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Influences on schoolchildren's
dietary selection
Focus on fat and fibre at breakfast

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by

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Abstract

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One important aim of the Swedish Action Programme for Nutrition is to increase the consumption of dietary fibre and decrease fat intake. The currently available extensive range of fat-reduced and fibre-enriched foods makes these dietary practices possible, but also makes the selection of a health promoting diet more complex. This thesis aims to contribute to the understanding of psychosocial influences on schoolchildren's food choice, with specific attention to fat and fibre content. The focus was on breakfast because typical Swedish breakfast foods are important sources of fat and fibre. The Theory of Planned Behaviour formed the theoretical basis of the studies. All pupils in the 5th, 7th and 9th grades in Mölndal municipality (N=1730) were asked to complete a questionnaire and a 7-day food record. Interviews were performed with 181 of those subjects. A picture-sort interview technique, the "stacking box methodology", was employed to describe perceptions and habitual choices.

Assessing diets of children and adolescents is not an easy task. As in all dietary surveys, reporting and participation biases may exist. The present study using food records illustrates several such biases, which should be taken into consideration in the design, analysis and interpretation of future studies. The "stacking box methodology" seems promising, and appeared to have some advantages compared to traditional methods. However, the two dietary assessment methods generally yielded similar results. Reduced-fat choices of milk and margarine were common, although a considerable number of subjects consumed full-fat products. When it comes to the consumption of bread and cereals, the low-fibre alternatives dominated.

At the age of 11 as well as 15, children's own attitudes and underlying beliefs were of importance for breakfast food choices, as was parental influence. Parents influenced food choice by controlling food availability, acting as models and encouraging the child to consume. The perceived parental norms supported dietary changes towards products with more fibre but not towards fat-reduced products. However, the perception of parents' own consumption seemed to favour consumption of fat-reduced milk. Participants' attitudes were associated with health beliefs as well as taste perceptions. In general, the results suggest that taste may be a barrier to the consumption of high-fibre products, while consumption of low-fat products appears to be impeded by health beliefs. Contrary to several other studies, the present results suggest that some aspects of young people's dietary behaviour are related to their knowledge. Specifically, the choice of high-fibre products was associated with knowledge of fibre sources and the choice of fat-reduced milk products was associated with a positive attitude towards limited fat intake.

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LIST OF ORIGINAL PAPERS

This thesis is based on the following papers, which will be referred to by their Roman numerals:

- I Berg C, Jonsson I, Conner M T, Lissner L. Sources of bias in a dietary survey of children. *European Journal of Clinical Nutrition* 1998;52:663-667.
- II Berg. C, Jonsson I, Conner M. Understanding choice of milk and bread for breakfast among Swedish children aged 11-15 years: An application of the Theory of Planned Behaviour. *Appetite* 2000; 34:5-19.
- III Berg M C, Jonsson I, Conner M T, Lissner L. Relation between breakfast food choices and knowledge of dietary fat and fiber among Swedish schoolchildren. *Journal of Adolescent Health* 2002; 31:199-207.
- IV Berg C, Jonsson I, Conner M, Lissner L. Schoolchildren's perceptions and reasons for choice of fat and fibre containing foods. Submitted.

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ABBREVIATIONS

BMI	Body mass index
CI	Confidence interval
CVD	Cardiovascular diseases
E%	Proportion of energy in percentage
HDL	High-density lipoproteins
OR	Odds ratio
RC	Relative concentration
ROC curve	Relative (receiver) operating characteristic curve
RP	Relative position
RV	Relative rank variance
SNR	Swedish Nutrition Recommendations
TPB	Theory of planned behaviour
TRA	Theory of reasoned action

INTRODUCTION

Encouraging health-promoting food habits

If dietary interventions are to be effective, more research is needed to provide knowledge about determinants of food choice and about how to effect change in those determinants. This thesis focuses on the first of these issues.

Diet and health

Food affects quality of life in many different ways in the short as well as the long term. In order to promote health and prevent dietary-related morbidity and mortality, a national plan of action has been developed, addressing food habits and health problems relevant to Sweden. According to this nutrition programme, the most important desirable dietary changes are to increase fibre intake and decrease fat intake (1). These nutrition goals are consistent with the European Union population goals (2). The suggested dietary changes in Sweden are to decrease the intake of fat, meat, pastry and dairy products rich in fat, and increase the intake of foods rich in dietary fibre such as cereals, fruit and vegetables (1).

The rationale for public nutrition goals is manifold. Healthy eating may prevent ill health, early death and psychological burdens on individuals and their families, and might also have an impact on the public economy. Although many of the links between diet and health are difficult to detect, diet is considered to play a role in some of the major causes of disease and death today. During the last decades, the nutrition problem situation in Sweden has changed dramatically. Dietary insufficiency diseases have decreased in public health importance; instead there is increasing concern about health hazards related to dietary excess, dietary imbalance and inactive lifestyles. For example, it is estimated that more than one third of deaths due to cardiovascular disease (CVD) in the European population aged 35-64 are attributable to diet (3). CVD is the main cause of death in Sweden, and also leads to prolonged illness (4). Effects on blood cholesterol levels, blood pressure, thrombogenic mechanisms, body weight and insulin resistance are some ways in which dietary factors exert their influence on CVD (3). It is estimated that more than half of the Swedish population has elevated ($>5,2$ mmol/l) cholesterol levels (4). Dietary prevention is suggested based on the strong evidence that intake of saturated fat raises cholesterol. Trans fatty acids as well saturated fats are considered to affect CVD

risk, while polyunsaturated fatty acids raise levels of beneficial HDL. There is also some evidence that soluble fibre lowers blood cholesterol levels (3).

Being overweight or obese is related to many diseases and health problems, including CVD, type 2 diabetes, cancer and psycho-social problems. Obesity has come to be regarded as one of the fastest growing epidemics (5). The prevalence of obesity is increasing in all age groups in Sweden, particularly among young people (4). Although obesity has underlying genetic causes, the current acceleration is likely to be a consequence of lifestyle changes. Sedentary lifestyles and over-consumption of high-fat and energy-dense foods are behavioural patterns that have been suggested as main influences on energy regulation (5). However, the influence of dietary composition on weight regulation is controversial; issues concerning effects other than energy density are in special need of resolution. Nevertheless, many studies indicate that a diet low in fat (6-8) and high in fibre (6, 9) might protect against obesity.

Cancer is the second greatest cause of death in Sweden (4). Consensus exists on some aspects of the relationship between diet and cancer, while more research is needed to clarify other relationships. Despite some uncertainty, current available data suggest that alcohol, some fatty acids and certain food preparation methods are risk factors for certain cancers, while a diet rich in certain micronutrients, dietary fibre, whole grains, fruit and vegetables is associated with reduced risk of some cancers (10).

Influencing food habits in children and adolescents

There are several potential advantages to encouraging health-promoting food habits in young people, one of which is that food habits in early years might influence disease development later in life. Based on evidence that the atherosclerosis process begins at an early age, it is recommended that dietary prevention of adult CVD should start in early childhood (11-13). Further, overweight in childhood is related to morbidity (14) and mortality (14, 15) in adulthood, and the risk of adult obesity is greater for obese children, compared to non-obese children (14, 16).

Another advantage of trying to influence food habits in children and adolescents is that the school is a unique arena for nutrition education in which it is possible to reach many different groups of young people. Moreover, children's food choices and preferences might influence the intake of other family members, as observed in an American study in which children were an obstacle to their parents' efforts to adopting a diet lower in fat (17).

The last, but not least, important advantage is that it might be easier to maintain established food habits than to change them later in life. It has been suggested that food habits are learned (18-20), but tend to be stable (20). There is no consensus that food habits are established in childhood but studies have

shown a longitudinal tracking of dietary intake or dietary preferences from pre-school to early school years (21), during school years (22, 23) and during adulthood (24). Retrospective studies have concluded that some childhood food habits persist later in life (25, 26) and that, although changes in roles and environments in different stages of life sometimes will lead to changes in food habits, these changes may be temporary (27, 28). Furthermore, the strength of attitudes has been demonstrated to vary over the life cycle, peaking at mid-life, implying that attitudes might be less resistant to change early in life (29).

However, even if there are public health advantages to influencing health-promoting food habits in young people, one can question the advisability of doing so from an ethical standpoint. In the light of the fact that adolescents value their present and future health highly, and view health as a means to achieving a good life (30), it seems more justified to facilitate and encourage health-promoting choices than to avoid doing so.

Swedish schoolchildren's diet

According to national dietary surveys, (31) the relative energy intake from macro-nutrients in the adult Swedish population has approached the recommendations during the nineties (32), with a decreased percentage of energy (E%) from fat. A corresponding trend has previously been observed among 14- and 17-year-old adolescents. The results of a study in northern Sweden indicated that the relative energy intake from fat had decreased as a result of an increased consumption of cereals. The percentage of dietary fat decreased from 42E% in 1967 to 33E% in 1989 (33). However, the intake of saturated fat had not declined. The most recent survey data suggest a reduced intake of saturated fat and an increased intake of carbohydrates in schoolchildren's diet would better correspond to the Swedish recommendations (33-35). The increase should preferably be in the form of foods naturally rich in carbohydrates, since the intake of refined sugars has been observed to be higher than desirable (35). When it comes to vitamins and minerals, the average intake in schoolchildren corresponded to the Swedish Nutrition Recommendations (SNR; 32) except for vitamin E, folacin and selenium, iron and vitamin D for girls; these intakes were below the recommended. (33-35).

Quite contrary to the recommendations, 11-15-year-olds' intake of low-fat milk, whole-grain bread, vegetables and fruits has declined during the recent years, according to the Swedish data in a WHO collaborative study (36, 37). Moreover, the consumption of soft drinks, sweets and potato crisps has become more frequent (36, 37), although these items are still less commonly consumed than in most other European countries (38). Cereals, milk products, fat and sweets are reported to be consumed daily by the majority of adolescents in Swedish surveys, while vegetables and fruit have been reported to be more rarely consumed (34, 39). It has also been demonstrated that more energy is

derived from light meals and snacks than from either of the main meals (33, 34). However, the majority eat breakfast and dinner, whereas many skip the school lunch (34, 39).

The average intakes of foods and nutrients described above give a picture of average food habits among schoolchildren, but it is important to remember that dietary intake, meal patterns and nutritional status differ between individuals. Social inequalities exist; for example, parents' low socio-economic status or low educational levels have been observed to be associated with lower consumption of vegetables (34, 39), higher fat intake (40), more irregular meal patterns (39) and higher BMI (39, 40). It has also been demonstrated that food habits co-vary with other health behaviours, e.g. smoking (34, 39, 41, 42), use of alcohol (42, 43) and drugs (42), and early sexual intercourse (43).

In conclusion, dietary surveys indicate that the average intake of nutrients in schoolchildren corresponds to the recommendations fairly well, but that certain changes (see p13) in the average Swedish diet (1) might be appropriate, especially in certain population groups. However, the results of these surveys must be interpreted with caution. The results are not up-to-date, are not representative for the entire Swedish school-aged population, and are likely to be associated with different errors. For example, the estimated average energy intakes (33, 34) are low compared to reference values (32), and an underestimation of energy intake was confirmed by the double-labelled water method in one of the studies (34). Thus, under-reporting is likely, and might be selective. Considering two of these possible biases (selection and response bias), it is more probable that available data make food habits look "better" than vice versa.

Fat and fibre intake

How then, do the intakes of dietary fat and fibre correspond to the recommendations? According to SNR (32), the intake of total fat should not provide more than 30% of energy intake. The intake of saturated fatty acids together with trans fatty acids are recommended to be less than 10E%. According to dietary surveys (33-35, 44, 45), the average diet of Swedish schoolchildren is high in fat. The results indicate that 60-90% of Swedish schoolchildren have an energy intake from fat exceeding the recommended upper limit of 30E% (34, 35, 44). The relative energy supply from fat has averaged 32-37% in studies performed during the eighties and nineties (33-35, 44, 45), and the corresponding value for saturated fat is 15-16E% (33, 35).

The new SNR (32) for fibre intake applies only to adults and, since there are insufficient grounds for a recommendation for children, it only suggests that a corresponding fibre proportion is probably too high for children under the age of three. Adults are recommended an intake of 25-35g fibre per day, which

corresponds to 3 g/MJ. Presently, there are no separate recommendations for soluble and insoluble fibre, but the acquisition of dietary fibre from a variety of sources is recommended. According to FAO/WHO (46), a diet with an increasing carbohydrate intake from a variety of sources should be gradually introduced from the age of two. A suggested safe range of dietary fibre intake for children is their age + 5-10g/day (47). Among Swedish 14-15-year-olds, the average intake of fibre has been observed to be 13-19g/day in girls and 16-25g/day in boys (33-35, 45). In a nationwide dietary survey, half of the 7-14-year-olds had a fibre intake below 15 g/day, and less than 25 % in this age group had a fibre intake of 20g/day or more (35).

Sources of fat and fibre

Milk is an important element of Swedish schoolchildren's diet. It is the major source of energy, protein and several vitamins and minerals. However, it is also the main source of fat, especially saturated fat. Milk and cultured milk contribute one quarter of the intake of saturated fat (35). In this age group, the average intake of milk and cultured milk is more than half a litre per day (34, 35, 48). With an intake of that magnitude, a switch from full-fat milk to low-fat milk would yield an energy reduction of 0,5MJ/day, i.e. ~5% of the reference intake value (32) if no energy compensation is calculated. The corresponding reduction of saturated fat intake would have been 10g/day, i.e. ~25% of the average intake (35).

Bread is another important source of energy and nutrients in schoolchildren's diet. It is already the major source of fibre (35), but has the potential to contribute even more fibre since white bread currently remains the most common choice (48). Sandwiches might also provide alternatives when it comes to fat content. Typical sandwich foods such as cheese, processed meat products and spread¹ contribute substantially to the intake of saturated fat; there are, however, low-fat alternatives.

Fruit and vegetables are also great potential contributors to increased dietary fibre intake.

Breakfast

This thesis focuses on breakfast because typical Swedish breakfast foods are important sources of fat and fibre. In Sweden, breakfast is generally a highly valued meal. One Swedish survey indicated that university students considered eating breakfast to be an important health behaviour in the same category as not smoking and not drinking excessively (49). Consequently, breakfast is

¹ In Swedish, the term "pålägg" refers to anything that is put on bread, often translated as spread. In this thesis, the term spread is used to refer to butter and margarine on bread.

commonly eaten. According to surveys, 72-95% of Swedish schoolchildren (11-15 years of age) eat breakfast daily and only 2-14% habitually skip breakfast (34, 42, 48, 50, 51). Skipping breakfast is most common among older children.

Some unpublished data from the studies in this thesis will provide background information about breakfast habits in the population studied. Figure 1 shows the composition of weekday breakfasts according to the food record in this thesis (study II). The most common breakfast consisted of milk and sandwiches sometimes with additional items.

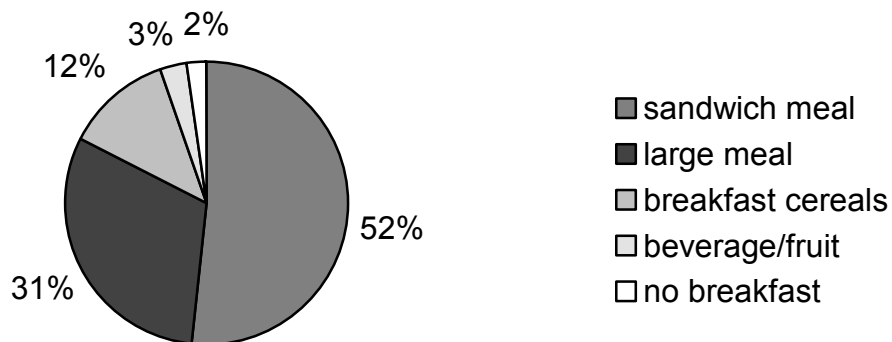


Figure 1. Categorisation of recorded breakfasts into different meal types: beverages and/or fruit; sandwich incl. any fruit/beverage; breakfast cereals (incl. porridge); a cooked meal or two of the following foods: sandwich, egg and breakfast cereals.

In the interviews (study III and IV), the children were asked why their habitual breakfast was composed as it was. The most frequently mentioned reason was taste; 35 % of subjects considered palatability to be an important attribute of their usual breakfast. Availability, satiety, habit, time and healthiness were other commonly given reasons, each accounting for 9-14% of responses. That time was a factor influencing breakfast habits was obvious when the breakfast context was described. Fourteen percent stated that they usually rushed while eating, and 41% reported that they ate quickly but without hurry, or that the tempo varied from day to day. The remaining 45% stressed that they prioritised time for breakfast and preferred to eat slowly in peace and quiet. The majority usually ate in the kitchen, some of them read or watched television during breakfast but most of them did nothing else while eating. Many of the children did not eat with their parents. Half of them reported that they often ate alone, and a similar proportion often made their breakfast themselves.

Understanding food choice from different perspectives

Because food choice is influenced by a variety of factors in a dynamic complex interaction, it can also be examined and understood from many different perspectives. Here, an attempt will be made to describe different research approaches to determinants of food choice, according to basic views on causality. These explanatory perspectives will be grouped together according to their main emphasis on heredity, environment or cognitions. This division gives a simplified picture of reality, and the distinctions between the perspectives should not be interpreted as well-defined limits (Figure 2).

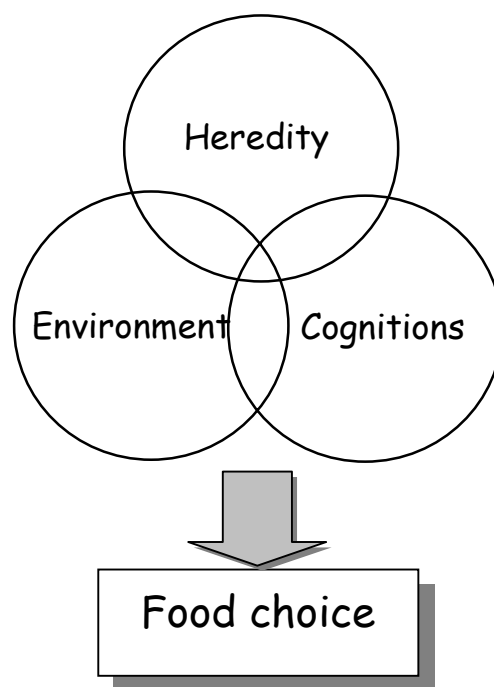


Figure 2. The choice of food is studied from different perspectives emphasising the influence of heredity, environment and cognitions to a various extent.

A sample of the contribution of different perspectives to the understanding of dietary selection is presented in the following text, the intention being to provide a multifaceted picture rather than accentuating conflicting standpoints. Studies addressing research questions of relevance for this thesis have been selected to serve as examples of different perspectives. Reviewing such a large and diverse area is a challenging task, and it is, of course, impossible to address every subject area in a complete and unbiased way.

Emphasis on heredity

Evolutionary biology

According to the theory of evolution, adaptation to the surrounding environment occurs through genetic transformation. Food intake is important for survival, and therefore it seems likely that evolution has impact on how and what people eat. However, according to a review by Birch (52) this explains very little about our food preferences. Since human beings are omnivores and adapted to consume what is accessible, they must learn which items are edible. Thus, it is the adaptability to access and supply through a few innate mechanisms in the process of food choice that have favoured survival. Today there is evidence of some hereditary characteristics. There is an inherent ability to like sweet and salty edibles, and to dislike bitter and sour flavours. A tendency to reject novel foods, neophobia, and an ability to develop aversion in response to delayed consequences following eating have also been suggested (52).

Genetic variation

In general, research suggests that genetic differences account for relatively little of the variance in human food preferences. Studies investigating resemblances of food preferences within the family have generally shown weak associations between children's and other family members' preferences. Moreover, resemblances between mother and father have been equal to or higher than resemblances between children and their parents. These results could be interpreted as indicating that the social and environmental influences within the family are of greater importance than heredity (53).

However, some genetic factors influencing preferences are known; for example, food allergy or intolerance such as lactose intolerance might affect preference for certain foods. There is also evidence of individual differences in the ability to perceive some bitter substances² (54). Among Europeans, approximately 25-30% are "blind" to these bitter substances (55). Some researchers claim that this taste ability is related to food preferences and consumption but there is no consensus on this issue. It has been observed that those who are "tasters" are more sensitive to other tastes besides bitter which they perceive more intensely. Therefore, it has been suggested that "tasters" are more likely to dislike irritants, sweetness and fat (56). However, a study in which children rated milk with varying fat content hedonically failed to demonstrate significant associations between genetic sensitivity to these bitter substances and taste preferences concerning fat content (57). In another study,

² The bitter substance phenylthiocarbamide (PTC) and its chemical relative 6-N-propylthiouracil (PROP).

non-taster girls rated full-fat milk higher hedonically than tasters, and the reverse tendency was observed for boys (58). Future research will enhance our understanding of these and other genetic influences on food preferences and choices, and how genetic predispositions interact with environmental factors.

Emphasis on environment

Food quality

Food technology research assumes that function and characteristics of food and its ingredients are decisive to whether or not it will be consumed. In addition to flavour which consists of both taste and smell (59), colour (60) and texture (61) are food qualities which affect acceptance.

Fat influences food sensory characteristics in several different ways. When a food is tasted, the first sensory signal from fat is the olfactory perception of fat-soluble volatile molecules. These compounds convey the characteristic flavour of many foods. When food is subsequently chewed and swallowed the texture is an important sensory quality dependent on fat content. The type of oral sensation depends on the food product and preparation, ranging from soft and juicy to crispy and brittle. In dairy products, fat takes the form of emulsified globules that are perceived as smooth and creamy. Thus, the fat content of milk contributes to the perception of its smoothness and viscosity (62, 63).

