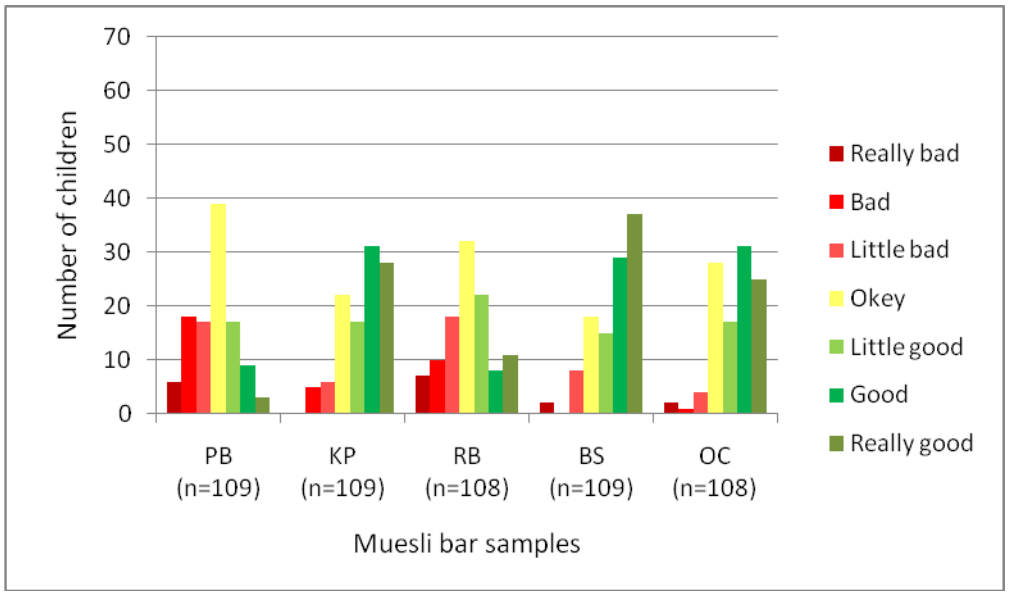
TEXTURE (DK children)



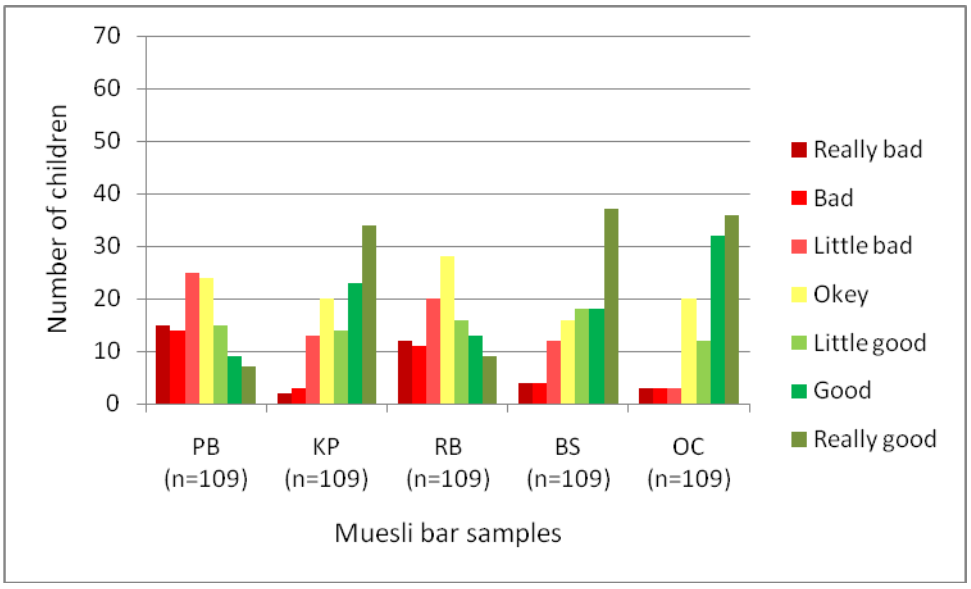
OVERALL LIKING (DK children)