External stimuli

According to a behaviouristic perspective, environmental factors shape people's behaviour. Because external factors can be controlled, humans, like animals, are adaptable. Conditioning is a form of learning in which either a given stimulus becomes increasingly effective in evoking a response, or a response occurs with increasing regularity in a well-specified and stable environment. Lappalainen and Sjödén (64) propose that most everyday behaviours can be explained this way and present their ideas concerning why and how a functional analysis should be applied to food habits. Food is described as having the following effects from a behavioural standpoint: learning effects (e.g. conditioned salivation), reinforcing effects (e.g. food as reward for behaviour) and stimuli for other behaviours (e.g. coffee ingestion might be a stimuli for talking).

Birch (52, 65) has conducted considerable research on how children's food preferences are established. She proposes that food preferences depend on the frequency of exposure to a particular food, and the context and consequences of food intake. Thus, reduction of neophobia might occur with exposure to a new food. However, it is not enough to taste once; testing 5-10 times will probably give results. Children might also learn to like particular foods by watching others eating them.

Birch stresses that the feeding strategies parents use affect children's preferences, and that the consequences often are the exact opposite of the intent. Her research suggests that parents' attempts to control their children's food intake by restricting access to foods actually makes the restricted foods more attractive. Moreover, when a child gets sweets or food as a reward it results in increased preferences for this food item. If the reward is given for eating, the foods eaten to obtain rewards become less attractive (52, 65). However, Lowe and colleagues (66) have argued that the way the reward is given affects the outcome. If the idea that the consumption of particular foods is valuable to the child is conveyed when rewarding the intake, it might have the desired effect, i.e. that the preference for those foods is enhanced.

Results of two Nordic dissertations can serve as examples of research supporting the idea that children's food behaviour is learned. Hølund (67) demonstrated that Danish children's intake of foods rich in sugar was determined by habit, which in turn was shaped by environmental factors. Examined cognitive factors such as knowledge, beliefs and attitudes did not contribute to the intake. Koivisto (68) pointed out the role of childcare when it comes to moulding children's food habits. She showed that children could learn to associate milk with the lunch meal. Children served milk with lunch at the day care centre were more likely to consume milk with lunch at school later in life, compared to those who were served water at the day care centre.

Socio-economic status and gender

There are several explanations for the inequalities in dietary intake. One view is that roles and striving for identity might entail circumstances and choices leading to certain types of consumption. Another point of departure is that actual circumstances and conditions such as economic, access to foods and to knowledge are reasons for inequalities. Dietary surveys in Europe have shown that people with higher socio-economic status (e.g. higher level of education or higher occupational status) adopt diets that are more consistent with nutritional recommendations than people with lower socio-economic status (69-71). For example, it has been observed that intake of full-fat milk is more frequent among those with lower socio-economic status (69). Gender differences are generally more pronounced than socio-economic differences, and women tend to have healthier dietary intake compared to men, if intake is judged according to current recommendations (70). The situation may be similar among Swedish schoolchildren (72), e.g. boys have tended to report consumption of full-fat milk to a greater extent than girls (34, 48, 73).

Identity

The structuralistic approach is strongly associated with the anthropologist Claude Lévi-Strauss. He (74) transferred theories from linguistics to the field of

mental structures underlying cultural patterns. Just as language is determined by grammar, human phenomena such as food traditions are considered to be formed by structures in the guise of conceptions and ideas. This grammar is like that of language, unconscious but interpretable. According to Lévi-Strauss, people structure their reality into binary oppositions. He analysed the opposition between nature and culture by studying cooking, which he referred to as a cultural phenomenon, present in all societies. When people cook food, they transfer nature to culture. By preparing food differently, people express that they are civilised and indicate to which culture they belong. Simmel (75) also pointed out the importance of food for evoking a sense of belonging and distinction. In his opinion it is the possibility to refine that which is primitive and natural to all that makes the meal significant from the social perspective. Douglas (76) shares the view that food is used for communication, but hers is a more dynamic approach. She stresses that food has different meaning in different contexts and for different individuals.

That the same person might belong to and be affected by different cultures is demonstrated in Prättälä's (77) doctoral thesis. According to her results, a group of Finnish teenagers' food habits at home were related to socio-economic factors. Consumption of full-fat milk and butter was associated with low socio-economic status. In contrast, no socio-economic differences were observed for foods consumed outside the home, where the adolescents were influenced by their friends. When they ate with their friends, they principally consumed sweets and "junk food" of which their parents did not approve.

The well-known French sociologist Pierre Bourdieu (78) describes how people can show affiliation to a group and thereby distinction from others by taste and manners. The ability to act and behave "correctly" is characteristic of the dominant class, as is the capacity to distinguish that which should be highly valued from that which should not. The middle classes strive to attain these skills but lack the qualifications, while the lower classes are satisfied with what the conditions governing their lives allow and make a virtue of necessity in contrast to unnecessary luxury. Because people are imprinted through conditioning, current conditions are of less importance for taste and behaviour than those during childhood and adolescence. These ideas were adopted in two Swedish doctoral theses. Svederberg (79) focused on the symbolic value of foods varying in fibre or fat content among different ethnic groups. She concluded that dietary changes were facilitated if they were perceived as a step towards a diet with higher symbolic value. Ekström (80) had Bourdieu's theories as a basis for analysing why some individuals' food habits do not correspond to their own ideals and intentions. She argues that this contradiction is only present among those who strive towards something higher and better, but are unable to achieve this aim. Being aware of the norms but not managing to realise one's goals only leads to a feeling of inadequacy. Thus, the ideal of a varied, nutritious and inexpensive diet only results in a guilty conscience.

In order to understand food consumption it is also of interest to study how social structures and the idea of the symbolic meaning of food have developed historically (81). Fjellström (82) analysed how food habits have changed in an industrial worker population during the last century. The dream of enhanced quality of life through abundance and wealth has led to the desire for high status foods such as butter, sifted flour, and dairy products that are rich in fat. The desire to abandon foods with a poverty label has resulted in the consumption of products with more fat and less fibre. However, Fjellström argues that knowledge, traditions and, above all, living conditions such as supply and technical progress have significantly influenced this development.

“The dream of the good life” in affluence and the process of change towards an ideal characterised by discipline and restraint represent contrasting phenomena. As larger segments of the population have the resources to consume what they want, it has been more difficult for the upper classes to distinguish themselves from the lower by abundance. Instead, restraint and self-control have come to represent positive attributes. This has also manifested itself in body ideal, and the ideal of a slim figure and the fear of obesity gradually have spread down the social scale (83).

Geographic situation

According to a cultural geographic standpoint, the diet within a territory is influenced by the foods that can be and have been produced there. Cultivation and animal breeding are dependent on factors such as climate, topography, natural vegetation and soil.

Bread and other cereals have been staple food in Sweden since the Stone Age (84). Bread type varies in different parts of the country and has been connected with cultivation conditions and technical development. In contrast to many other countries, several types of unleavened bread have been preserved in modern Swedish tradition (85). In the nineteenth century, wheat was only grown to a small extent and white flour was a luxury (86). Thus, most bread types were baked out of whole-grain rye, oats and barley which are less suitable for leavened breads. Some of these traditions still existed at the end of the twentieth century even if consumption of white leavened bread has increased dramatically (87).

When it comes to livestock, Sweden belongs to a territory in which cattle have been an important feature since the Stone Age, for manifold reasons (86). The fact that animal fat has been of greater importance than vegetable fat might be due to cultivation requirements. In general, oil plants require other conditions than those found in Sweden. Butter has been an important commodity and was one of the most important export commodities during the Middle Ages (88). Because almost all cream was used for butter, sour skimmed milk was traditionally consumed (89, 90).

Koçtürk (91) has studied how food habits change after migration to a new culture. She found that changes begin with foods such as beverages, fruits, sweets and fats. The attachment to milk products, vegetables, meat, fish and egg are stronger, and these foods are thereby more resistant to replacement. The longest time, perhaps generations, may be required to alter the consumption of staple foods. According to Koçtürk, bread, potatoes, pasta and rice are staple foods in Sweden.

Agricultural and trade policy

Nordic researchers in various disciplines have demonstrated that political actions favour producers rather than consumers, and that economic interests often take precedence over health interests (92-95). Milk has been of great economic and nutritional importance in Scandinavia. The dairy industry has therefore had a strong position and production and sales of butter have been favoured over margarine through legislation and price regulations (93-95). In recent years the nutritional goal of decreasing the population's intake of fat has come into conflict with the existing surplus of fat. Kjærnes (94) demonstrates how this conflict has made the introduction of low-fat milk difficult in Norway, and Jensen (93) argues that research results contradicting most other evidence have been used to defend milk fat.

However, the joint agricultural policy of the European Union has resulted in a high price of butter compared to vegetable fat for the consumer. On the other hand, there is a subsidy to the industry for the use of milk fat. Furthermore, there has been a programme for promotion of milk products rich in fat, e.g. subsidising the use of fat-rich cheese, and full and medium-fat milk in schools and childcare institutions³. After Sweden entered the EU 1995, the sale of low-fat milk to day-care centres and schools decreased in favour of higher-fat alternatives; this might be interpreted as a result of these subsidies (97).

Emphasis on cognitions and environment

Price, income and expected utility

According to the economic consumption theory, consumers' choices are assumed to be determined by price, income and expected utility. Economic factors are considered to be much easier to estimate compared to non-economic factors, and thereby more advisable to examine. Economists conventionally use a measure of the responsiveness of demanded quantity to price changes, known as price elasticity. Most main food products have been found to be inelastic, i.e. less responsive to price changes. Products such as milk, fat and cereals have

³ Since 2001, low-fat milk, soured milk and yoghurt are also the objects of subsidy, but the subsidy level increases with increasing fat content (96).

been observed to be very price-inelastic. When responsiveness to a change in the average level of income is studied, these types of foods tend to have negative income-elasticity, i.e. consumption falls with income (98, 99).

Meaning, context and situation

Furst and colleagues (100) have developed a model of the food choice process in which ideals, personal characteristics, resources, social relationships and food contexts are considered to affect food choice. These influences interact with each other and are affected by the roles and contexts to which a person has been and is exposed. Together, these factors underlie the development of strategies and rules for making food choices. An interview study (101) applying this model observed that one strategy for simplifying food selection was to categorise foods and eating situations. Because values were often conflicting, it was necessary to prioritise some of them according to the situation. Another way of handling conflicting values was to balance prioritisations across certain time frames, e.g. to compensate unhealthy foods with healthy ones during the day or week.

When analysing his in-depth interviews with young adults, Jansson (28) point of departure was that people act according to their personal opinions and perceptions. These ideas are developed in the interaction with others but are interpreted by each individual based on given experiences and circumstances. One of the conclusions of this study is that the participants did not consider it meaningful to choose foods that might promote long-term health in a situation in which they were young and healthy. Their nutritional knowledge was good, but they chose foods that they perceived as healthy only to a small extent. When they chose foods rich in fibre or low in fat it was due to short-term reasons such as appearance concern or stomach troubles.

According to Palojoki (102), homemakers' food choices are determined by living conditions, habits, traditions, taste preferences of household members, and economic and time resources within the household. The importance of these factors varies since conditions, ideas and intentions are dependent on the context. Factual knowledge had little effect on food choice, an exception being that fat quality was considered in the choice of sandwich spread. The choice between different foods was problematic because of the necessity to make compromises between contradictory needs. Palojoki claims that if factual knowledge is to be important in this process, it must be meaningful to the individual. Without a comprehensive picture, if knowledge only consists of rote-learned fragments, it is not possible to apply it in daily life.

The modern society

Holm (103) claims that people have the opportunity to choose their own "food culture" in today's society. Food habits also become a part of the responsibility

for identity and health. This individualisation puts pressure on the individual since it requires reflection, self-scrutiny and decision-making. Holm interviewed young adults participating in a dietary intervention. In spite of the fact that they liked the new “healthy” food and wanted to change their food habits, their serum cholesterol values did not indicate that they maintained their new food habits after the intervention. The “healthy” food habits were impeded by practical, economical and social barriers, and the fact that the health benefits of the food were not observable except in the blood test results. However, the overall view was that it was easy to continue with the new habits. The problem was that “healthy” food was not associated with a desirable culture, but rather with sick or ascetic people.

The picture of the reflective consumer living a life characterised by a choice between several alternative lifestyles is also depicted by Bugge (104), according to whom risk calculations have become central in modern society. The individual is forced to relate to diet and health and to take responsibility for her/his body. At the same time less and less food production take place in the home, resulting in decreased knowledge of production, and the fact that one has to trust experts and theoretical knowledge. The results of the interviews with parents of small children, demonstrate that few of them were unconcerned with the information about diet and health with which they were confronted. They either tried to follow the recommendations or else they repudiated them. The general opinion was that a high-fat diet was a health risk, but some considered this risk to be overstated and assumed that the risk principally concerned others. There was also a widespread opinion that children need a high fat intake for normal growth and development (105). Another important barrier to the acceptance of low-fat products was the perception of them as artificial industrial products, which made them unnatural and uncontrollable. Moreover, the participants generally saw an opposition between “tasty food” and “healthy food”; the food rich in fat was associated with pleasure whereas the lean food was considered to be less palatable and difficult to combine with social intercourse. Nevertheless, low-fat products were frequently consumed and the principal motives were concerns about health and appearance (104).

Emphasis on cognitions

Perceptions of health risks

Risk perceptions, both serious and more trivial, are considered important in the choice of food since consumers are more often motivated by the desire to avoid mistakes than the wish to maximise utility (106). According to the results of a Swedish survey, a diet rich in fat and low in fibre was believed to be the greatest public dietary risk in Sweden (107). The public risk evaluation of a high-fat, low-fibre diet did not essentially differ from that of the experts (108). When it

comes to personal risk, toxic substances and biocides were considered to be the most serious problems, while the high-fat, low-fibre diet placed fifth on the list of perceived risks. The fact that perceptions of personal risk differ from those of public risk might be due to the fact that risk is a mixture of both probability and consequence, and the probability may, to some extent, be influenced by the individual (107).

The fact a diet rich in fat and low in fibre is perceived as a minor threat to personal health might be explained by the fact that one's own diet is overrated. People tend to be unrealistically optimistic when assessing the probability of being subjected to positive or negative events. This particularly applies to events which are considered to be controllable, among which are the risks and advantages related to one's own diet. Research has demonstrated that people tend not only to underestimate the risk of being affected by negative nutritional consequences (e.g. weight gain, feeling unwell or contracting a heart disease), but also to overestimate their own knowledge concerning potential risks (109), and the quality of their own diet (110). For example, European surveys have demonstrated that people tend to underestimate their fat intake (111, 112). This can lead to the idea that dietary changes for health reasons are primarily needed by others. A survey of a representative sample of adults from each member state in the EU showed that 70% of the citizens of Sweden as well as the EU as a whole thought that they did not need to change their food habits since their diet quality was already sufficient from a health perspective (113).

Expectations and evaluations

Social cognition models have been widely applied for increasing the understanding of determinants of health behaviours such as food choice (see Conner and Norman (114), for a review). One basic assumption in these theories is that cognitive factors are important determinants of behaviour, and that many other determinants such as socio-economic and religious factors are mediated through these cognitive factors. Thus, social behaviour is considered to be better understood by examining people's perception of reality, rather than studying the objective reality. However, people themselves cannot always state what determines their behaviour and how important different determinants are in relation to each other. Therefore, the behaviour of an individual is often examined in relation to her/his beliefs and perceptions.

Some of these models, known as grounded theories, have been developed specifically to explain health behaviours e.g. "the Health Belief Model" and "Protection Motivation Theory". Other theories were not originally developed in order to understand health behaviour, and have a wider field of application, e.g. the "Theory of Reasoned Action" (TRA) and the "Theory of Planned Behaviour" (TPB) (115). In some respects, many of the social cognition models share common similar features. Cognitions such as attitudes, feelings and beliefs

are considered in different ways, and components focusing on the perceived consequences of performing the behaviour are generally included. Another basic assumption is that people tend to engage in behaviours they believe they have control over, and to avoid those they believe they cannot accomplish (116). Models developed especially for health behaviour also focus on perceived susceptibility to a health threat and perceived severity of this threat.

In studies using TRA or TPB for understanding the choice of milk or bread, primarily attitudes (117-126), but also social norms (117, 121-124) and perceived control (124) have predicted the intention to consume the food. Both taste and health aspects were in turn associated with the attitude towards consumption (118-120, 123, 127).

Tuorila (123) combined TRA with a hedonic test to predict buying intention and consumption of milks with varying fat content. The subjects' reported liking of the milk in the sensory test had a negligible effect on the predictive power of the model. Thus, according to this study, cognitive factors were much more important than the sensory response. However, although attitude was the best predictor of milk choice, Tuorila argued that social pressure actually determined this choice. In her opinion, it is more likely that beliefs and attitudes are developed to justify the food choice than that beliefs actually result in a certain choice. The results are interpreted in the light of consistency theories. Thus, people must make their consumption reasonable to themselves and therefore form beliefs and attitudes to support their choice.

The aim of Laub Hansen's (128) thesis was to study the relation between nutrition knowledge, attitudes and food choice among young adults. The results show that the participants were able to put their knowledge into practice when asked to compose a healthy breakfast in an experimental situation. The most common reasons for including particular foods in this breakfast were high fibre content and low fat content. Taste preferences and habits were also reasons for choosing foods for a healthy breakfast. For example, whole-grain bread was selected because it was considered palatable, and cheese was selected, even if it was considered unhealthy, because of its taste.

Näslund (49) studied the association between cognitive factors and different health behaviours. According to the results, these health behaviours were related to the attitude towards the specific behaviour. The attitude was, in turn, associated with knowledge of the importance of the behaviour for different diseases. A few analyses showed a direct relationship between knowledge and behaviour, e.g. knowledge was associated with intake of dietary fibre.

Summary, explanatory perspectives

Food choice is studied from many different perspectives, some examples of which are given in Table 1. Different conclusions may be drawn, depending on the perspective from which food choice is studied. The results of the research reviewed here indicate that genetic factors affect food selection, but that cognitive and environmental factors are more important.

Table 1. Summary of the main explanatory perspectives described here.

Main emphasis	Perspective	Focus on
Heredity	Biological	Genetic predisposition
Environment	Technical	Food quality
	Behaviouristic	Responses to external stimuli
	Structuralistic	Structures: mental, social, societal etc.
Cognitions and environment	Economic	Economic factors (and expected utility)
	Interactionistic	Ideas and meanings in interaction with other people and with environment
Cognitions	Cognitive	Attitudes, beliefs, perceptions and feelings

Every study must have specific bases and perspectives, but this does not imply that other perspectives should be rejected. It is, of course, easier to do so when justifying the choice of perspective for oneself and others, but the results will be more meaningful if they are regarded as a piece of a bigger picture. In this section, different explanatory perspectives have been described, and this thesis is placed on the research map in the next section.

THEORETICAL BASIS

Perspectives

Different directions within a research area can be categorised in many different ways, e.g. according to methods used, disciplines, the research motive, or as described above, basic view of causality. To begin with, a cognitive angle of approach is adopted in this thesis. Independently of factors (genetic, environmental and cognitive) influencing food preferences and dietary selection, these influences may be reflected in individuals' perceptions. Therefore, studying relationships between people's food choice and their beliefs and attitudes might help us to understand the variation in food selection within a population.

Further, in this thesis food choice is studied from a health perspective, i.e. health aspects are the motive for research, and generate the research questions. When it comes to disciplines, this thesis in home economics uses theories and methods derived from the fields of social psychology⁴ and nutrition⁵. In Home economics management of resources, immaterial (e.g. cognitive factors and health) as well as material, is emphasised. It is a multidisciplinary research field aiming at developing an understanding of everyday life as it is perceived by individuals or households. The general incentive of research in home economics is to generate knowledge that will contribute to the enhancement of the quality of life (102).

The theory of planned behaviour

When the extent to which cognitive factors influence food selection is examined, the Theory of Planned Behaviour (131; TPB; Figure 3) can serve as a useful framework. The model is an extension of the Theory of Reasoned Action (132 ; TRA) which assumes that behaviour such as food choice is determined by an individual's intention to perform the specific behaviour. The behavioural intention is, in turn, regarded as a result of the attitude towards the behaviour

⁴ Emphasis on the thoughts, feelings and behaviour of individuals as shaped by the actual, imagined, or implied presence of others (129).

⁵ Emphasis on food/nutrients and health (130).

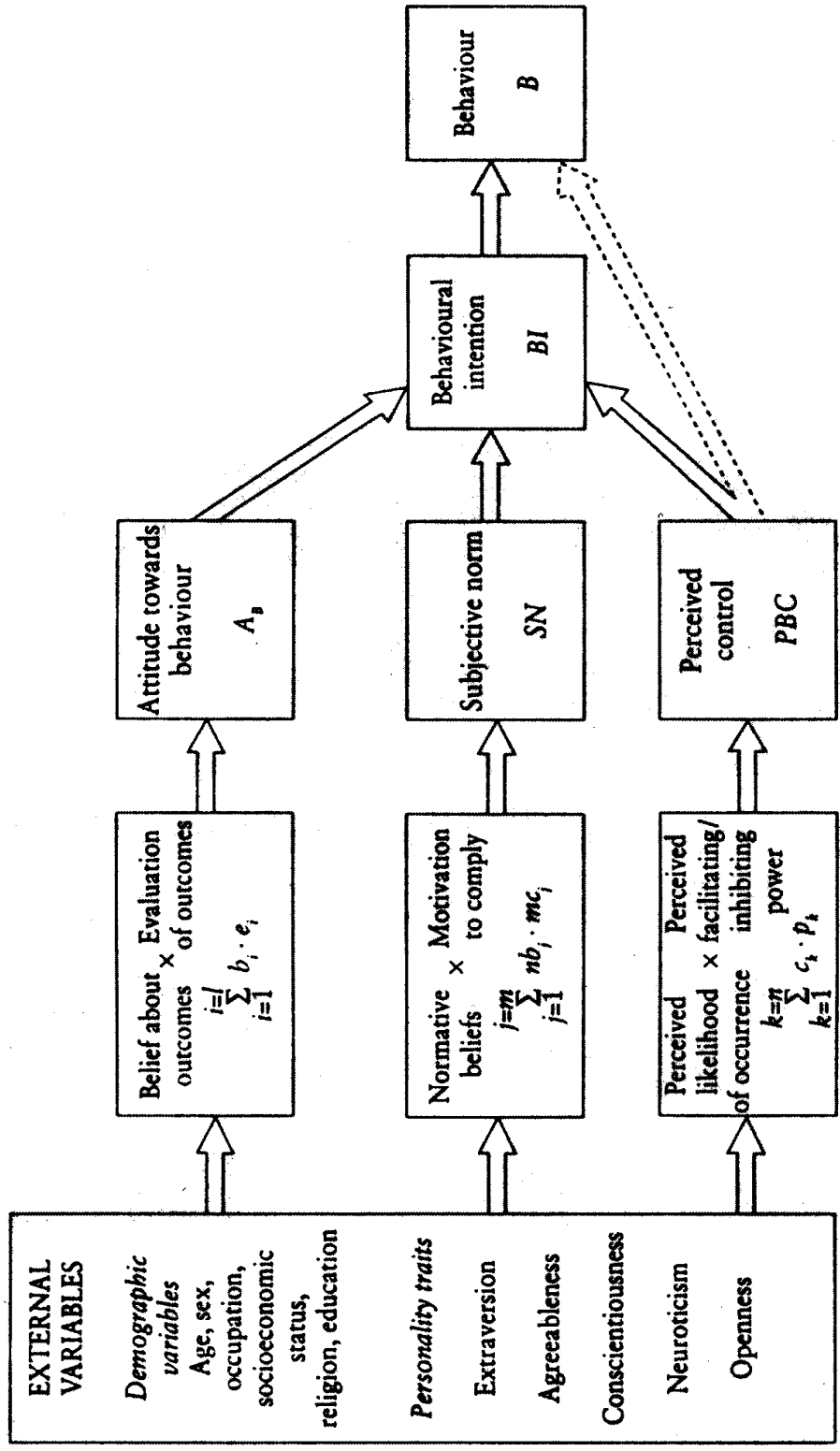


Figure 3. Original description of the theory of planned behaviour (TPB;133). Reproduced with permission of the publisher.

(defined as a favourable or unfavourable evaluation of performing the behaviour) and the perceived social pressure (subjective norm) to engage in the behaviour. The TRA implies that the individual has complete control over the performance of the behaviour. In order to take behaviours which are not completely under volitional control into account, another component has been added to the model. In the TPB, the behavioural intention is also assumed to be influenced by the individual's perception of the amount of control one has over the behaviour. This third component is labelled perceived behavioural control and includes both internal control factors such as skills and emotions and external control factors such as accessibility. Further, TPB postulates that behaviour is determined both by the intention to act and the behavioural control. Because actual control is difficult to assess, perceived behavioural control is used as a proxy measure, which will predict behaviour if the individuals are correct in their control perceptions. Food choice has been the target behaviour in a number of studies based on TPB or TRA (133-135). In general, adults have been involved, but these theories have also proved to be suitable for examining food choice among schoolchildren (117, 136, 137).

According to the theory, it is possible to understand a behaviour by assessing the beliefs and evaluations underlying the three determinants of the intention. The theory claims that at a specific point in time, a person holds a limited number of salient beliefs about engaging in a behaviour, and those beliefs serve as the primary determinants of the attitude towards that behaviour. Similarly, the subjective norm and perceived control have underlying beliefs. These beliefs might be generated by direct experience or by information. Thus, even if the causal links in the model are illustrated in a single direction, from beliefs to behaviour, the theory does not exclude feedback loops (138); neither does it deny covariation of the components within the model (131). Above all, the model emphasises compatibility between the components, i.e. a strong relationship will only be observed if there is a high level of correspondence between the different parts, e.g. a general attitude is not a good predictor of a specific behaviour or vice versa. Each behaviour is suggested to include the elements of (a) action, (b) target, (c) context and (d) time and will be best predicted by cognitive factors (e.g. attitude) on the same level with respect to each of these four elements. For example, a child might be (a) consuming (b) low-fat milk at (c) breakfast on schooldays in the immediate (d) future.

Many extensions of the TPB have been suggested (139, 140). In this thesis, an additional norm component was included, the descriptive norm. The original norm component usually reflects social approval or acceptance by others (usually referred to as an injunctive norm) which might be distinct from social influences via noticing others' behaviour (descriptive norm; 141).

Definitions

Food choice, dietary selection: Used interchangeably and broadly interpreted, i.e. an assortment of foods, the food consumed or selected, or the act of choosing a food.

Attitude: A psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour (139).

Beliefs: The associations or linkages that people establish between the attitude objects and various attributes that they ascribe to them (142).

Nutrition knowledge: Knowledge can be conceptualised as factually true and be judged as correct or incorrect within the constraints of current scientific knowledge (143).

Injunctive norm: Social approval or acceptance by others (141).

Descriptive norm: Social influences by noticing others' behaviour (141).

AIMS

The main objective was to examine determinants of schoolchildren's food choice, with specific attention devoted to fat and fibre content, by means of two different instruments. The focus was on breakfast because typical Swedish breakfast foods are important sources of fat and fibre, each food type available in a number of alternatives with varying fat and fibre content. Furthermore, the Swedish breakfast is also generally a meal varying relatively little from day to day.

Specifically, the aims were:

- To investigate 11-15-year-olds' dietary behaviour, beliefs and knowledge concerning alternative cereals, spreads and milk products.
- To study influences on 11-15-year-olds' breakfast choices of cereals, spreads and milk products by:
 - attitudes and underlying beliefs
 - social norms
 - perceived behavioural control
- To study how these variables are associated with age and gender
- To examine aspects of data validity, e.g. representativeness of the study sample.

SUBJECTS AND METHODS

Study population and design

Food choices and perceptions were studied by means of questionnaires, food records and structured interviews. The study population consisted of pupils in grade 5 (age~11), 7 (age~13) and 9 (age~15) in Mölndal municipality. Participation rates are presented in Figure 4. The studies were approved by the Ethical Committee of Göteborg University.

Questionnaire study (papers I and II)

The pupils and their parents were initially contacted by letter, and informed about the study and that participation was voluntary. The data collection was performed between September and December, 1995. All pupils in the 5th, 7th and 9th grades in Mölndal municipality (n=1730) were asked to complete a questionnaire during school hours. A single investigator (C.B.) personally administered the questionnaires and gave identical instructions to all classes. All those present on the day of questionnaire administration answered questions about intentions, attitudes and beliefs concerning milk and bread. The questionnaire also included background variables. Usable questionnaires were completed by 1584 participants. After two weeks, the children were asked to fill in a 7-day food record by menu, and one of their parents was asked to answer a questionnaire dealing with socio-economic factors. The questionnaire to the parents was completed by 63 % of the families. Acceptable breakfast food records were completed by 1162 children, and 1096 children (63%) completed both questionnaire and food record. A dropout analysis was performed, in which those who completed the food record were compared with non-responders with respect to background and food variables.

Interview study (papers III and IV)

Individual interviews were performed with approximately 10% of the 1730 eleven- to fifteen-year-olds during school hours. The children were instructed to compose their usual as well as different hypothetical breakfasts from photographs. The interview also covered dietary knowledge, beliefs and changes. The participants were selected in a random weighted cluster sample,

Study population

all pupils in 5th, 7th and 9th grade in Mölndal
n=1730

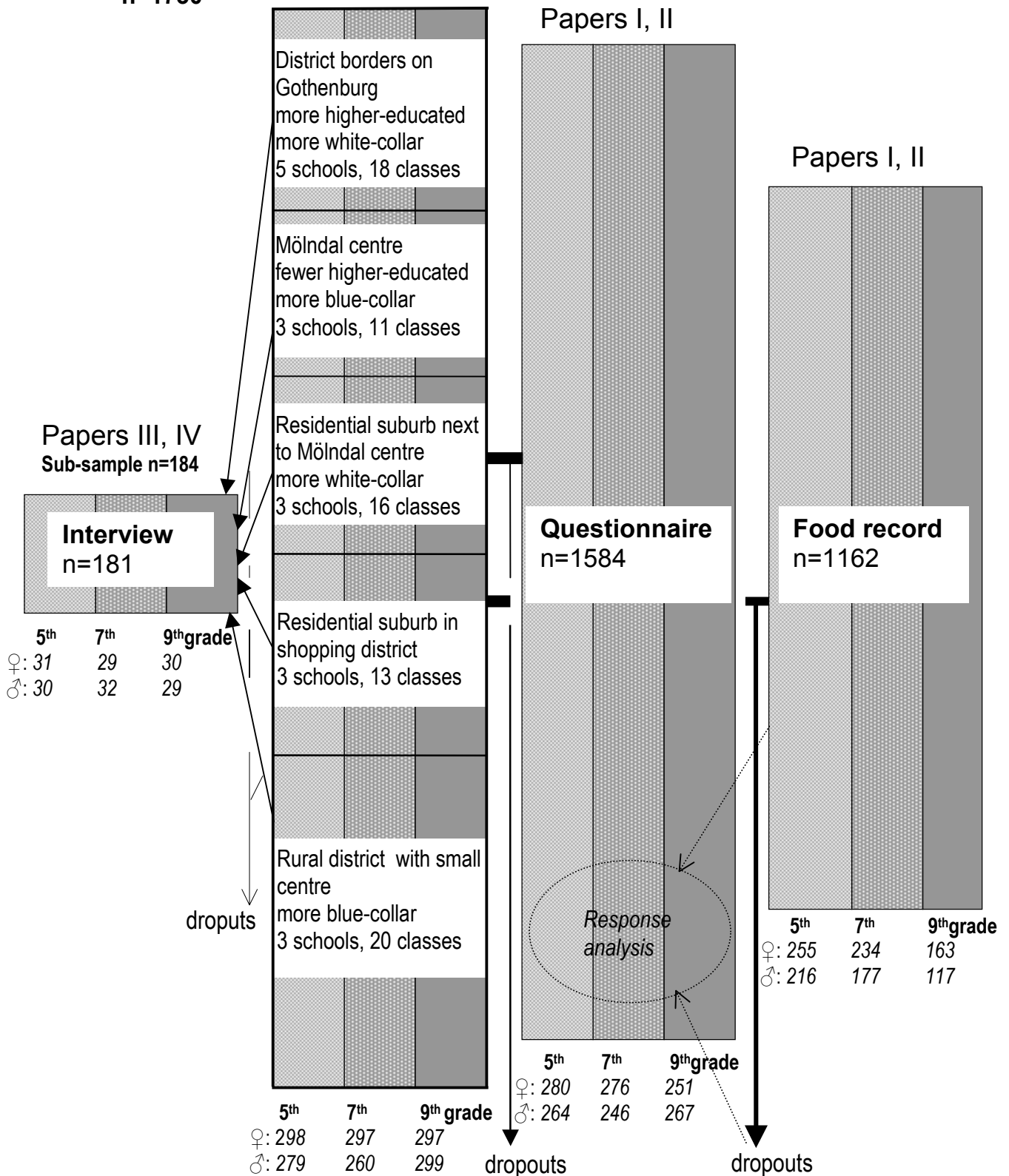


Figure 4. Study population and participation. Socio-economic characteristics are given for each of the five school districts relative Mölndal as a whole.

stratified by grade. In order to obtain a sample that was representative of different socio-economic groups, one class in each grade was randomly selected from each of the five school districts in Mölndal. In the five chosen classes in each age group, varying numbers of pupils were randomly selected after weighting for the total number of pupils in the area. The selected children and their parents were informed in writing that participation was voluntary, that selection were random, and that the interview was not linked to their response to the questionnaire. Among the eligible 184⁶ subjects, 3 declined to participate. There were approximately equal numbers of girls and boys in each grade. The data collection was performed between February and May 1996.

Mölndal municipality

Mölndal is situated on the west coast of Sweden, bordering on Sweden's second largest city, Göteborg and had 54 254 inhabitants on January 1, 1996. Mölndal was chosen because the demography in many respects is representative of Sweden as a whole. Some demographic data for the municipality compared to Sweden as a whole, are given in Table 2.

Data collection

Questionnaire and food record (papers I and II)

A questionnaire about intentions, attitudes, perceived norms, perceived control, and underlying beliefs was developed, based on the Theory of Planned Behaviour. The focus was on consumption of milk with varying fat content and on high-fibre bread. The questions were constructed based on the results of a previous study (117) in which focus group interviews were carried out to identify schoolchildren's most common beliefs about those foods. Food intake was assessed by a "menu"-type 7-day food record in which only the type, not the amount, of food was recorded. Common breakfast foods were pre-coded and pupils were asked to mark those days on which they had consumed each food. There was also space for recording other food items. The questionnaire and a 7-day record were tested in a pilot study with 84 pupils in 5th grade (Berg et al., unpublished data, 1995), and were revised on the basis of the results and comments from the children and their teachers.

⁶ 186 subjects were selected but two of these pupils had moved before the interviews took place.

SUBJECTS AND METHODS

Table 2. Some demographic data for Mölndal municipality and Sweden as whole.

	Mölndal	Sweden
Distribution in age groups 1996-01-01 ^a , %		
0 - 6 years	10,5	9,4
7 - 15 years	10,9	10,6
16 - 19 years	4,4	4,6
20 - 44 years	35,7	34,0
45 - 64 years	23,8	23,9
65 - 79 years	11,1	12,8
80 - years	3,6	4,7
Family structure 1990-11-01 ^b , % of all households		
one parent household	4,2	3,9
two parent household	24,9	21,8
other household with children	0,8	0,9
Average number of children 1990-11-01 ^b	1,7	1,8
Dwelling condition 1990-11-01 ^b		
own the house	40	39
tenant owner	16	15
tenancy agreement	40	40
Foreign nationals 1995-12-31, % of population	5,4 ^c	6,0 ^d
Percentage employed 1994 ^a	77	72
Receiving public assistance 1995 ^e , % of population	8	8
Average income, 1993, Skr ^a	154 800	141 900

^a (144)

^b (145)

^c personal communication Mölndal municipality

^d (146)

^e (147)

Interviews (papers III and IV)

Food choice and perceptions were studied by individual interviews applying the stacking box methodology. This interview technique was developed by Jonsson and colleagues (148-151), and has subsequently been applied by other researchers (152-154). For the purpose of the present studies, colour photographs of 50 breakfast foods (listed in Table 3) were displayed in two boxes, Figure 5. Foods were chosen to represent breakfast foods commonly consumed by schoolchildren, and some foods were added to represent alternatives with respect to fibre and fat content. Each food was represented with ten identical pictures stacked on top of each other in a compartment. When one picture was removed by the interviewee, a spring device in the bottom of the compartment made the card below pop up to the same level as the other pictures. The order of the cards was randomly arranged within food groups, and twelve cards changed positions randomly every fifth interview, in order to avoid biased selection of cards as a consequence of the order in which they were presented.



Figure 5. The stacking box

Table 3. Foods in the stacking box, and original composition of two hypothetical breakfasts (**a** and **b**) in which the participants were asked to exchange foods in order to create meals with less fat and more fibre.

Foods in compartment 1	Foods in compartment 2
<p><u>Group 1*:</u> Milk, <0,1% fat Milk, 0,5% fat Milk, 1,5% fat Milk, 3% fat (b) Soured milk, 0,5% fat Soured milk, 1,5% fat Soured milk, 3% fat (a) Natural yoghurt, 0,5% fat Fruit yoghurt, 0,5% fat Fruit yoghurt, 2% fat Natural yoghurt, 3% fat Fruit yoghurt, 7% fat</p> <p><u>Group II*:</u> Sweet cornflakes, 1,5% fibre (a) Cornflakes, 2,5% fibre Sweet fruit muesli, 6% fibre Fruit muesli, 9% fibre Semolina porridge (b) Oat porridge</p> <p><u>Group III*:</u> Sweet buns White bread, loaf, 2% fibre White bread, sweet round loaf, 3% fibre (b) Sweet rye and wheat bread, 3,5% fibre (a) Rye bread, 6% fibre Rye bread, 9% fibre Rye crisp bread, 15% fibre</p>	<p><u>Group IV*:</u> Margarine, 40 % fat Margarine, 60 % fat Margarine, 80 % fat (b) Butter-margarine, 80 % fat (a) Butter</p> <p><u>Group V*:</u> Soft cheese, 9% fat Cheese, 18% fat Cheese, 28% fat (a) Ham (a) Liver paste Sausage, 20-35% fat (b) Caviar Mackerel in tomato sauce Egg</p> <p><u>Group VI*:</u> Sugar and honey (b) Milk chocolate mix (b) Coffee and tea Apple juice and apple drinks Orange juice (a) Rosehip soup Jam and marmalade (a) Tomato and cucumber (b) Sweet pepper Orange Apple and banana</p>

*To make it easier for children to locate a certain type of food, the pictures in the stacking box were presented in six food groups. Within each food group the order of the cards was randomly arranged, and two randomly selected cards changed places every fifth interview.

The author of this thesis performed all the interviews, which lasted about 30 minutes and were recorded manually and tape-recorded. The participants were instructed to select food items from the stacking boxes, and to report reasons for their choices. They were asked to compose their “usual breakfast” and six hypothetical breakfasts; “preferred”, “normative”, “tasty”, “healthy”, “mother’s” and “father’s”. If their usual breakfast had changed during the previous year, they were asked how and why. To identify any other foods than those represented in the stacking box, a file with a large number of additional pictures was used. The participants were not informed that the study focused on fat and fibre content of foods, and any questions relating to this issue were placed at the end of the interview.

Furthermore, the participants stated their own opinions on what constitutes a healthy breakfast, and their perceptions of favourable and/or unfavourable aspects of fat, coarse bread, and fruit and vegetables. They were also asked if they knew what the Keyhole symbol⁷ stands for. Finally, the children were shown two breakfasts, using the cards, which they were instructed to alter to increase the fibre and decrease the fat. The original compositions of these two breakfasts are shown in Table 3.

Data analyses

Categorization of interview data (papers III and IV)

Bread and cereals choices were classified into ordered categories according to fibre content, and milk and spread choices according to fat content. Although not the main focus of this study, sugar content was also considered in the categorisation of breakfast cereals, and fat quality in the categorisation of spread. Table 4 shows the ordered categories and frequency of reported usual breakfast choices.

Statements and reported reasons for food choice were also classified into categories. To investigate a potential bias introduced by having a single researcher analysing the data, twenty randomly chosen interviews were analysed by two independent judges. In addition to the principle investigator (C.B.) who performed and analysed all the interviews, a person educated in the field of nutrition and especially trained for this task, categorised statements from the interviews. Inter-rater agreement was 92% (agreement divided by agreements and disagreements). The few observed disagreements were not concentrated to one or a few categories but could be attributed to the open-ended structure of the questions.

⁷ A label in the shape of a green or black keyhole identifying low-fat and high-fibre alternatives for products with varying fat and fibre content

SUBJECTS AND METHODS

Table 4. Categorisation of interview data. Ordered categories of bread and breakfast cereals with varying fibre content, and milk and spread with varying fat content, and number of reported usual breakfast choices.

Category according to fat/fibre content	Represented by picture of	Users %	
<i>Bread</i>			
1	White bread	wheat bread 2% fibre and wheat bread 3% fibre	40
2	Rye bread, sifted flour	rye and wheat bread 3,5% fibre	28
3 ^a	Medium-fibre bread	rye bread 6% fibre	7
4 ^a	High-fibre bread $\geq 7\%$ fibre ^b	rye bread 9% fibre and crisp bread 15% fibre	10
<i>Breakfast cereals</i>			
1	Sweet flakes and porridge <2% fibre	sweet cornflakes 1,5% fibre	12
2	Low-fibre flakes and porridge >2% fibre	cornflakes 2,5% fibre and semolina porridge made of grains 3% fibre	16
3 ^a	Muesli <9% fibre and/or $\geq 13\%$ sugar	sweet muesli 6% fibre	6
4 ^a	Muesli $\geq 9\%$ fibre and <13% sugar ^b	muesli 9% fibre	1
5 ^a	High-fibre porridge ^b	porridge made of oatmeal 10% fibre	6
<i>Milk</i>			
1	Full-fat milk	milk 3% fat	23
2 ^a	Medium-fat milk	milk 1,5% fat	34
3 ^a	Low-fat milk ^b	milk 0,5% fat	16
4 ^a	Skimmed milk ^b	milk <0,1% fat	1
<i>Spread</i>			
1	Butter	butter 80% fat, 53% saturated fat and butter-margarine 80% fat, 40% saturated fat	19
2	Margarine	margarine 80% fat, 36% saturated fat	17
3 ^a	Medium-fat margarine	margarine 60% fat	3
4 ^a	Low-fat margarine <41% fat ^b	margarine 40% fat	42
5 ^{ac}	No fat on bread		4

^a Classified as reduced-fat products/high-fibre products when choices were predicted by beliefs and knowledge in logistic regressions.

^b Marked with the Keyhole symbol, which is a label identifying low-fat, and high-fibre alternatives (for breakfast cereals also low sugar alternatives) among products with varying fat or fibre content.

^c This category was not included in the validation against food record

Statistical methods

The statistical methods are described in detail in papers I-IV. We employed non-parametric methods because the data was considered to be on an ordinal level scale. Conventional statistical methods used were the Wilcoxon signed-rank test, the odds ratio, the Mann Whitney test, the Kruskal Wallis test, the Chi squared test, the Spearman rank correlation and logistic regression. A significance level of 5% (two-sided test) was used.