Frequency graphs - Swedish children

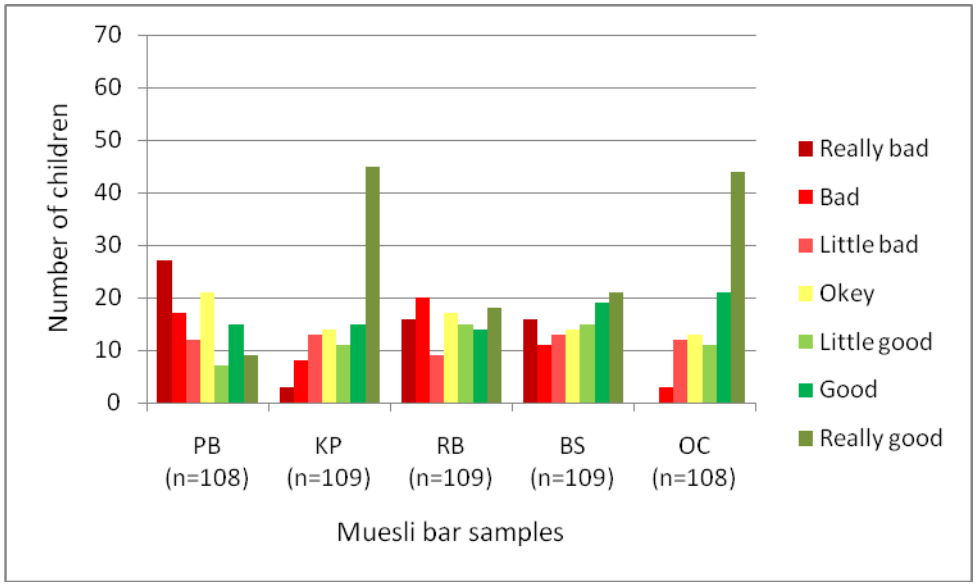
The graphs bellow show Swedish *(SW)* children's distribution of ratings for the appearance, smell, flavour/taste and texture of each muesli bar.



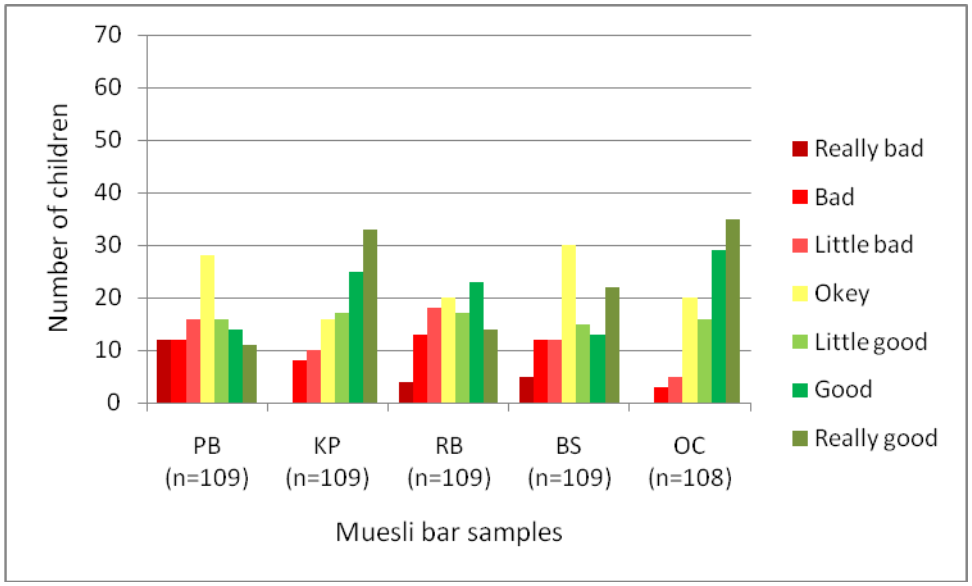
APPEARANCE (SW children)



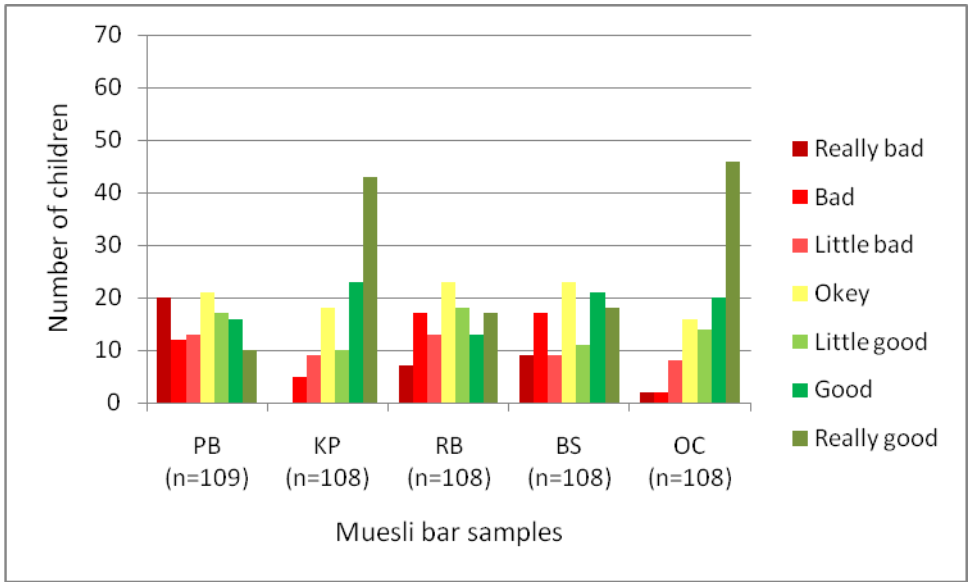
SMELL (SW children)



FLAVOUR/ TASTE (SW children)



TEXTURE (SW children)



OVERALL LIKING (SW children)