A non-parametric method developed by Svensson (155) for measuring systematic disagreement in paired ordered categorical data was used for comparisons between two sets of breakfast choices (e.g. usual milk choice vs. perception of healthy milk choice, or milk choice reported in food record vs. in stacking box interview). This method has been described in previous studies applying the stacking box methodology (149, 150). Specifically, systematic disagreement between breakfasts was illustrated by plotting the two sets of cumulative relative frequencies of categories against each other. The Relative (Receiver) Operating Characteristic (ROC) curve provides information on extent and location of systematic disagreements in categories. In case of total agreement, the ROC curve lies exactly on the diagonal of identical co-ordinates. Systematic disagreement between choices in two breakfasts will result in a ROC curve located to one side of the diagonal, and is quantified for statistical testing by the measure called Relative Position (RP). The more pronounced the deviation, the greater the systematic disagreement between two sets of choices. If the choice in one breakfast is concentrated to a limited part of the scale of categories, compared to the other breakfast, there will be a systematic difference in concentration of the classification. The empirical measure of this type of systematic disagreement is called Relative Concentration (RC). Possible RP and RC values are in the interval -1 to 1 , and values close to zero indicate lack of systematic disagreements between the two sets of choices. Even with identical cumulative relative frequencies, individual variations between food choices may be present. This additional disagreement will be called random, as it cannot be explained by systematic inconsistency between the two sets of choices. The random observable disagreements were measured by the Relative Rank Variance (RV). Possible RV values are in the interval 0 to 1 , and values close to zero indicate minor random disagreements between the two sets of choices.

The standard errors of RP, RC and RV were estimated by using the jack-knife technique, based on the variance of all possible values of this measure with one observation deleted. Significant evidence of systematic and random disagreements were tested by a standard normal test statistic, z .

Methodological considerations

In order to create a comprehensive picture of schoolchildren's food choices, two different research approaches were used: a questionnaire study involving the whole population and interviews with a sub-sample. Food record by menu was considered to be an appropriate method for dietary assessment in the questionnaire study. With this method, it was possible for the children to identify food types by reading the packages, with assistance from their parents. Food frequency questionnaires would have been less demanding for the participants, but more complicated to fill in. Repeated dietary recall interviews were excluded because much more resources would have been required to collect such an amount of data within the time frames.

In the first pilot study, a 4-day food record was used (149). In order to make the data more representative of "usual" intake, we increased the recording period to seven days. However, it must be acknowledged that even one week's current intake may not be representative of "usual" intake. Non-consecutive records collected over a longer period might have captured a more usual intake. However, available resources made repeating the food records impossible.

The fact that many choices are simultaneously available and that pictures are more appropriate than food frequency questionnaires for children of varying verbal abilities are advantages of the stacking box dietary interview technique. This approach turns the problem into an identification task for the interviewee rather than a task involving food description or making written choices. Another important advantage is that this interview technique tends to stimulate the children's interest and is efficient since it has the flexibility to focus on some specific foods that are of particular interest to each individual.

Validation of dietary assessment methods

It was not possible to validate reported intake in the food record with biological markers or energy expenditure because only breakfast consumption on the food level was measured; nor was it appropriate to compare the children's reports with those of their parents, since the children frequently made their breakfast themselves and ate alone. Therefore, only systematic change in the number of food items reported during the seven-day recording period was studied, i.e. if the same amount of food items were reported at the end of the period as in the beginning.

However, the two dietary methods were validated relative to each other (inter-instrument agreement). Food choices included in the "usual breakfast" according to interviews were compared with reported food consumption in the 7-day food record. The most commonly reported food category within a food group represented "frequent breakfast choice" in the food record. To be

considered as “frequent”, the specific food must have been reported on at least three days. “Usual breakfast choice” in interviews corresponded with “frequent breakfast choice” in the food record in 55, 66, 82, 74 % for bread, breakfast cereals, milk and spread, respectively. “Total misclassification” (i.e. not in the same or immediate nearest category) was observed for 16, 14, 2, and 17 % of the data for bread, breakfast cereals, milk and spread, respectively.

When analysed with Svensson’s (155) non-parametric method, the disagreements between bread choices in interviews and food record were only of a random ($RV=0,12$; $p=0,0035$), and not of a systematic (non-significant RP or RC values), nature. Consequently, the ROC curve (Figure 6) is close to the diagonal. In contrast, a pronounced systematic disagreement was observed in the choices of breakfast cereals ($RP=-0,21$; $p=0,0099$, and $RC=-0,19$; $p=0,052$), while the measure of random differences (RV) was not significant. As illustrated by the ROC curve in Figure 6, the main reason for the disagreement is that choices of low-fibre sweet cereals were less commonly reported as “frequent breakfast choice” in the food record than as “usual breakfast choice” in interviews. This bias might be explained by the fact that the choice of low-fibre sweet cereals was not pre-coded in the food record formula. Thus, some children might, for instance, have reported consumption of cornflakes when they consumed “Frosties”.

The ROC curve for milk (Figure 6) is close to the diagonal, and the values of the measures of the systematic (RP and RC) and random parts (RV) of the disagreement are not significant. However, both a systematic ($RP=0,12$; $p=0,0056$), and a small random ($RV=0,04$; $p=0,03$) disagreement were observed for spread choice. The ROC curve shows a deviation towards choices with higher fat content in the spreads most frequently reported in food records compared to spreads chosen from stacking boxes. A possible but unlikely explanation for the systematic disagreement might be a secular trend towards consumption of products with lower fat content. The interviews were performed only a few months after the questionnaire. A 1999 dietary survey of 11-13-year-olds in Möln dal (Berg et al., unpublished data) showed a change in intake, with more fat-reduced spreads compared to the present food record survey.

The reliability and validity of the stacking box method have previously been tested in a pilot study with forty-four 10-16-year-old boys (150). The agreement between usual choices on two interview occasions was judged satisfactory for milk, margarine and breakfast cereals but the reliability was poorer for bread. Likewise, and consistent with the present study, the agreement between stacking box choices and 4-day food records was lower for bread than for the other foods. In addition to a random disagreement for bread observed in the present study, a systematic disagreement, with more choices of white bread from the stacking boxes, was also observed in the pilot study. In contrast to the present study, no systematic differences were observed for spread and breakfast cereals in the

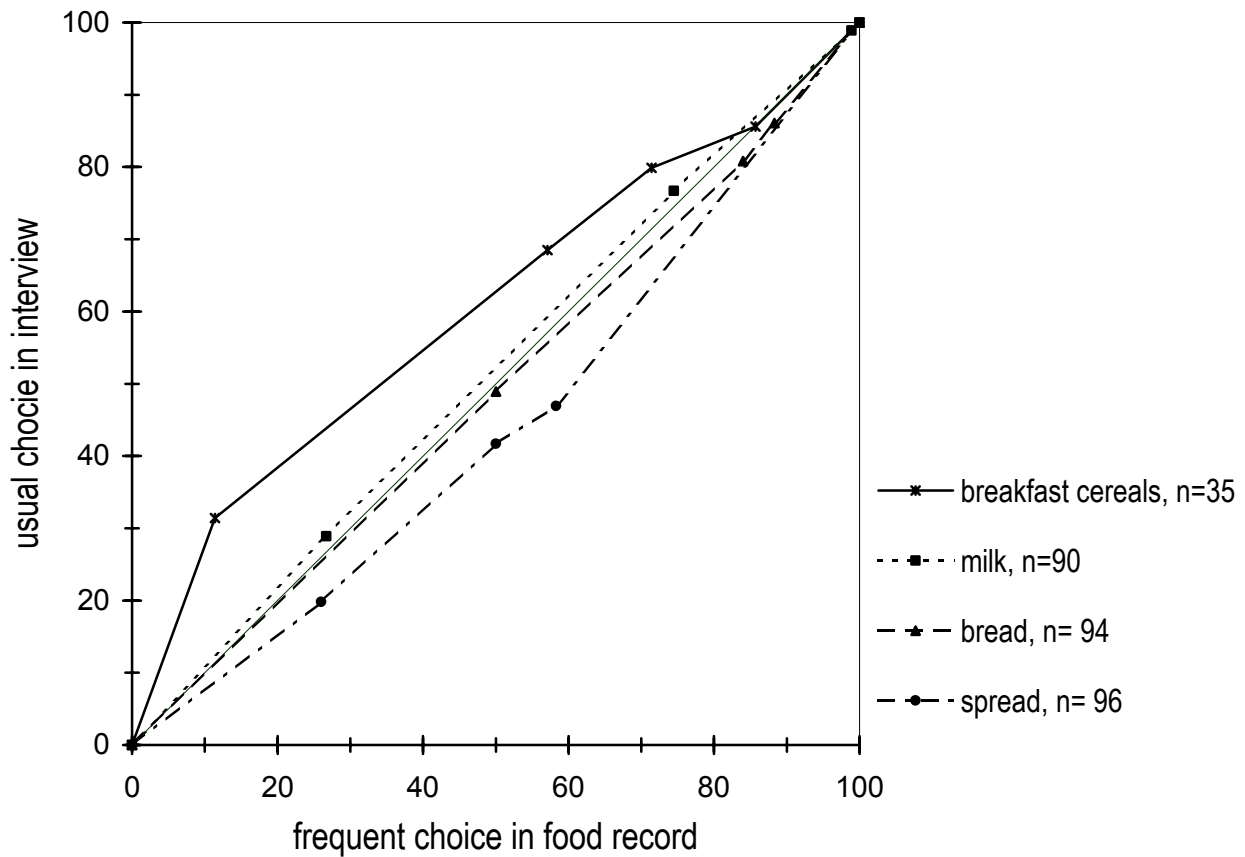


Figure 6. ROC curves for fibre content in bread and breakfast cereals, and fat content in milk and spread choices according to usual choices reported in interviews, and frequent choices reported in food records (n=119). Cumulative percent of categories with increasing fibre content and decreasing fat content (Table 4 shows the classification into ordered categories).

previous study, which might be explained by small samples in the pilot study. Furthermore, a random disagreement for milk observed in the previous study was not evident in the present study; that the 7-day record captured usual behaviour better than the 4-day food record might be one reason for this.

In summary, according to the present relative validation, the percentage agreement was very high for milk. No systematic differences between the two methods were observed for milk and bread, but for breakfast cereals and spread. For breakfast cereals it seems that this bias could be attributable to the food record. Moreover, it is the subjective opinion of the interviewer that participants generally showed interest in the food pictures, found the instructions simple and seemed to be entertained by the interviews. The researchers in the pilot study applying the stacking box methodology reported similar experiences (150).

RESULTS AND DISCUSSION

Food choice (papers I, II and IV)

The most commonly recorded breakfast foods are shown in Figure 7, and Table 4 shows the frequency of habitual user of certain breakfast foods, according to the interviews. Reduced-fat choices of milk and spread were common, although a considerable proportion of the children consumed full-fat alternatives. When it comes to the consumption of bread and cereals, the low-fibre alternatives dominated. If data from the two dietary assessment methods are compared, a discrepancy not observed in the analysis of inter-instrument agreement is noticed. The proportion of full-fat milk consumers tended to be lower in the food record data than in the interview data. This is likely to be due to a selection bias (described below) in the food record. Thus, the proportion of full-fat milk consumers is likely to be higher than the results in Figure 7 suggest.

Food records (one-day) performed by pupils in the 5th and 7th grades (1999) indicate that the consumption of low-fibre alternatives such as white bread and cornflakes have increased, compared to the data from 1995. Likewise, the trend for milk conflicts with the recommendations, with increased consumption of medium-fat milk and decreasing low-fat milk consumption. On the other hand, consumption of reduced-fat margarines has increased while consumption of full-fat spreads, especially those high in saturated fat, has decreased (unpublished data, Berg et al.).

In conclusion, 11-15-year-olds have the potential to choose foods containing more fibre and less fat for breakfast. Figure 7 also shows that the examined foods are commonly and frequently consumed for breakfast in this age group.

RESULTS AND DISCUSSION

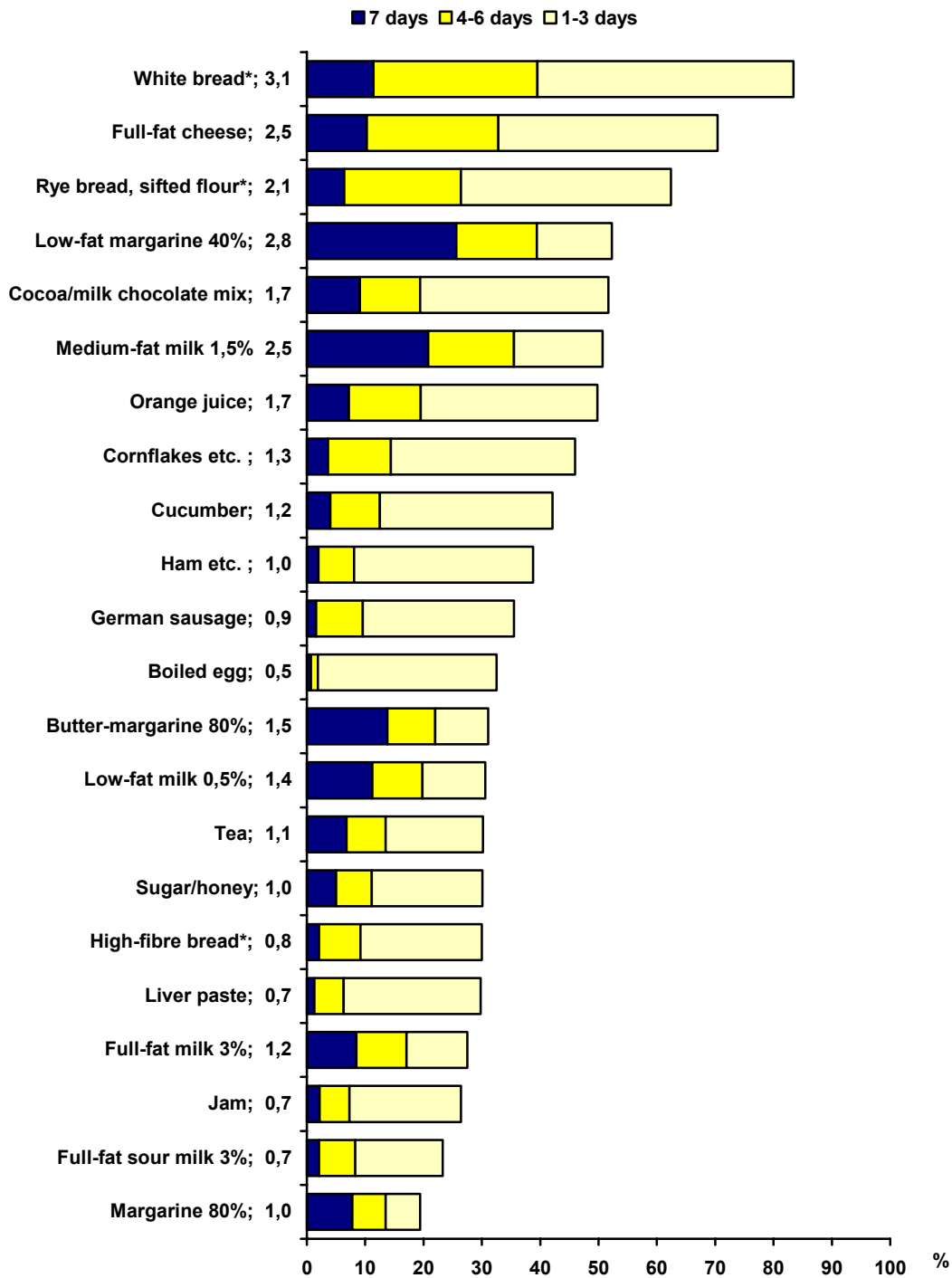


Figure 7. The most commonly recorded foods. The black bars show those who have recorded the food at all breakfasts during the 7-day food record, and the total bar shows those who have recorded the food at least once during the week. The average frequency is also given for each food. (*Crisp bread is not included in the shown bread categories)

Attitudes, beliefs and knowledge (papers II-IV)

In the interviews the schoolchildren were asked to define a healthy breakfast for themselves; in the most common response it was described as a fulfilling meal, containing vitamins, enabling them to get through the school day. A complete list of attributes of a healthy breakfast is presented in Table 5. A total of 13% characterised a healthy breakfast as having a low fat content, and 9% characterised it as contributing dietary fibre.

Table 5. The schoolchildren's (n=181) definition of a healthy breakfast. Number of responses in each category.

Attributes of a healthy breakfast	n
Allows me to get through the school day	55
Contains vitamins	39
Is fulfilling	30
Is low in fat	23
Includes good food or ingredients	20
Contributes to energy intake	17
Contains dietary fibre	17
Makes me feel well	17
Contains nutrients	14
Is refreshing	12
Provides variation	12
Is good for the body	11
Is low in sugar	9
Is tasty	7
Prevents disease	7
Does not include bad food or ingredients	6
Keeps up my spirits	5
Is good for the stomach	3
Contains minerals	3
Contains protein	3
Promotes growth	2
Prevents obesity	2
Is not tasty	2
Is natural	1
Contains fat	1
Is good for the teeth	1
Is eaten without rushing	1

Knowledge about fat and fibre content in breakfast foods was examined by asking the children to alter hypothetical breakfasts in interviews. They were able to make more correct suggestions to reduce fat content than to increase fibre content. When the participants were asked about the pros and cons of intake of coarse bread, fruit and vegetables, they associated bread, but not fruit and vegetables with dietary fibre. Thus, consistent with previous studies (156, 157), the results of the present interview study indicate that knowledge of foods' fat content seems to be higher than knowledge of fibre content. On the other hand, almost all children thought that high-fibre bread, fruit and vegetables were good for them, but a third did not believe a restricted fat intake was advisable. Nor did they mention anything about fat quality when positive and/or negative effects of dietary fat and healthy breakfast choices were discussed. Some reported needing a high fat intake because "children need fat" or because "I am a little bit small", and full-fat products were considered as the healthiest choice by a substantial proportion of children. When composing a healthy breakfast, one third of those including milk chose full-fat milk, and the percentage selecting full-fat spread was even greater. The healthiness of full-fat milk being highly valued by schoolchildren has previously been observed in other countries (156, 158).

In the interview, the participants were asked to give their reasons for the habitual consumption of each food in the "usual" breakfast. The percentage that mentioned taste, availability, health or habit as reasons for their usual consumption of the examined food groups is shown in Figure 8. Other mentioned reasons were satiety effects, suitability, instructions from parents, others' consumption, convenience, time, cost and culture. Some also mentioned growth and being "natural" as motives for the choice of full fat products. Taste was the major reason for consumption of bread, breakfast cereals and milk, and availability was the dominant reason for the consumption of spread. In general, this was true for each food category as well, one notable exception being that availability was the main reason for choosing full-fat milk. Healthiness played some role in the choice of high-fibre bread, breakfast cereals, medium and full-fat milk.

Attitudes, beliefs and knowledge in relation to food choice

The present studies demonstrate that 11-15-year-olds' food choices were related to their attitudes and beliefs. Furthermore, in contrast to several other studies (159-162), the results demonstrate some positive relationships between dietary knowledge and food choice. The schoolchildren's reported motives for changing to habitual consumption of foods with more fibre or less fat than in products used previously is another indication that they take health aspects into consideration when making food choices.

RESULTS AND DISCUSSION

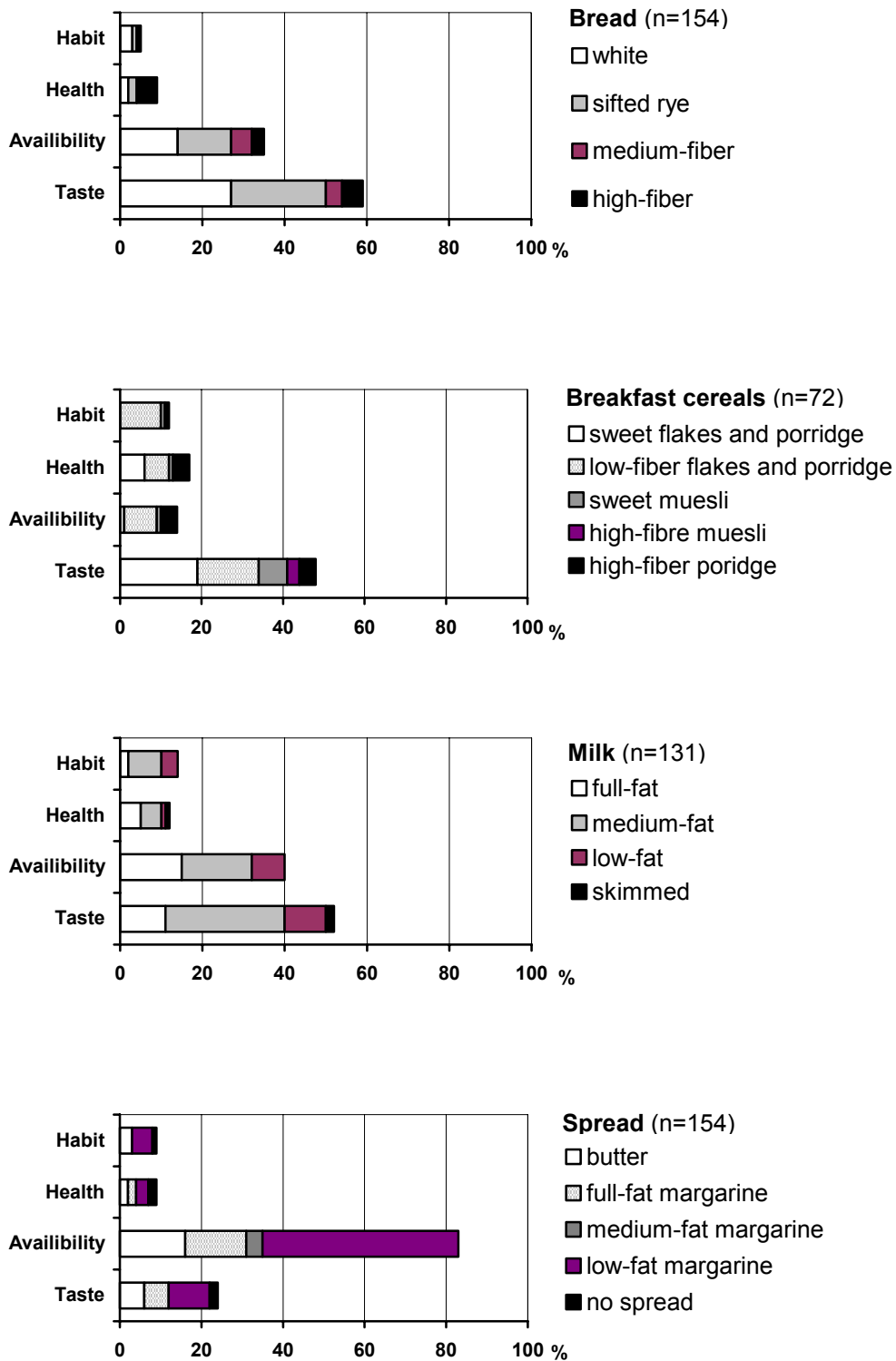


Figure 8. The four most commonly reported reasons for usual consumption of bread, breakfast cereals, milk and spread. Proportions of users who mentioned aspects of taste, availability, health and habit, stratified by category of food. More than one reason was given by some of the children.

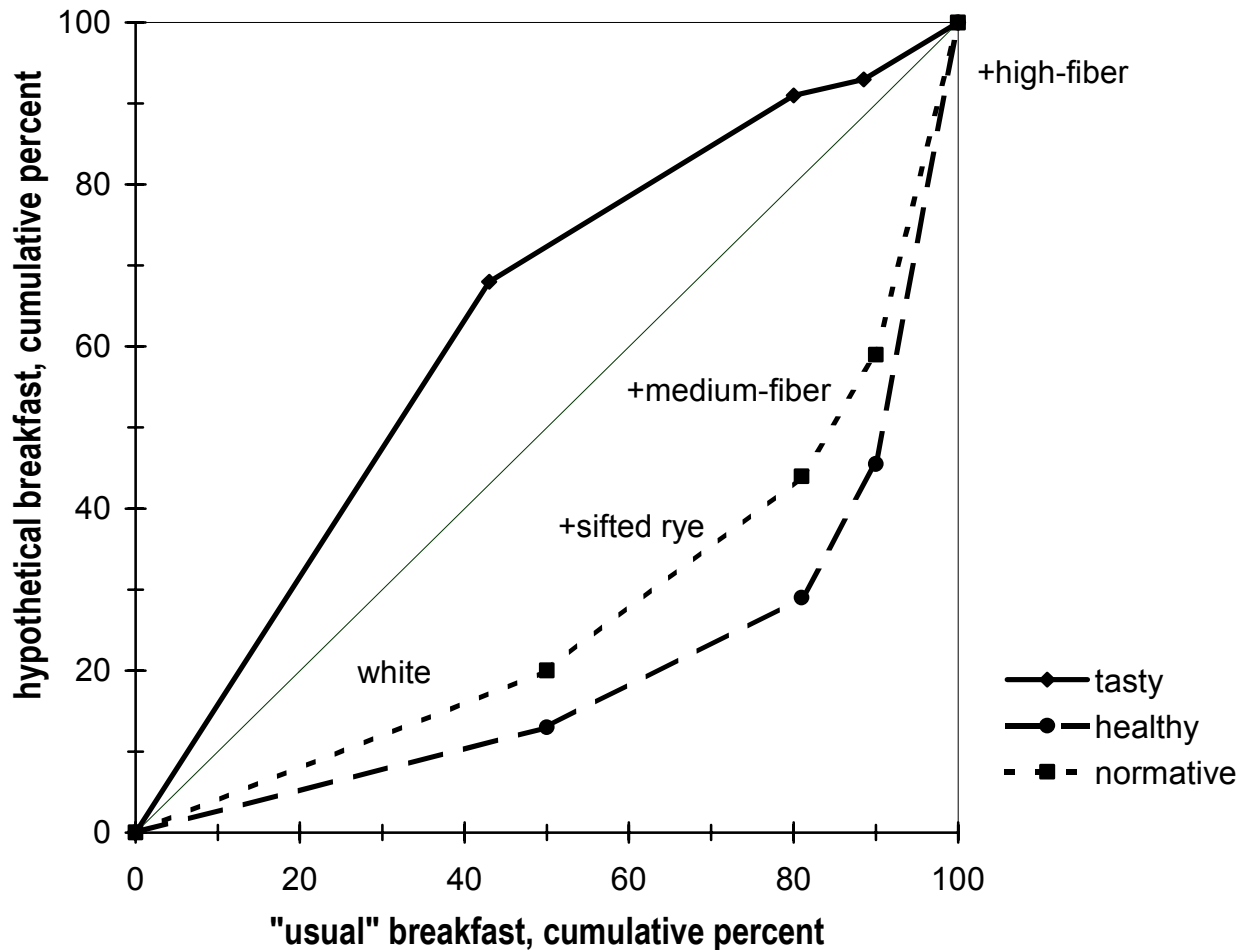


Figure 9. ROC curves for agreements, regarding categories of bread with varying fibre content, between usual and hypothetical breakfasts (“tasty”, “healthy” and “normative”).

In the present interview study, knowledge concerning sources and health attributes of dietary fibre predicted consumption of high-fibre products. Consistently, those who reported consumption of high-fibre bread in food records were more conscious of the fact that coarse bread contains fibre ($p < 0,001$) and valued a high fibre intake more than those who had not eaten high-fibre bread ($p < 0,01$) during the food record week. The influence of health aspects on choice (through own attitudes or parental influences) is also supported by the analysis of the different breakfasts composed in the interviews, showing that some ate higher-fibre alternatives despite finding the low-fibre choices more palatable (Figure 9 and 10).

The results show a systematic disagreement for both bread ($RP=-0,26^{***}$) and breakfast cereals ($RP=-0,28^{***}$) between "tasty" and "usual" breakfast, with more low-fibre choices in the breakfast perceived as palatable than in that usually eaten. The systematic differences between "healthy" and "usual" breakfast were in the opposite direction from palatable ($RP= 0,59^{***}$ for bread; $RP=0,40^{***}$ for breakfast cereals).

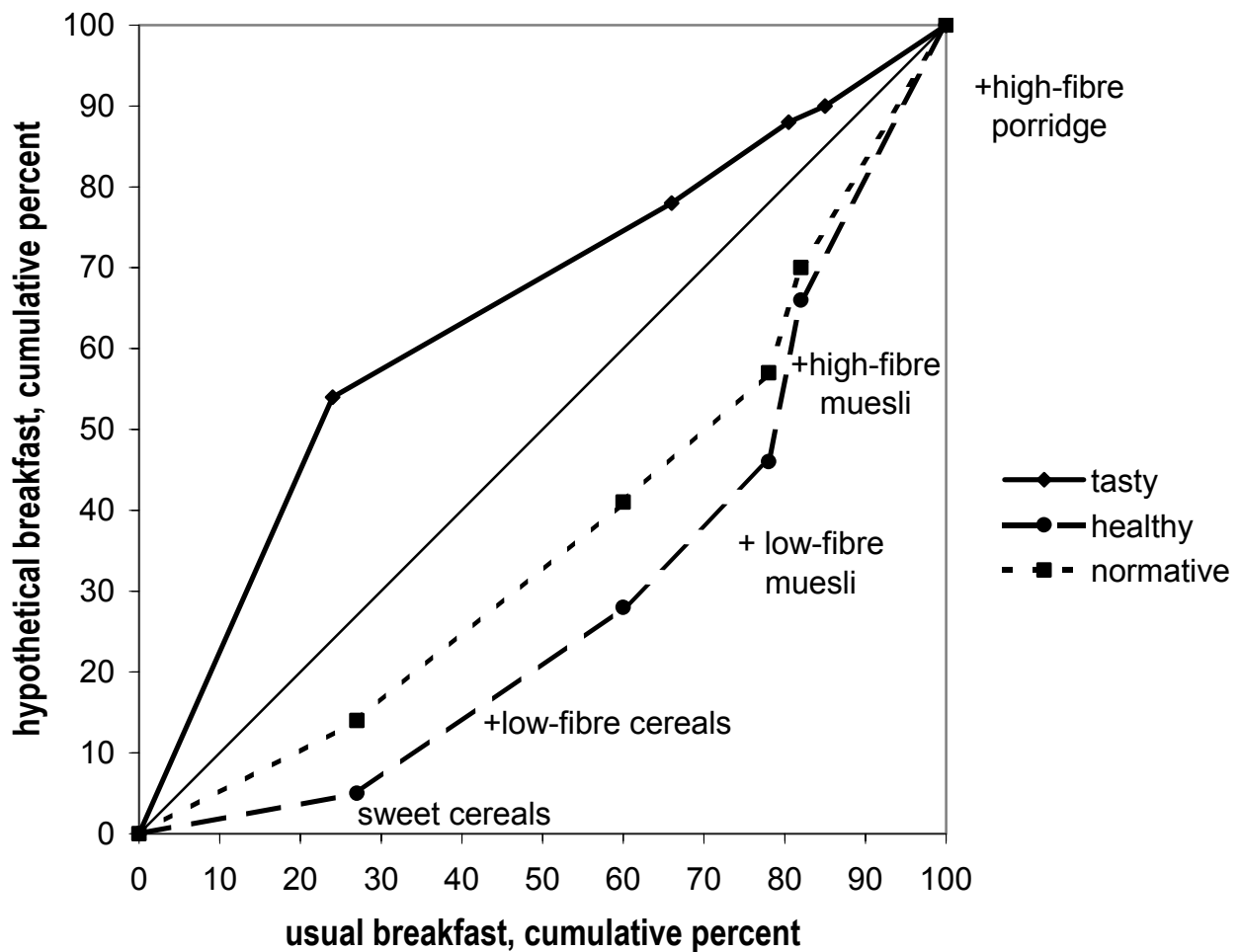


Figure 10. ROC curves for agreements, regarding categories of cereals with varying fibre content, between usual and hypothetical breakfasts ("tasty", "healthy" and "normative").

In contrast, the majority of the children used the kind of margarine and milk that they also perceived as healthy and palatable (Figure 11 and 12). The only significant disagreements observed for milk and spread was a weak systematic difference for spread in the comparison of “healthy” and “usual” breakfast (RP=0,09*). Thus, strong relationships were observed between taste and health perceptions and consumption of milk and margarine, and weaker associations and more conflicting perceptions were observed for bread and breakfast cereals.

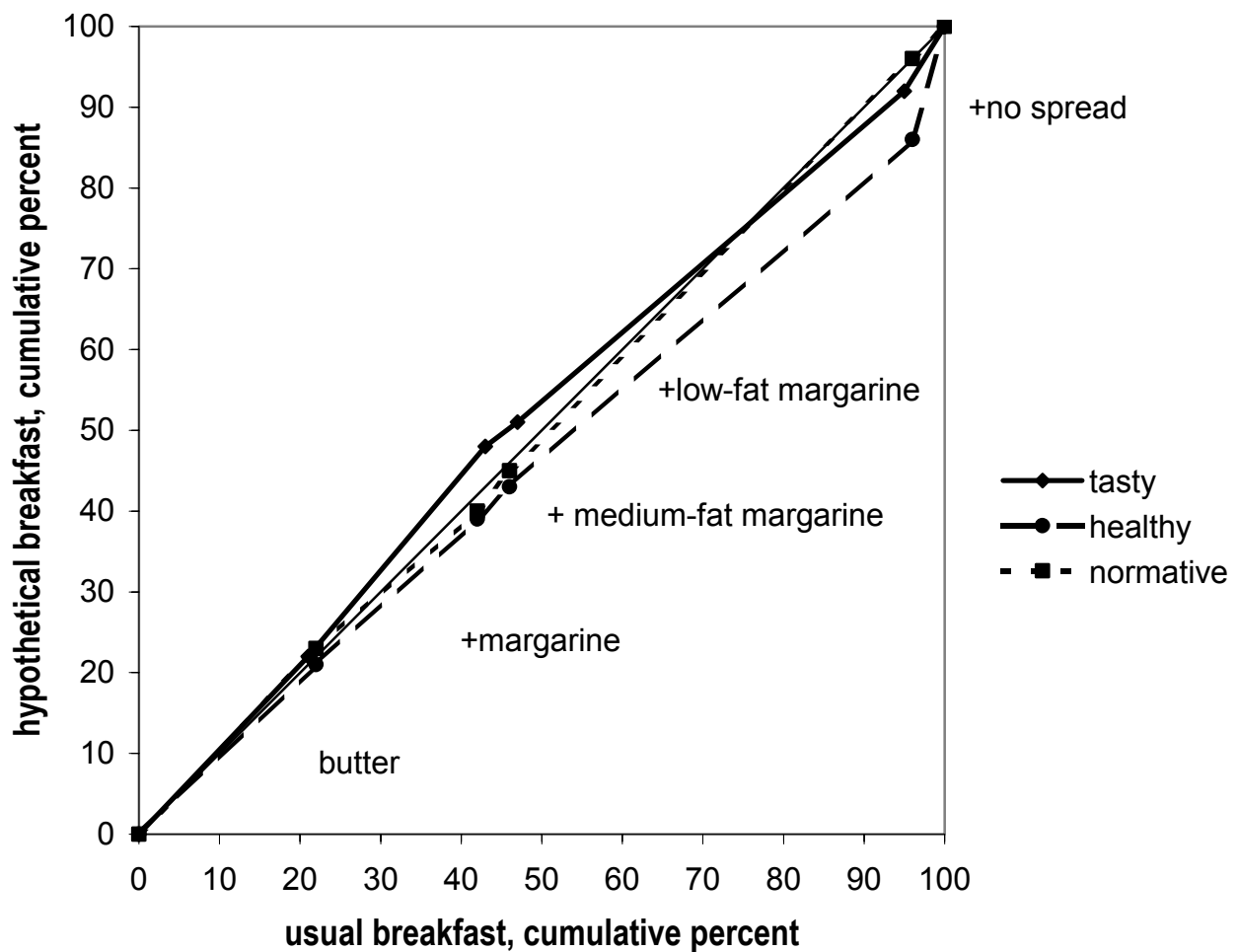


Figure 11. ROC curves for agreements, regarding categories of spread with varying fat content, between usual and hypothetical breakfasts (“tasty”, “healthy” and “normative”).

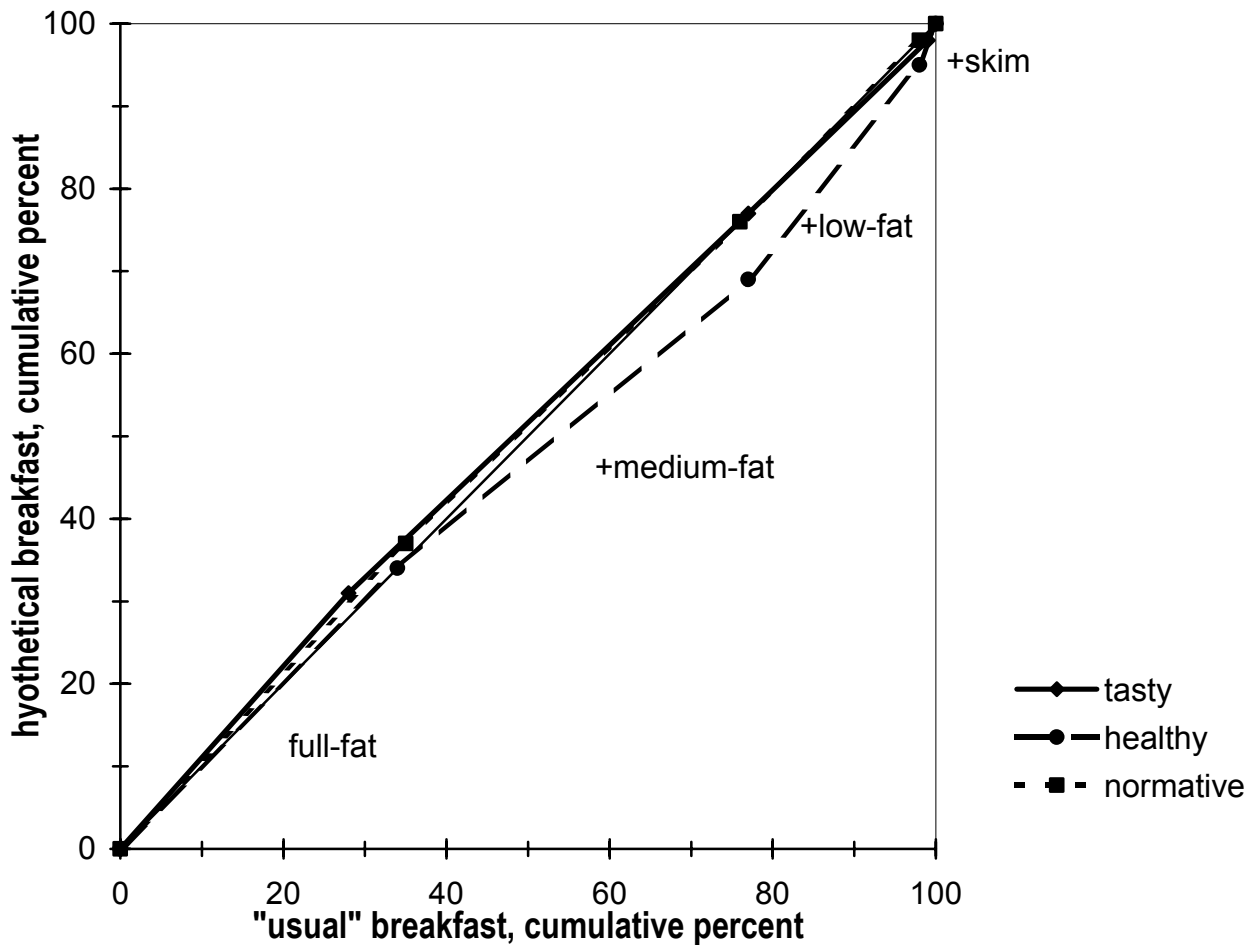


Figure 12. ROC curves for agreements, regarding categories of milk with varying fat content, between usual and hypothetical breakfasts (“tasty”, “healthy” and “normative”).

The lack of deviation between milk choices in actual versus healthy breakfasts, despite the fact that only 1/6 consumed low-fat milk, indicate that the children’s health beliefs do not generally support a change to low-fat alternatives. The interview study also demonstrated that a positive attitude towards limited fat intake was a significant predictor of habitual consumption of reduced-fat milk products. Likewise, the results of the questionnaire study show that the attitude towards a high fat intake was significantly associated with the choice of milk, with users of low-fat milk evaluating it to a greater extent as something negative and users of full-fat milk as something positive (Figure 13).

The association between evaluation of fat intake and milk choice is likely to be partly explained by weight concerns. When the children were asked whether they thought that fat in the diet was good for them or not, they mainly associated negative consequences of a high fat intake with weight concerns. Weight gain was also valued more negatively among those who drank milk with less fat compared to those who drank milk with more fat (Figure 13). Weight concerns were not mentioned as a reason for food choice in the interviews, but it might have been considered too sensitive an issue to discuss. Considering that it is common among schoolchildren, especially girls, to report dieting behaviour and dissatisfaction with their body weight, it is likely that these concerns about weight and body image influence their food choices (163). Such associations between weight concerns and food choice have also been demonstrated in studies involving adolescents in other countries (164, 165).

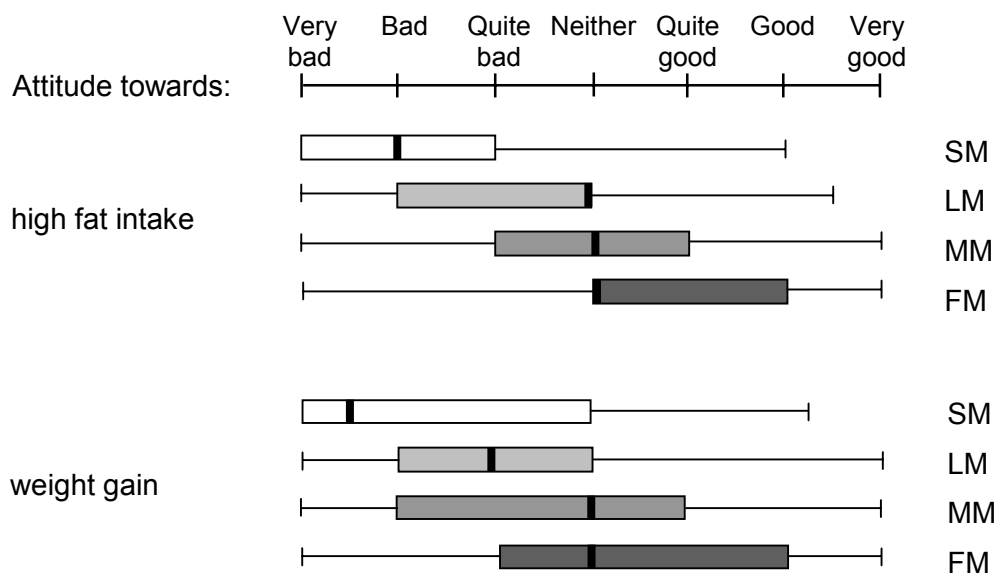


Figure 13. Attitudes towards high fat intake and weight gain. Responses of those who only drank skimmed milk (SM, n=14), low-fat milk (LM, n=232), medium-fat milk (MM, n=386) and full-fat milk (FM, n=182) during the 7-day food recording. The box plot shows the median, the quartiles and the 2,5 and 97,5 percentiles. Kruskal-Wallis test, $p < 0.001$.

Previous studies have concluded that taste is the most important general determinant of food choice (166). In the present interview study, taste was the major reason for choice of bread, breakfast cereals and milk when the participants were asked to give their reasons for habitual consumption. Moreover, the foods included in the “usual breakfast” were, to a great extent, also chosen for a “tasty breakfast”. In the questionnaire study, taste perceptions were important predictors of the attitudes towards the consumption of specific milk types but not towards consumption of high-fibre bread.

In conclusion, attitudes and food choice were related not only to taste perceptions but also to health and weight concerns. However, it is difficult to identify causal factors in the choice of food even where a clear relationship can be observed. Nevertheless, it is important to emphasise that children's own attitudes and beliefs are related to their consumption and that they consider health aspects. Also, it should not be forgotten that even if health aspects are not the most important determinant of food choice, knowledge of the association between food and health is a prerequisite to the beneficial choice. The results indicate that increased knowledge concerning sources and health attributes of dietary fibre might principally promote consumption of high-fibre foods in 11-15-year-olds, while they might need to be confronted with the recommendation that fat intake in school-aged children be limited in order to choose reduced-fat products. When it comes to sensory aspects, the children generally preferred low-fibre products, although they found the type of milk and spread they usually consumed the most palatable, irrespective of fat content.

Social norms (papers II and IV)

The present questionnaire study confirms that the TPB might be usefully extended to include descriptive norms, i.e. the perceived behaviour of others, as suggested by previous studies (137, 167-169). Descriptive norms were distinct from injunctive norms (social approval by others), and of greater importance. It was more common among the children to report that their parents drank low-fat alternatives than that they consumed full-fat milk (descriptive norm). The injunctive norm was in the opposite direction, with a higher percentage perceiving that their parents and significant others wanted them to drink full-fat milk than that believing that they wanted them to consume low-fat alternatives. Consequently, the majority of those who usually consumed full-fat milk perceived that their parents would like them to do so.

Contrary to the results in the questionnaire study, the "usual breakfast" was more likely to include the same food categories as those chosen for a "normative breakfast" than for "mother's and father's breakfasts". There are several possible explanations for the food choice being more closely related to the descriptive norm in the questionnaire study while the association was stronger for the injunctive norm in the interview study. One reason might be that the analysis of the interviews only dealt with the habitual choice between categories while the analysis in the questionnaire study focused on intention to consume (and reported consumption in the food record). Thus, the results of the questionnaire study might not only reflect the consumption of one food category in relation to another, but also in relation to non-consumption of that food group. Furthermore, the usual choice corresponds to the most commonly consumed food category while intention to consume might correspond to one of many

possible choices. For example, full-fat milk might be a child's usual food choice, but since many milk types are used in the household, low-fat milk is also used frequently. Another reason might be that the measure of injunctive norm in the questionnaire might fail to represent what it is meant to measure. Feunkes (170) has suggested that subjective norm (i.e. injunctive norm) may assess perceived independence from the social environment instead of social pressure.

Except for the relative importance of the two norm components, the results of the interview study correspond with those of the questionnaire study. The interviewees reported that their parents consumed milk types with lower fat content than those in their own habitually consumed breakfast (RP=0,21** for mother's breakfast; RP=0,17* for father's breakfast), but thought that their parents wished them to use the milk that they usually consumed. Thus, if children's perceptions are in accordance with parents' actual views of their child's choice, the results of the present studies might indicate a perception among parents that children need milk with more fat. When it comes to spread, many children reported that their parents consumed the same type and that their choice concurred with parents' wishes. This might indicate that the fat in milk is considered particularly appropriate for children, an idea which is, to some extent, also supported by children's own health perceptions.

In contrast to dairy products, an explicit deviation between parental norms and actual choice was observed for cereal products. The interviewees perceived that their parents wanted them to choose bread (Figure 9; RP=0,42***) and breakfast cereals (Figure 10; RP=0,26***) containing more fibre than those in their own usual breakfast, and that their parents consumed bread (RP=0,35*** for both mother's breakfast and father's breakfast) and breakfast cereals (RP=0,37*** for mother's breakfast; RP=0,10, NS for father's breakfast) with more fibre themselves. Children's own reasons for not complying with their parent's wish was palatability, indicating that perception of the taste of high-fibre products prevents consumption of those products.

In conclusion, the results suggest that the children were influenced by parental norms in their breakfast choices. It seemed that the parents influenced children's choice both by direct encouragement and by acting as models. Both injunctive and descriptive norms supported consumption of bread and breakfast cereals with more fibre than in habitually consumed products. When it comes to milk and spread, the children chose according to their perceptions of parents' wishes. Thus, injunctive norms did not support a change towards low-fat products among those who did not already consume such products. However, parents' milk choice might induce the children to consume low-fat milk since they perceived that their mothers and fathers used milk with lower fat content than in that they usually consumed themselves.

Control of consumption (papers II and IV)

Influences on children's and adolescents' food choice are likely to be different from those on adults' food choice, since children are dependent on their parents for foods available at home. Children's own stated reasons for consumption demonstrated that availability influences consumption. For example, the majority reported that they consumed a particular type of spread because it was offered at home. That children do not have complete control over their consumption is also confirmed by the results of the questionnaire study, suggesting that perceived control was associated with intention to consume and with actual consumption of milk and bread. The fact that children's perception of parents' wishes (injunctive norm) contributed to the prediction of consumption independently of perceived control might indicate that the children were not completely aware of being controlled by their parents or did not want to admit that this was the case. However, consumption was more strongly associated with children's intentions than with their perceptions of parents' wishes and perceived control. Moreover, the great majority reported in the interviews that they consumed the milk and spread that they wanted. Most of the children also consumed the bread and breakfast cereals that they preferred, and those who did not were not exclusively limited to consumption of high-fibre categories. For some children, restricted access resulted in consumption of bread and breakfast cereals with more fibre than in those preferred by themselves, while others reported that they preferred and would have consumed an alternative with more fibre if it had been available at home and if they had had time to prepare it.

In conclusion, the results suggest that the children did not have complete control over what they consumed for breakfast, but that their breakfast choices were, to a great extent, in accordance with their preferences. Parents' influence on their children's choices by controlling availability of foods was demonstrated by the children's own stated reasons for breakfast choices and for not consuming preferred foods. In particular, the choice of spread was reported to be determined by availability. However, even if the results suggest that the parents influenced their children's consumption through control over access to food, the children tended not to be restricted to a consumption of high-fibre or low-fat foods.

Age and gender differences (papers I-IV)

Older children had more knowledge, compared to younger ones, concerning health attributes of dietary fibre, the meaning of the keyhole symbol and sources of dietary fat and fibre. An interaction between age and gender was observed for

the attitude towards a high fat intake, with more negative evaluations of high fat intake increasing with age for girls and the reverse for boys. The same tendency was seen in the evaluation of weight gain. Previous studies have reported that females are more interested in a slim body shape and dieting (163) and that boys instead want to increase weight and muscularity (171). Wesslén (172) claim that adolescent boys and girls live in two different food-cultures. According to results from focus group interviews, food was principally viewed as fuel by the boys, who considered it more important that food was palatable than that it was healthy. In contrast, the girls preferred food with low energy and fat content and felt guilty when not eating in a restrained manner.

According to their attitudes and intentions, older subjects and females were more inclined to choose low-fat milk and high-fibre bread than males and younger children. Corresponding albeit smaller age differences were also obvious for actual milk consumption, but not for consumption of high-fibre bread. The frequency of skimmed milk intake was higher in girls than in boys, but there were no significant gender differences for the other milk types and high-fibre bread. It is likely that a non-participation bias diminished the differences in milk choice between boys and girls. Dropout from the food record was more common among those intending to drink full-fat milk, and this under-representation was only observed among boys.

When the usual and hypothetical breakfasts composed in interviews were compared, no age or gender differences were observed for measures of disagreement. Likewise, the results of the questionnaire study did not demonstrate any significant differences between gender or age groups in the relative influence of the components on the intentions to consume high-fibre bread and milk with varying fat content nor on the actual consumption of those foods. Moreover, there were no significant differences between the groups concerning the relative importance of underlying beliefs on attitudes to the consumption of high-fibre bread and milk with varying fat content. Thus, in this population, age and gender were related to the variables in the TPB, but age or gender did not affect the associations between those variables.

In conclusion, the older children had greater dietary knowledge, compared to younger ones and they tended to choose milk with lower fat content. Regarding promotion of choice of low-fat, high-fibre breakfast foods, the present data suggest that parents should be involved even with the older children, while children's own attitudes and underlying beliefs are already important at the age of 11.

Limitations and strengths (paper I-IV)

Dietary assessment methods

There are several advantages and disadvantages to both dietary assessment methods used. Some of the limitations will be mentioned here, starting with the selection problems. One disadvantage to interviews is that they are time-consuming and thereby necessitate smaller samples, compared to data collection using questionnaires. On the other hand, dropout is more likely in a food record survey that is burdensome for the participants and dependent on teachers' willingness to encourage and administer delivery of completed food diaries. In the present questionnaire study, a selection bias was observed. Children not completing the food record differed significantly from participants with respect to demographic, lifestyle and dietary factors. The dietary portion of the dropout analysis showed that non-participation was associated with intention to drink full-fat milk for breakfast and with omitting breakfast. This suggests that a selection bias caused by dropouts may result in non-representative dietary data. More alarming is the fact that this bias may create biased associations if there is a relation between studied variables and non-response. The present studies showed examples suggesting that bias might either create misleading associations or obscure actual associations.

Another possible bias was also observed in the questionnaire study, in which the number of reported food items declined during the recording period. This might be due to variations during the week but more likely reflects a discrepancy between reported and usual diet. This decline might be explained by a fatigue effect with under-reporting at the end of the period, or by over-reporting at the beginning of the period due to social desirability, or by a combination of the two. Assuming that the burden on participants is a source of error, the observation of these two biases suggest that less burdensome methods might provide more valid data in this target group.

Validation of the methods against each other suggests that the usual breakfast choice of milk could be captured both by the stacking box interview technique and by breakfast record during seven consecutive days. It seems to be somewhat more difficult to accurately assess habitual choice of bread. One reason might be that it is common to use only one or two milk types, while bread use may be more varied. A high within-subject variation might make the food record less suitable to assess usual consumption, but this is probably not the only reason for the random differences between the methods. Another explanation might be that it is difficult to identify and distinguish bread alternatives compared to "standard types" of foods such as different milk types. Misclassification of bread categories is likely to occur in both the questionnaire and the interview study, and might account for the low reliability for bread

choices, in the composition of usual and hypothetical breakfast, observed in a pilot study (150). However, it should be pointed out that no systematic bias was detected. In contrast, the disagreement between the choice of breakfast cereals and spread between the two methods was mainly of a systematic nature. A revision of the food record formula to include more types of breakfast cereals would probably diminish this disagreement for cereals. The disagreement for spread is harder to explain but might be interpreted as a change in consumption between the two assessments. In summary, the stacking box method seems to give similar information as the food record in assessing habitual choice of milk and breakfast cereals, but might present some differences for identifying usual spread or bread type. Moreover, the fact that consistent associations are observed indicates valid assessments. However, we cannot draw any conclusions with certainty since the two methods may share similar biases.

The theory of planned behaviour

TPB has been extensively applied in attempts at understanding health behaviour and, according to a review of the effectiveness of nutrition education, social psychological theories such as the TPB have been found to be effective in guiding the design of nutrition education interventions (173). These theories focus on people's perceptions of the situation rather than the reality. The basic assumption is that even if many external factors are likely to be important, it is valuable to investigate cognitive factors since they are regarded as mediating the effects of those external factors on food choice. In addition to focusing on cognitions, these theories aid us in defining important abstract concepts and describing their relations to behaviour. A characteristic that makes TPB especially useful is the emphasis on the specific correspondence of beliefs to behaviour in a given social context. The model also provides instructions for measuring and analysing variables. Unfortunately, the operationalisation of cognitive variables into this highly theoretic model is problematic. For example, the rules for analysing data have been criticised on statistical grounds (174). In the present studies, we considered the data to be on an ordinal level scale, and therefore did not add or multiply variables as suggested by the model. Other revisions of the TPB have also been suggested (139, 140), e.g. extension of the model with a descriptive norm, which was successfully carried out in this thesis. Figure 14 shows the TPB with modifications as applied in this thesis.

In the interview study, we adopted the concept of TPB as a theoretical framework, but applied an alternative operationalisation of the model. The stacking box interview technique appears to have some advantages, compared to questionnaire studies based on TPB. Firstly, the picture-based interview method for dietary assessment and investigation of perceptions was designed to be appropriate for children in the full range of examined age groups. Moreover, it

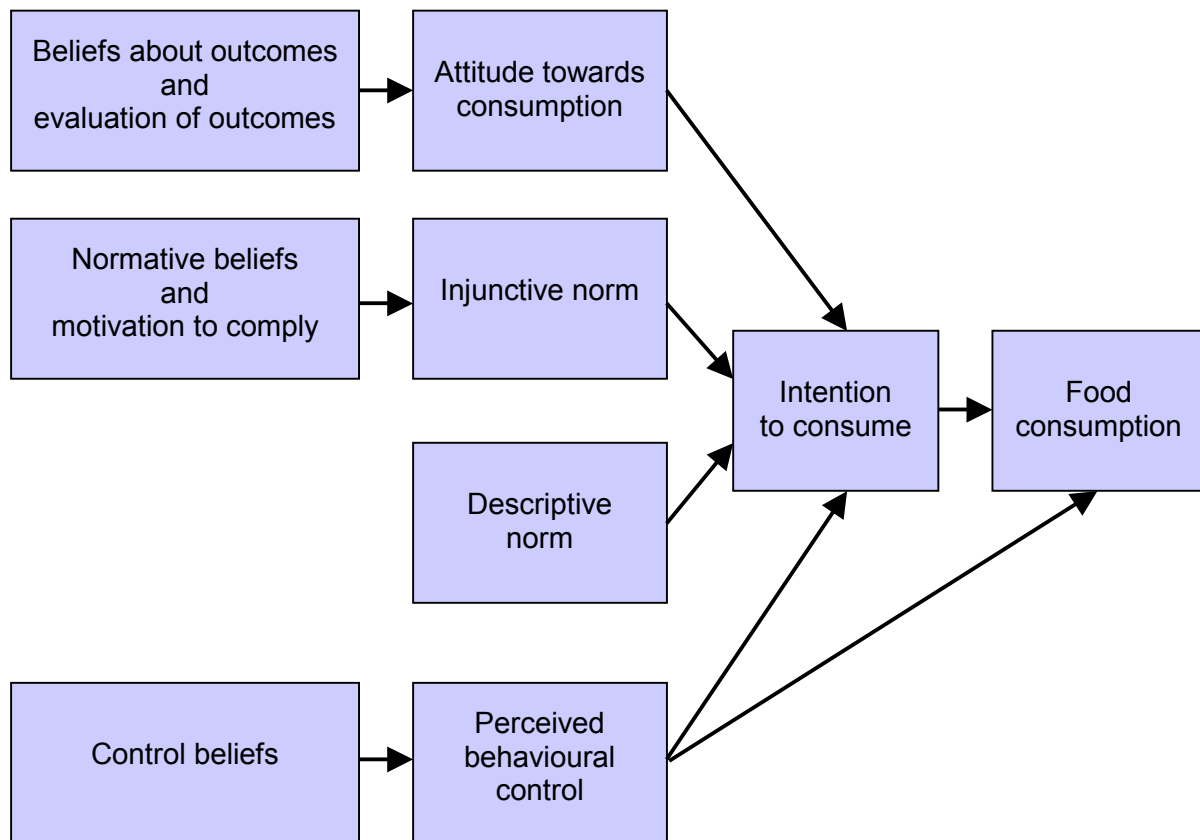


Figure 14. TPB with modifications as applied in this thesis

might be easier to communicate in a dialogue than in a written formula. For example, formulation of questions to measure perceived control of consumption of a food has been shown to be problematic (133), while it seemed to be easy for the participants in the present study to explain why they did not consume what they wanted to consume. Another advantage of this interview method is that associations between perceptions and consumption can be investigated for different alternatives within a food group in contrast to the usual application of the TPB which focuses on consumption either of a single food or a whole food group and related cognitive factors. In the present questionnaire study, we had to confine the investigation to milk and only one type of bread in order to avoid an excessively long questionnaire.

Furthermore, it has been suggested that the relationship between attitude and intention will be less clear when the attitude is ambivalent (175). Thus, the usual TPB applications might be good at predicting consumption of foods about which most subjects in the examined population do not have very conflicting outcome beliefs (e.g. milk). The predictive power might be lower for foods towards

which people are ambivalent, such as bread and breakfast cereals. However, even if the relationship between attitude and behaviour is strong, it only tells us that those who have a more positive attitude towards consuming a food are more likely to consume that food than those with a negative attitude. In order to understand how individuals arrive at their decisions, it might also be essential to examine beliefs underlying the attitude. In a questionnaire, subjects are normally presented with the beliefs most frequently mentioned in a pilot study (modal salient beliefs), while individuals might vary in their beliefs underlying the attitude. The existence of associations in the way beliefs and attitudes usually are presented might also be expected. In order to capture individual salient beliefs, the participants in the interview study were asked about their reasons for consumption in addition to investigating modal salient beliefs in an alternative manner (health and taste perceptions).

In general, studies applying the TPB employ cross-sectional designs, as is the case in the present studies. It is possible to conduct cross-sectional research with relatively modest resources, but this approach has certain limitations. Longitudinal research might be needed in order to establish causal relationships among the variables in the model. Furthermore, simultaneous assessment of intention and behaviour might exaggerate the relationship between these variables. In the present questionnaire study, dietary behaviour was measured in a food record administrated two weeks after the questionnaire was completed. However, many other studies do not include any prospective measures of dietary behaviour. When subjects are asked about their usual consumption of a food and their intention to consume it in the same questionnaire, a strong association may be expected. Likewise, an incorporation of past behaviour in an attempt to reflect habit may have limited relevance. Suppose that children answered the following questions at the same moment: how often do you consume, how often do you intend to consume and how often did you consume this particular food? It is obvious that strong correlations between these items do not necessarily imply that intentions and habits determine food consumption.

However, despite the difficulty of designing adequate measures of habit, it has been suggested that everyday behaviours are controlled only partially by intentions and may be controlled in part directly by habits (139, 176, 177). Only if daily life routines, such as food habits, are volitional, can the TPB be regarded as a complete model of such behaviours. Thus, unintentional automatic repetition of past choice might be a factor determining food selection, which is not reflected in this model.

Generalisability

Even if Mölndal municipality did not greatly differ demographically from Sweden as a whole, it cannot be established that the sample in the present dietary survey was representative of 11-15-year-old Swedes. There might be a

risk of regional cultural differences in examined variables. Furthermore, the selection bias mentioned above might have influenced the results related to data from the food record.

Summary

Food choice must be studied from multiple perspectives and TPB is one of many theories that can serve as a useful framework when investigating food choice from a cognitive perspective. However, the application of this highly theoretical model to complex behaviours is, unfortunately, associated with some problems in measurement and analysis. Therefore, an alternative operationalisation of the model might have some advantages over the usual application of TPB. In addition to a questionnaire study based on TPB, the stacking box interview technique was used in the present thesis. These two applied research approaches complement each other since they are distinguished by specific limitations in many aspects.

Two sources of bias were observed in the food record survey. Non-participants differed significantly from participants, and a decline in recorded foods during the recording period was observed. It is even more likely that such biases are present in other dietary surveys with estimated or weighed records including all meals. Thus, it is of great importance to take such biases into consideration in the design, analysis and interpretation of dietary surveys.

GENERAL DISCUSSION

Focus on categories of foods

Much nutrition research has focused on nutrients, while food choices have been more poorly researched. This is one reason for the difficulties in the process of developing food-based dietary guidelines (178). It is not only knowledge about how food intake is associated with health and nutrients that is required. If these guidelines are to be effective, they must also be developed in the light of people's attitudes, beliefs and knowledge linked to their consumption of specific foods.

The results of the present study demonstrate that these links differ between food groups and between food categories. Thus, it might not be sufficient to examine cognitive variables related to consumption of "healthy foods" or even food groups such as bread, as is the case in several studies. The analyses of food categories were successful for the foods examined in the present thesis, although we might need alternative approaches for some other foods. It would also have been interesting to focus on for example cheese, but the distribution of data did not allow for classification since the overwhelming majority chose regular-fat cheese. However, results from Nordic studies indicate that it is easier to switch to reduced-fat milk and spread alternatives than to change to low-fat cheese (103, 104, 128).

Choice of reduced-fat products

Previous studies have demonstrated that children's taste preferences for high-fat foods have been associated with the percentage of total energy as fat in their diet (179, 180), and the present results reflect the strong influence of taste on food choice. We might then conclude that some children choose high-fat products because of their sensory preferences for fat, but why do preferences for foods with varying fat content differ? In a review article about children's preferences for high-fat foods, Birch (181) stated that "At this point, there is no evidence to support the possibility that there is an innate, unlearned preference for fat, and this possibility seems unlikely because the "fat taste" is not unitary and the sensory characteristics imparted by fat vary widely across food systems". Furthermore, results of studies with patients who have been advised to use low-fat products as a part of their diet therapy indicate that consumption will affect liking for low-fat foods (182, 183) even if hedonic rating tests may not support

altered taste perceptions (183). Sensory responses to foods might not only depend on their intrinsic properties but also on contextual factors. Several studies have demonstrated how product information on food affects sensory judgements. For example, information about fat content has been observed to affect liking for foods in different directions depending on consumers' attitudes (184-188). Thus, the initial motive for habitual consumption might not be taste but other factors, such as health and weight concern.

One possible interpretation of the present results is that some children and their parents considered full-fat products as healthy choices for schoolchildren, and that these children learned to appreciate the taste of these products. That children's perceptions of healthy dietary intake and parental norms supported habitual consumption, despite the fact that full-fat as well as low-fat products were frequently consumed, indicates that there is a need for increased public knowledge about healthy food alternatives, and about recommendations concerning dietary fat for children and adolescents.

The data in this thesis has been interpreted from the perspective of the present Swedish Nutrition Recommendations, while it is not within the scope of this study to judge these recommendations, the ongoing debate on appropriate dietary fat recommendations for children should be mentioned. Some researchers argue that fat should not be restricted in children's diets since there is no clear evidence that a low-fat diet will prevent morbidity and mortality in adulthood. They have apprehensions that restrictions may create unhealthy attitudes towards food and eating, and that a limited fat intake is potentially harmful for growth and development (189-192). However, many experts recommend limitation of fat intake for schoolchildren (193-197). There is no consensus regarding the range of optimal fat intake in childhood, but a number of studies (summarised in (198)) have demonstrated that growth, development and micronutrient intakes are not compromised in children consuming 27-30% of their dietary energy as fat. It should also be mentioned that some data indicates a reverse association (protective) between milk fat intake and certain risk factors for CVD, e.g. serum cholesterol (199) and BMI (200). However, these relationships require further investigation before a consensus can be reached on the topic of reduced-fat products for children. Once such a consensus is reached, it is important that a clear unambiguous message be delivered to the children and their parents. This should occur not only by information but also, for example, through the selection of foods offered in school. Today, there is a growing focus on body weight and appearance in the marketing of low-fat foods, which could potentially be balanced by promoting knowledge about health aspects of dietary fat.

Parental influences

The present results suggest that parents influence their children's breakfast choices via norms and by controlling available foods. The important role of the family in dietary behaviour has been confirmed in previous studies demonstrating that food choice and fat intake aggregate in families (201, 202) and that changes in intake among family members living together are interrelated (202, 203). There is also some evidence (204-207) that dietary beliefs and behaviour established at home persist when children leave home. In light of these findings, it is surprising that many studies have failed to demonstrate strong parent-child resemblance in food preferences⁸ (208). Rozin (209) refers to this contradiction as the family paradox and argues that methodological shortcomings are not a very likely explanation. Thus, in contrast to what is dictated by common sense, these latter findings suggest that children to a very small extent learn to like particular foods by food exposure at home. However, even if that is true, parents might influence their children, not only directly through the foods purchased and served in the household, but also by affecting habits, beliefs and attitudes facilitating certain food choices.

Interestingly, Feunekes and colleagues (202, 210) have shown that Dutch youths' fat and food intake is more closely related to that of family members than to their best friends' intake. They observed that the strongest resemblance within the family was for foods eaten at the main meals, while the few foods associated with friends' intake were mainly snack foods. Similar findings have been reported by an Australian study (211), and other studies have observed that samples of Finnish and Canadian adolescents associate "junk food" with friends, independence and pleasure, while other foods are associated with parents, meals, health and being at home (77, 212). If data from these samples are applicable to adolescents in Sweden, it might be more difficult for parents to influence snack consumption than the choice of breakfast foods eaten at home.

Despite the widespread assumption that parents affect their children's dietary habits, there have been few investigations of the process of parental influence on children's attitudes and intakes (213). It is of interest to further investigate not only parental influences on children's food behaviour, but all the multidirectional influences within the family, e.g. children's influences on their parents' choices, and how siblings influence each other. Furthermore, since children's and adolescents' food choices seem to be controlled and influenced by their parents, future research should focus both on parents' and children's choices, attitudes, beliefs and knowledge.

⁸ "Preferences" is generally used synonymously with "liking" in those studies

CONCLUSIONS

Practical:

- Actions aiming at influencing schoolchildren's breakfast food choices should be addressed both to children and their parents. This applies to teenagers as well as younger children.
- Although it is usually believed that dietary knowledge does not influence dietary behaviour, our results suggest that schoolchildren's breakfast choices are directly associated with their dietary knowledge. Knowledge appears to motivate as well as facilitate "healthier" choices.
- There is a need for increased public knowledge about healthy food alternatives for schoolchildren, particularly regarding alternatives varying in fat content and fat quality.
- In the case of milk choices, children did not show any ambivalence. Thus, a child is likely to prefer the milk that she/he perceives as healthiest regardless of whether it is low-fat or high-fat.
- Schoolchildren's consumption of high-fibre products is limited by the fact that they don't find them palatable, but might be increased by altering taste properties of the foods or by influencing liking for these foods.

Theoretical:

- Errors will always be present in dietary surveys, and should be taken into consideration in the design, analysis and interpretation of these studies.
- The Theory of Planned Behaviour can serve as a useful framework when examining food choice, but the operationalisation of the model is associated with some problems. The stacking box interview technique represents a viable alternative to the usual application.
- It is important to investigate descriptive norms in addition to injunctive norms in situations where people serving as models may advocate one thing and do something else themselves. Our results suggest that both descriptive and injunctive norms are important for children's' food choice.

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REFERENCES

1. Folkhälsoinstitutet, Livsmedelsverket. Nationell handlingsplan för nutrition. Enligt regeringsbeslut 1995-10-26. [National action program for nutrition, 1995]; 1996.
2. Eurodiet Steering Committee. Nutrition and diet for healthy lifestyles in Europe: Science and policy implications. Proceedings of the European Conference. May 18-20, 2000. Crete, Greece. *Public Health Nutr* 2001;4:337-434.
3. Williams C. Food, nutrition and cardiovascular disease prevention in the European Union. Brussels: The European Heart Network; 1998.
4. Socialstyrelsen. Folkhälsorapport 2001 [Public health report 2001]. Stockholm: Epidemiologiskt centrum, socialstyrelsen; 2001.
5. WHO. Obesity: Preventing and managing the global epidemic. Technical report series. Geneva: World Health Organization; 2000. Report No.: 894.
6. Yao M, Roberts SB. Dietary energy density and weight regulation. *Nutr Rev* 2001;59:247-258.
7. Astrup A, Ryan L, Grunwald GK, Storgaard M, Saris W, Melanson E, et al. The role of dietary fat in body fatness: evidence from preliminary meta-analysis of ad libitum low-fat dietary intervention studies. *Br J Nutr* 2000;83(suppl.1):S25-S32.
8. Bray GA, Popkin BM. Dietary fat intake does affect obesity! *Am J Clin Nutr* 1998;68:1157-73.
9. Howarth NC, Saltzman E, Roberts SB. Dietary fiber and weight regulation. *Nutr Rev* 2001;59:129-139.
10. Greenwald P, Clifford CK, Milner JA. Diet and cancer prevention. *Eur J Cancer* 2001;37:948-965.
11. American Academy of Pediatrics. National Cholesterol Education Program. Report of the expert panel on blood cholesterol levels in children and adolescents. *Pediatrics* 1992;89, suppl. 3:525-584.
12. WHO. Prevention in childhood and youth of adult cardiovascular disease: Time for action. Technical report series. Geneva: World Health Organization; 1990. Report No.: 792.
13. Recommendations of the European Atherosclerosis Society prepared by the International Task Force for Prevention of Coronary Heart Disease. Prevention of coronary heart disease: Scientific background and new clinical guidelines. *Nutr Metab Card Dis* 1992;2:113-156.

REFERENCES

14. Must A. Morbidity and mortality associated with elevated body weight in children and adolescents. *Am J Clin Nutr* 1996;63(suppl. 3):445S-447S.
15. Gunnell DJ, Frankel SJ, Nanchahal K, Peters TJ, Smith GD. Childhood obesity and adult cardiovascular mortality: a 57-y follow-up study based on the Boyd Orr cohort. *Am J Clin Nutr* 1998;67:1111-1118.
16. Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T. Do obese children become obese adults? A review of the literature. *Prev Med* 1993;22:167-177.
17. Keenan DP, AbuSabha R, Sigman-Grant M, Achterberg C, Ruffing J. Factors perceived to influence dietary fat reduction behaviors. *J Nutr Educ* 1999;31:134-144.
18. Birch L. Children's food preferences: developmental patterns and environmental influences. *Ann Child Dev* 1987;4:171-208.
19. Eertmans A, Baeyens F, Van den Bergh O. Food likes and their relative importance in human eating behaviour: Review and preliminary suggestions for health promotion. *Health Educ Res* 2001;16:443-456.
20. Mela D. Food choice and intake: The human factor. *Proc Nutr Soc* 1999;58:513-521.
21. Singer MR, Moore LL, Garrahe EJ, Ellison RC. The tracking of nutrient intake in young children: The Framingham children's study. *Am J Publ Health* 1995;85:1673-1677.
22. Kelder SH, Perry CL, Klepp KI, Lytle LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. *Am J Public Health* 1994;84(7):1121-6.
23. Nader PR, Stone EJ, Lytle LA, Perry CL, Osganian SK, Kelder S, et al. Three-year maintenance of improved diet and physical activity: The CATCH cohort. *Child and adolescent trial for cardiovascular health. Arch Peadiatr Adolesc Med* 1999;153:695-704.
24. Dunn J, Liu K, Greenland P, Hilner J, Jacobs D. Seven-year tracking of dietary factors in young adults: The CARDIA study. *Am J Prev Med* 2000;18:38-45.
25. Branen L, Fletcher J. Comparison of college students' current eating habits and recollections of their childhood food practices. *J Nutr Educ* 1999;31:304-310.
26. Elbone S, Johnson MA, Fisher JG. Milk consumption in older Americans. *Am J Publ Health* 1998;88:1221-1224.
27. Winter Falk L, Bisogni CA, Sobal J. Food choice processes of older adults: A qualitative investigation. *J Nutr Educ* 1996;28:257-265.
28. Jansson S. Matvanor och hälsomedvetande. En studie av ensamboende ungdomar [Food habits and health consciousness. A study of adolescents living on their own]. Uppsala: OSJ Förlag; 1990.

REFERENCES

29. Ajzen I. Nature and operation of attitudes. *Annu Rev Psychol* 2001;52:27-58.
30. Uddenberg N. Hälsans diktatur? - Varför vill svenska ungdomar vara friska [Dictatorship of health? - Why do Swedish adolescents want to be healthy]. *Socialmedicinsk tidskrift* 1993;70:103-106.
31. Becker W. Svenskarna äter nyttigare - allt fler väljer grönt [The Swedes eat healthier - more people choose green-stuff]. *Vår Föda* 1999;51(1):24-27.
32. Livsmedelsverket. Svenska näringsrekommendationer [Swedish nutrition recommendations]. 3th ed. Uppsala: Livsmedelsverket; 1997.
33. Bergström E, Hernell O, Persson LA. Dietary changes in Swedish adolescents. *Acta Paediatr* 1993;82(5):472-80.
34. Samuelson G, Bratteby LE, Enghardt H, Hedgren M. Food habits and energy and nutrient intake in Swedish adolescents approaching the year 2000. *Acta Paediatr* 1996;85(suppl. 415):1-19.
35. Becker W. Befolkningens kostvanor och näringsintag i Sverige 1989. Metod och reultatanalys. [Food habits and nutrient intake in Sweden 1989; summary in English]. Uppsala: Livsmedelsverkets förlag; 1994.
36. Marklund U. Skolbarns hälsovanor under ett decennium [Health behaviour in school-aged children, a WHO collaborative study]. Stockholm: Folkhälsoinstitutet; 1997. Report No.: 1996:110.
37. Marklund U, Danielson M. Svenska skolbarns hälsovanor 1997/1998 [Health behaviour in school-aged children, a WHO collaborative study]. Stockholm: Folkhälsoinstitutet; 2000. Report No.: 2000:5.
38. Currie C, Hurrelmann K, Settertobulte W, Smith R, Todd J, editors. Health and health behaviour among young people. Health behaviour in school-aged children: a WHO cross-national study (HBSC), international report. Copenhagen: World Health Organization; 2000.
39. Höglund D, Samuelson G, Mark A. Food habits in Swedish adolescents in relation to socioeconomic conditions. *Eur J Clin Nutr* 1998;52:784-789.
40. Bergström E, Hernell O, Persson LA. Cardiovascular risk indicators cluster in girls from families of low socio-economic status. *Acta Paediatr* 1996;85:1083-90.
41. Berg Kelly K. Ungdomsmedicin [Adolescent medicine]. Stockholm: Liber AB; 1998.
42. Becker W. Färre äter skollunch varje dag [Fewer eat schoollunch every day]. *Vår Föda* 2002;54(1):9-13.
43. Berg Kelly K, Kullander K. Do adolescents' own intentions regarding healthy behaviours affect outcome? A two-year prospective study. *Acta Paediatr* 1999;88:983-989.
44. Hagman U, Bruce Å, Persson LA, Samuelson G, Sjölin S. Food habits and nutrient intake in childhood in relation to health and socio-economic conditions. A Swedish Multicentre Study 1980-81. *Acta Paediatr Scand* 1986;75(Suppl. 328):1-56.

REFERENCES

45. Larsson B, Johansson I, Hellsten G, Hallmans G, Ericson T, Bruce Å. Blood lipids and diet in Swedish adolescents living in Norsjö, an area with high incidence of cardiovascular diseases and diabetes. *Acta Paediatr Scand* 1991;80:667-74.
46. FAO/WHO. Carbohydrates in Human Nutrition: Interim report of a joint FAO/WHO Expert Consultation, Rome, Italy, 14 to 18 April 1997. Food and nutrition paper. Rome: FAO/WHO; 1998. Report No.: 66.
47. Williams C. Importance of dietary fiber in childhood. *J Am Diet Assoc* 1995;95:1140-1149.
48. Höglund D, Nilsson-Gren A, Mark A, Bendsjö-Wiström H, Persengård K, Samuelson G. GöteÄlvstudien. En studie av kostvanor bland ungdomar i årskurs 8 [A study of food habits among adolescents in the 8th grade]. *Folkhälsosekretariatets skriftserie*. Göteborg: Folkhälsosekretariatet i Göteborg; 1996. Report No.: 1996:09.
49. Näslund GK. Health Behavior. Studies on determinants for health behavior and the relationships between behavior, beliefs and knowledge (Doctoral dissertation, Karolinska institute, 1996). Stockholm: Karolinska institutet; 1996.
50. Grufman M, Carlsten C, Krabbe M. Så har vi det! En studie från Göteborg om ungdomars livsstil och hälsa 1990-96 [Things are like this! A study from Gothenburg of adolescents' life style and health]. *Folkhälsosekretariatets skriftserie*. Göteborg: Folkhälsosekretariatet i Göteborg; 1997. Report No.: 1997:05.
51. Nordlund G, Jacobson T. Högstadikeenheten: högstadiееlevernas måltidsvanor relaterat till hur de mår och känner sig i skolan, deras skolprestationer och sociala bakgrund [The senior level of compulsory school questionnaire]. Umeå: Pedagogiska institutionen, Umeå universitet; 1997. Report No.: 53.
52. Birch L. Development of food preferences. *Annu Rev of Nutr* 1999;19:41-62.
53. Rozin P, Vollmecke TA. Food likes and dislikes. *Ann Rev Nutr* 1986;6:433-456.
54. Guo SW, Reed DR. The genetics of phenylthiocarbamide perception. *Ann Hum Bio* 2001;28:111-142.
55. Drewnowski A. Genetics of taste and smell. *World Rev Nutr Diet* 1990;63:194-208.
56. Prutkin J, Duffy VB, Etter L, Fast K, Gardner E, Lucchina LA, et al. Genetic variation and inferences about perceived taste intensity in mice and men. *Physiol Behav* 2000;69:161-173.
57. Anliker JA, Bartoshuk L, Ferris AM, Hooks LD. Children's food preferences and genetic sensitivity to the bitter taste of 6-n-propylthiouracil (PROP). *Am J Clin Nutr* 1991;54:316-20.
58. Keller KL, Steinmann L, Nurse RJ, Tepper BJ. Genetic taste sensitivity to 6-n-propylthiouracil influences food preference and reported intake in preschool children. *Appetite* 2002;38:3-12.

REFERENCES

59. Cain W. Taste vs. smell in the organization of perceptual experience. In: Solms J, Booth DA, Pangborn RM, Raunhardt O, editors. Food acceptance and nutrition. San Diego: Academic press; 1987. p. 63-77.
60. Zollinger H. The importance of colour vision for man. In: Solms J, Booth DA, Pangborn RM, Raunhardt O, editors. Food acceptance and nutrition. San Diego: Academic press; 1987. p. 47-62.
61. Szczesniak AS. Relationship of texture to food acceptance and nutrition. In: Solms J, Booth DA, Pangborn RM, Raunhardt O, editors. Food acceptance and nutrition. San Diego: Academic press; 1987. p. 157-172.
62. Drewnowski A. Taste preferences and food intake. *Annu Rev Nutr* 1997;17:237-53.
63. Drewnowski A. Sensory Properties of fat and fat replacements. *Scan J Nutr* 1992;36(Suppl. 26):17-20.
64. Lappalainen R, Sjödén PO. A functional analysis of food habits. *Scand J Nutr* 1992;36:125-133.
65. Birch LL. Developmental aspects of eating. In: Shepherd R, editor. *Handbook of the psychophysiology of human eating*. Chichester: John Wiley & Sons Ltd; 1989. p. 179-203.
66. Lowe CF, Dowey A, Horne P. Changing what children eat. In: Murcott A, editor. *The nations' diet: The social science of food choice*. New York: Addison Wesley Longman; 1998. p. 57-80.
67. Hølund U. Explanation and change of adolescents' dietary behavior (Doctoral dissertation, The Royal Dental College, Aarhus, Denmark, 1991). Århus: The royal dental college; 1991.
68. Koivisto Hursti U-K. Child food choice and the family (Doctoral dissertation, Uppsala University, 1997). Uppsala: Acta Universitatis Upsaliensis; 1997.
69. Roos G, Prättälä R. Disparities in food habits. Review of research in 15 European Countries. Helsinki: National Public Health Institute; 1999. Report No.: B24.
70. Roos E. Social patterning of food behaviour among finnish men and women (Doctoral dissertation, University of Helsinki, 1998). Helsinki: National Public Health Institute; 1998.
71. De Irala-Estévez JD, Groth M, Johansson L, Oltersdorf U, Prättälä R, Martínez-González MA. A systematic review of socio-economic differences in food habits in Europe: Consumption of fruit and vegetables. *Eur J Clin Nutr* 2000;54:706-714.
72. Samuelson G. Dietary habits and nutritional status in adolescents over Europe. An overview of current studies in the Nordic countries. *Eur J Clin Nutr* 2000;54(suppl. 1):S21-S28.
73. Becker W, Andersson B. En av tio hoppar över frukosten [One out of ten omit the breakfast]. *Vår Föda* 1995;47(7):9-17.
74. Lévi-Strauss C. The culinary triangle. *Partisan Review* 1965;33:586-595.

REFERENCES

75. Simmel G. The sociology of the meal (M. Symons, trans.; original work published 1957, *Soziologie der Mahlzeit*). *Food and Foodways* 1994;4:345-350.
76. Douglas M. Deciphering a meal. *Daedalus* 1972;101:61-81.
77. Prättälä R. Young people and food. *Socio-cultural studies of food consumption patterns* (Doctoral dissertation, University of Helsinki, 1989). Helsinki: University of Helsinki; 1989.
78. Bourdieu P. *Kultursociologiska texter*. (Original work published 1979: *La distinction. Critique sociale du jugement*). Stockholm: Salamander; 1986.
79. Svederberg E. *Tänkande bakom val och användning av livsmedel. Faktorer som medverkar till eller utgör hinder för förändring av matvanor i hälsofrämjande riktning* [Conceptualizations in relation to choice and use of food. Circumstances that contribute to compliance or lack of compliance with dietary guidelines conducive to health], *Lund studies in education 1* (Doctoral dissertation, Lund University, 1997). Lund: Lund University Press; 1997.
80. Ekström M. *Kost, klass och kön* [Food, Preparation, Class and Gender], *Umeå studies in sociology* (Doctoral dissertation, Umeå University, 1990). Umeå: Sociologiska institutionen; 1990.
81. Mintz SW. *Sweetness and power: the place of sugar in modern history*. New York: Penguin; 1986.
82. Fjellström C. *Drömmen om det goda livet. Livskvalitet och matvanor i ett uppväxande industrisamhälle: Stocka sågverk 1870-1980* [The dream of the good life. The quality of life and food habits in an expanding industrial society: Stocka Sawmill 1870-1980], *Acta Ethnologica Umensia* (Doctoral dissertation, Uppsala University, 1990). Uppsala: Almqvist & Wiksell; 1990.
83. Mennell S, Murcott A, van Otterloo AH. *The sociology of food: eating, diet and culture*. London: SAGE Publications; 1992.
84. Myrdal J, Welinder S, Pedersen EA, Widgren M. *Jordbrukets första femtusen år* [The first five thousand years of agriculture]. In: Myrdal J, editor. *Det svenska jordbrukets historia*. Stockholm: Natur och kultur/LTs förlag; 1998.
85. Campbell Å. *Det svenska brödet* [The Swedish bread]. Stockholm: Svensk Bageritidskrift; 1950.
86. Myrdal J, Gadd C-J. *Den agrara revolutionen* [The agrarian revolution]. In: Myrdal J, editor. *Det svenska jordbrukets historia*. Stockholm: Natur och kultur/LTs förlag; 2000.
87. Bäck L. *Livsmedelsinköpens regionala variationer* [Regional variations in provisions purchases]. Uppsala: Kulturgeografiska institutionen, Uppsala universitet; 1983. Report No.: 84.
88. Myrdal J. *Jordbruket under feodalismen* [The agriculture during the feudalism]. In: Myrdal J, editor. *Det svenska jordbrukets historia*. Stockholm: Natur och kultur/LTs förlag; 1999.
89. Björnhag G, Myrdal J. *Nötkreaturens produktion och utfodring enligt 1500-talets kungsgårdsräkenskaper* [The production and foddering of the cattles according to accounts of State demesne]. In: Myrdal J, Sten S, editors. *Svenska husdjur från medeltid till våra dagar*. Stockholm: Nordiska museet; 1994.

REFERENCES

90. Ränk G. Från mjölk till ost. Drag ur den äldre mjölkhushållningen i Sverige [From milk to cheese]. Stockholm: Nordiska museet; 1966.
91. Koctürk T. Structure change in food habits. *Scand J Nutr* 1995;39:2-4.
92. Bolin O. Agricultural policies in confrontation with public health interests. In: Kjærnes U, Holm L, Ekström M, Fürst E, Prättälä R, editors. *Regulating markets regulating people. On food and nutrition policy*. Oslo: Novus forlag; 1993. p. 65-76.
93. Jensen T. Nutrition. A dilemma in the politics of food. In: Kjærnes U, Holm L, Ekström M, Fürst E, Prättälä R, editors. *Regulating markets regulating people. On food and nutrition policy*. Oslo: Novus forlag; 1993. p. 17-36.
94. Kjærnes U. A sacred cow. The case of milk in Norwegian policy. In: Kjærnes U, Holm L, Ekström M, Fürst E, Prättälä R, editors. *Regulating markets regulating people. On food and nutrition policy*. Oslo: Novus forlag; 1993. p. 91-106.
95. Viinisalo M. The butter-margarine war. The fat issue in Finland before the second world war. In: Kjærnes U, Holm L, Ekström M, Fürst E, Prättälä R, editors. *Regulating markets regulating people. On food and nutrition policy*. Oslo: Novus forlag; 1993. p. 107-122.
96. Interventionsenheten J. Stöd för mjölk och mjölkprodukter som konsumeras av skolbarn, VG 2:10 [EU school milk subsidy scheme]. Retrieved June 1, 2002 from http://www.sjv.se/download/SJV/trycksaker/Pdf_vagledning/vg2_10.pdf. In; Mars 2001.
97. von Hartman F. Uppföljning av EU:s subventioner av mjölk och mejeriprodukter till skolor och daghem [Evaluation of the EU subsidies of milk and dairy products to schools and day-carecentres]. F-serien. Stockholm: Folkhälsoinstitutet; 1997. Report No.: 1997:4.
98. Ritson C, Hutchins R. Food choice and the demand for food. In: Marshall DW, editor. *Food choice and the consumer*. Glasgow: Blackie academic & professional; 1995. p. 43-76.
99. Tangermann S. Economic factors influencing food choice. In: Ritson C, Gofton L, McKenzie J, editors. *The food consumer*. Chichester: John Wiley & Sons Ltd.; 1986. p. 61-83.
100. Fürst T, Connors M, Bisogni CA, Sobal J, Winter Falk L. Food choice: a conceptual model of the process. *Appetite* 1996;26(Suppl.1):247-266.
101. Connors M, Bisogni CA, Sobal J, Devine CM. Managing values in personal food system. *Appetite* 2001;36:189-200.
102. Palojoki P. The complexiy of food related activities in a houshold context. Study of Finnish homemakers' food choices and nutrition knowledge (Doctoral dissertation, University of Helsinki, 1997). Helsinki: University of Helsinki; 1997.

REFERENCES

103. Holm L. Kostens forandring [Dietary change] (Doctoral dissertation, Roskilde University). København: Akademisk Forlag; 1991.
104. Bugge A. Mat till begjaer og besvaer. Forbrukerenes vurderinger og kunnskaper om helse, miljø og etiske aspekter ved mat [Health, environmental and etical aspects of food - consumers' views and knowledge]. Arbeidsrapport. Lysaker: Statens institutt for forbruksforskning (SIFO); 1995. Report No.: 6-1995.
105. Wandel M, Bugge A, Skoglund Ramm J. Matvaner i endring og stabilitet. En studie av måltidsvaner og matforbruk i ulike forbrukergrupper [Change and stability in food habits]. Lysaker: Statens institutt for forbruksforskning (SIFO); 1995. Report No.: 4-1995.
106. Mitchell VW. A role for consumer risk perceptions in grocery retailing. *Br Food J* 1998;100:171-183.
107. Sjöberg L. Kost och hälsa - riskuppfattningar och attityder [Diet and health - risk perceptions and attitudes]. Uppsala: Statens livsmedelsverk; 1996. Report No.: 1.
108. Sjöberg L, Oskarsson A, Bruce Å, Darnerud PO. Riskerna med att äta mat [The risks of eating food]. *Vår föda* 1997;49(7):3-9.
109. Frewer LJ, Shepherd R, Sparks P. The interrelationship between perceived knowledge, control and risk associated with a range of food-related hazards targeted at the individual, other people and society. *J Food Safety* 1994;14:19-40.
110. Raats M, Sparks P. Unrealistic optimism about diet-related risks: Implications for interventions. *Proc Nutr Soc* 1995;54:737-745.
111. Brug J, Van Assema P, Kok G, Lenderink T, Glanz K. Self-rated dietary fat intake: association with objective assessment of fat, psychosocial factors, and intention to change. *J Nutr Educ* 1994;26:218-223.
112. Paisley C, Lloyd H, Sparks P, Phil D, Mela DJ. Consumer perceptions of dietary changes for reducing fat intake. *Nutr Res* 1995;15:1755-1766.
113. Kearney JM, McElhone S. Perceived barriers in trying to eat healthier - results of a pan-EU consumer attitudinal survey. *Br J Nutr* 1999;81(Suppl. 2):S133-S137.
114. Conner M, Norman P. The role of social cognition in health behaviours. In: Conner M, Norman P, editors. *Predicting health behaviour: research and practice with social cognition models*. Buckingham: Open University Press; 1995. p. 1-22.
115. Salovey P, Rothman AJ, Rodin J. Health behavior. In: Gilbert DT, Fiske ST, Lindzey G, editors. *The handbook of social psychology*. 4th ed. New York: Oxford University Press; 1998. p. 633-683.
116. AbuSabha R, Achterberg C. Review of self-efficacy and locus of control for nutrition- and health-related behavior. *J Am Diet Assoc* 1997;97:1122-1132.
117. Gummeson L, Jonsson I, Conner M. Predicting intentions and behaviour of Swedish 10-16-year-olds at breakfast. *Food Qual Pref* 1997;8:297-306.

REFERENCES

118. Saba A, Moneta E, Nardo N, Sinesio F. Attitudes, habit, sensory and liking expectations as determinants of the consumption of milk. *Food Qual Pref* 1998;9:31-41.
119. Shepherd R. Belief structure in relation to low-fat milk consumption. *J Hum Nutr Diet* 1988;1:421-428.
120. Shepherd R, Sparks P, Bellier S, Raats MM. Attitudes and choice of flavoured milks: Extensions of Fishbein and Ajzen's theory of reasoned action. *Food Qual Prefer* 1991;2;3:157-164.
121. Shepherd R, Stockley L. Fat consumption and attitudes towards food with a high fat content. *Hum Nutr Appl Nutr* 1985;39(6):431-442.
122. Shepherd R, Stockley L. Nutrition knowledge, attitudes, and fat consumption. *J Am Diet Assoc* 1987;87:615-619.
123. Tuorila H. Hedonic responses to colour, sweetness, saltiness and fattiness in selected foods as related to corresponding attitudes and other behavioural measures (Doctoral dissertation, University of Helsinki, 1986). Helsinki: University of Helsinki; 1986.
124. Raats MM, Shepherd R, Sparks P. Attitudes, obligations and perceived control: Predicting milk selection. *Appetite* 1993;20:239-241.
125. Sparks P, Hedderley D, Shepherd R. An investigation into the relationship between perceived control, attitude variability and the consumption of two common foods. *Eur J Soc Psychol* 1992;22:55-71.
126. Brewer JL, Blake AJ, Rankin SA, Douglass LW. Theory of reasoned action predicts milk consumption in women. *J Am Diet Assoc* 1999;99:39-44.
127. Shepherd R, Towler G. Nutrition knowledge, attitudes and fat intake: Application of the theory of reasoned action. *J Hum Nutr Diet* 1992;5:387-397.
128. Laub Hansen G. Unges ernæringsbevidsthed og dens indflydelse på deres kostvalg [Nutritional awareness of young subjects in relation to their food choices]. Unpublished doctoral dissertation. Frederiksberg: The Royal Veterinary and Agricultural University; 1991.
129. Jones EE. Major developments in five decades of social psychology. In: Gilbert DT, Fiske ST, Lindzey G, editors. *The handbook of social psychology*. 4th ed. New York: Oxford University Press; 1998. p. 3-57.
130. Andersson S, Axelsen M, Berg C, Normén L, Tulldahl J. Nomenklatur inom ämnesområdet näringslära. Förslag till en gemensam tolkning av termer [Nomenclature in the field of nutrition]. *Scand J Nutr* 1997;41:33-36.
131. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process* 1991;50:179-211.
132. Ajzen I, Fishbein M. *Understanding attitudes and predicting social behavior*. Englewood Cliffs N.J.: Prentice-Hall; 1980.
133. Conner M, Sparks P. The theory of planned behaviour and health behaviours. In: Conner M, Norman P, editors. *Predicting health behaviour: research and practice with social cognition models*. Buckingham: Open University Press; 1995. p. 121-162.

REFERENCES

134. Godin G, Kok G. The theory of planned behaviour: A review of its applications to health-related behaviors. *Am J Health Promot* 1996;11:87-98.
135. Stafleu A, de Graaf C, van Staveren WA, Schroots J. A review of selected studies assessing social-psychological determinants of fat and cholesterol intake. *Food Qual Pref* 1991/2;3:183-200.
136. Mesters I, Oostveen T. Why do adolescents eat low nutrient snacks between meals? An analysis of behavioral determinants with the Fishbein and Ajzen model. *Nutr Health* 1994;10:33-47.
137. Dennison CM, Shepherd R. Adolescent food choice: an application of the theory of planned behaviour. *J Hum Nutr Diet* 1995;8:9-23.
138. Fishbein M, Ajzen I. *Belief, attitude, intention and behavior*. Reading: Addison-Wesley; 1975.
139. Eagly A, Chaiken S. *The psychology of attitudes*. Orlando: Harcourt Brace College publisher; 1993.
140. Conner M, Armitage CJ. Extending the theory of planned behavior: A review and avenues for further research. *J Appl Soc Psych* 1998;28:1429-1464.
141. Cialdini RB, Trost MR. Social influence: social norms, conformity, and compliance. In: Gilbert DT, Fiske ST, Lindzey G, editors. *The handbook of social psychology*. 4th ed; 1998. p. 151-191.
142. Eagly A, Chaiken S. Attitude structure and function. In: Gilbert DT, Fiske ST, Lindzey G, editors. *The handbook of social psychology*. 4th ed; 1998. p. 269-322.
143. Parmenter K, Wardle J. Evaluation and design of nutrition knowledge measures. *J Nutr Educ* 2000;32:269-277.
144. Statistiska centralbyrån. *Årsbok för Sveriges kommuner* [Statistical yearbook of administrative districts of Sweden 1996]. Örebro: SCB; 1996.
145. Svenska kommunförbundet. *Levnadsförhållanden i Sveriges kommuner* [Circumstances in Sweden's municipalities]. Stockholm: Kommentus förlag; 1994.
146. Statistiska centralbyrån. *Statistisk årsbok 1997* [Statistical yearbook 1997]. Stockholm: SCB; 1997.
147. Socialstyrelsen. *Statistik socialtjänst*. Stockholm: Socialstyrelsen; 1996. Report No.: 1996:8.
148. Ahlström R, Baird JC, Jonsson I. School children's preferences for food combinations. *Food Qual Prefer* 1990;2:155-165.
149. Gummeson L, Jonsson I, Conner MT, Svensson E. Assessing factors influencing food choice among 10-16-year-old schoolboys. A pilot study with a stacking box method. *J Hum Nutr Diet* 1996;9:219-229.
150. Jonsson I, Gummeson L, Conner M, Svensson E. Assessing food choice in school children: Reliability and construct validity of a method stacking food photographs. *Appetite* 1998;30:25-37.

REFERENCES

151. Jonsson I, Baird JC, Becker W, Sjöden P-O. Kostintervjuer med män i Borås. Jag äter det jag är van vid och mår bra [Dietary interviews with men in Borås. I eat what I am used to, and feel well]. *Vår Föda* 1993;45(7):312-20.
152. Lagström H, Seppänen R, Jokinen E, Salminen M, Simell O. The impact of children-targeted dietary counseling of parents on food (milk) preferences of preschool-aged children in the STRIP project. *Scand J Nutr* 2001;45:51-56.
153. Dennison CM. The factors affecting food choice in adolescents. Unpublished doctoral dissertation. Reading: The university of Reading; 1996.
154. Noble C, Corney M, Eves A, Kipps M, Lumbers M. School meals: Primary schoolchildren's perceptions of the healthiness of foods served at school and their preferences for these foods. *Health Educ J* 2001;60:102-119.
155. Svensson E. Application of a rank-invariant method to evaluate reliability of ordered categorical assessments. *J Epidemiol Biostat* 1998;3:403-409.
156. Resnicow K, Reinhardt J. What do children know about fat, fiber and cholesterol? A survey of 5,116 primary and secondary school students. *J Nutr Educ* 1991;23:65-71.
157. Cremer SA, Kessler LG. The fat and fiber content of foods: What Americans know. *J Nutr Educ* 1992;24:149-152.
158. Williams HM, Woodward DR, Ball PJ, Cumming FJ, Hornsby H, Boon JA. Food perceptions and food consumption among Tasmanian high school students. *Aust J Nutr Diet* 1993;50:154-161.
159. Gibson EL, Wardle J, Watts CJ. Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite* 1998;31:205-228.
160. Perron M, Endres J. Knowledge, attitudes, and dietary practices of female athletes. *J Am Diet Assoc* 1985;85(5):573-576.
161. Touliatos J, Lindholm BW, Wenberg MF, Ryan M. Family and child correlates of nutrition knowledge and dietary quality in 10-13 year olds. *J Sch Health* 1984;54:247-249.
162. Rise J, Hølund U. Prediction of sugar behaviour. *Community Dent Health* 1990;7:267-272.
163. Edlund B. Dieting in Swedish children and adolescents (Doctoral dissertation, Uppsala University, 1997). Uppsala: Acta Universitatis Upsaliensis; 1997.
164. Contento IR, Michela JL, Williams SS. Adolescent food choice criteria: Role of weight and dieting status. *Appetite* 1995;25:51-76.
165. Barker M, Robinson S, Wilman C, Barker DJP. Behaviour, body composition and diet in adolescent girls. *Appetite* 2000;35:161-170.
166. Shepherd R. Factors influencing food preferences and choice. In: Shepherd R, editor. *Handbook of the psychophysiology of human eating*. Chichester: John Wiley&Sons Ltd; 1989. p. 3-24.

REFERENCES

167. Conner M, Martin E, Silverdale N, Grogan S. Dieting in adolescence: An application of the theory of planned behaviour. *Br J Health Psych* 1996;1:315-325.
168. De Vries H, Backbier E, Kok G, Dijkstra M. The impact of social influences in the context of attitude, self-efficacy, intention, and previous behavior as predictors of smoking onset. *J Appl Soc Psych* 1995;25:237-257.
169. Grube JW, Morgan M, McGree ST. Attitudes and normative beliefs as predictors of smoking intentions and behaviours: a test of three models. *Br J Soc Psychol* 1986;25:81-93.
170. Feunekes G. Food, fat, family and friends: studies on the impact of the social environment on dietary intake (Doctoral dissertation, Wageningen Agricultural University, 1996). Wageningen: Ponsen&Looijen; 1996.
171. Moore DC. Body image and eating behavior in adolescent boys. *Am J Dis Child* 1990;144:475-479.
172. Wesslén A. Teenagers and food. The impact of culture and gender on attitudes towards food (Licentiate thesis, Uppsala University, 2000). Uppsala: Uppsala University; 2000.
173. Contento I, Balch G, Bronner Y, Paige D, Gross S, Bisignani L, et al. The effectiveness of nutrition education and implications for nutrition education policy, programs, and research: a review of research. *J Nutr Educ* 1995;27:277-422.
174. Evans MG. The problem of analyzing multiplicative composites. *Am Psychol* 1991;46:6-15.
175. Conner M, Sparks P. Ambivalence and attitudes. In: Stroebe W, Hewstone M, editors. *European Review of Social Psychology*. Chichester, New York: John Wiley & Sons Ltd.; 2002.
176. Ouellette JA, Wood W. Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychol Bull* 1998;124(1):54-74.
177. Ronis DL, Yates JF, Kirscht JP. Attitudes, decisions, and habits as determinants of repeated behavior. In: Pratkanis AR, Breckler SJ, Greenwald AG, editors. *Attitude structure and function*. Hillsdale: Erlbaum; 1989. p. 213-239.
178. Becker W, Gibney M, Kearney J, Serra-Majen L, Wisenman M. Food based dietary guidelines - a staged approach. Conclusions. *Br J Nutr* 1999;81(Suppl 2):S153.
179. Fisher JO, Birch LL. Fat preferences and fat consumption of 3- to 5-year-old children are related to parental adiposity. *J Am Diet Assoc* 1995;95:759-764.
180. Ricketts CD. Fat preferences, dietary fat intake and body composition in children. *Eur J Clin Nutr* 1997;51:778-781.
181. Birch L. Children's preferences for high-fat foods. *Nutr Rev* 1992;50:249-255.
182. Tonstad S, Sivertsen M. Food dislikes and dietary intake in children with familial hypercholesterolemia and controls. *Scand J Nutr* 1996;40:146-150.

REFERENCES

183. Laitinen JH, Tuorila HM, Uusitupa MI. Changes in hedonic responses to sweet and fat in recently diagnosed non-insulin-dependent diabetic patients during diet therapy. *Eur J Clin Nutr* 1991;45:393-400.
184. Shepherd R, Sparks P, Bellier S, Raats M. The effects of information on sensory ratings and preferences; The importance of attitudes. *Food Qual Prefer* 1991/92;3:147-155.
185. Westcombe A, Wardle J. Influence of relative fat content information on responses to three foods. *Appetite* 1997;28:49-62.
186. Kähkönen P, Tuorila H, Rita H. How information enhances acceptability of a low fat spread. *Food Qual Prefer* 1996;7:87-94.
187. Engell D, Bordi P, Borja M, Lambert C, Rolls B. Effects of information about fat content on food preferences in pre-adolescent children. *Appetite* 1998;30:269-282.
188. Aaron JJ, Mela DJ, Evans RE. The influences of attitudes, beliefs and label information on perceptions of reduced-fat spread. *Appetite* 1994;22:25-37.
189. Olson RE. Is it wise to restrict fat in diets of children? *J Am Diet Assoc* 2000;100:28-32.
190. Satter E. A moderate view on fat restriction for young children. *J Am Diet Assoc* 2000;100:32-36.
191. Lifshitz F, Tarim O. Consideration about dietary fat restrictions for children. *J Nutr* 1996;126(Suppl.4):1031S-1041S.
192. Zlotkin SH. A review of the Canadian "Nutrition recommendations update: Dietary fat and children". *J Nutr* 1996;126:1022S-1027S.
193. Dwyer J. Should dietary fat recommendations for children be changed? *J Am Diet Assoc* 2000;100:36-37.
194. Krebs NF, Johnson SL. Guidelines for healthy children: Promoting eating, moving, and common sense. *J Am Diet Assoc* 2000;100:37-39.
195. Lytle LA. In defense of a low-fat diet for healthy children. *J Am Diet Assoc* 2000;100:39-41.
196. Van Horn L. Primary prevention of cardiovascular disease starts in childhood. *J Am Diet Assoc* 2000;100:41-42.
197. Giovannini M, Agostoni C, Gianni M, Bernado L, Riva E. Adolescence: macronutrient needs. *Eur J Clin Nutr* 2000;54:S7-S10.
198. Bier DM, Lauer RM, Simell O. Fat intake during childhood, Summary. *Am J Clin Nutr* 2000;72(suppl.):1410S-1413S.
199. Samuelson G, Bratteby LE, Mohsen R, Vessby B. Dietary fat intake in adolescents: inverse relationships between the estimated intake of saturated fatty acids and serum cholesterol. *Br J Nutr* 2001;85:333-341.
200. Smedman AEM, Gustafsson I-B, Berglund LGT, Vessby BOH. Pentadecanoic acid in serum as a marker for intake of milk fat: relations between intake of milk fat and metabolic risk factors. *Am J Clin Nutr* 1999;69:22-29.

REFERENCES

201. Oliveria SA, Ellison RC, Moore LL, Gillman MW, Garrhie EJ, Singer MR. Parent-child relationships in nutrient intake: the Framingham children's study. *Am J Clin Nutr* 1992;56:593-598.
202. Feunekes GI, Stafleu A, de Graaf C, van Staveren WA. Family resemblance in fat intake in the Netherlands. *Eur J Clin Nutr* 1997;51:793-799.
203. Virta-Autio P, Virtanen SM, Räsänen L, Aro A, Tuomilehto J, Åkerblom HK, et al. Changes in milk and fat choices of nondiabetic siblings of newly diagnosed diabetic children: A two-year prospective study. *J Nutr Educ* 1996;28:272-278.
204. Lau RR, Quadrel MJ, Hartman KA. Development and change of young adults' preventive health beliefs and behavior: influence from parents and peers. *J Health Soc Beh* 1990;31:240-259.
205. Stafleu A, Van Staveren WA, De Graaf C, Burema J, Hautvast JG. Family resemblance in energy, fat, and cholesterol intake: A study among three generations of women. *Prev Med* 1994;23:474-80.
206. Stafleu A, Van Staveren WA, De Graaf C, Burema J, Hautvast JG. Family resemblance in beliefs, attitudes and intentions towards consumption of 20 foods; A study among three generations of women. *Appetite* 1995;25:201-6.
207. Stafleu A, Van Staveren WA, De Graaf C, Burema J, Hautvast JG. Nutrition knowledge and attitudes towards high-fat foods and low-fat alternatives in three generations of women. *Eur J Clin Nutr* 1996;50:33-41.
208. Borah-Giddens J, Falcigla GA. A meta-analysis of the relationship in food preferences between parents and children. *J Nutr Educ* 1993;25:102-107.
209. Rozin P. Towards a psychology of food choice. Bruxelles: Institut Danone; 1998.
210. Feunekes GIJ, de Graaf C, Meyboom S, van Staveren WA. Food choice and fat intake of adolescents and adults: associations of intakes within social networks. *Prev Med* 1998;27:645-656.
211. Woodward DR, Boon JA, Cumming FJ, Ball PJ, Williams HM, Hornsby H. Adolescents' reported usage of selected foods in relation to their perceptions and social norms for those foods. *Appetite* 1996;27:109-117.
212. Chapman G, Maclean H. "Junk food" and "healthy food": Meanings of food in adolescent women's culture. *J Nutr Educ* 1993;25:108-113.
213. Wardle J. Parental influences on children's diets. *Proc Nutr Soc* 1995;54:747-758.