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EVALUATION OF FOOD CHOICE BEHAVIOR: DEVELOPMENT AND VALIDATION OF HEALTH AND TASTE ATTITUDE SCALES

Katariina Roininen

ACADEMIC DISSERTATION

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Custos

Professor Lea Hyvönen
Department of Food Technology
University of Helsinki
Helsinki, Finland

Supervisor

Professor Hely Tuorila
Department of Food Technology
University of Helsinki
Helsinki, Finland

Reviewers

Dr. Patricia Pliner,
Department of Psychology
University of Toronto
Mississauga, Ontario, Canada

and

Professor Leena Räsänen
Department of Applied Chemistry and Microbiology
University of Helsinki
Helsinki, Finland

Opponent

Docent Raimo Lappalainen
Department of Psychology
University of Tampere
Tampere, Finland

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ABSTRACT

Attitude scales that purely concentrate on measuring health-, taste-, and sensory-related attitudes in the food choice process have not been available. There has however, been a need for scales that can be used, for example, in monitoring long term nutrition-related attitudes or for consumer segmentation in product development. These Health and Taste Attitude Scales (HTAS) were developed and validated to meet this need.

The development of Health and Taste Attitude Scales was started by using an adapted laddering technique to identify the ways consumers perceive the health and hedonic aspects of foods. This information, along with previous research, was used in statement generation. In the final testing phase, 37 health-related and 34 taste-related statements were tested using a nationally representative sample of the Finnish population (n=1005). Statements were rated on seven-point scales with the categories ranging from “disagree strongly” to “agree strongly”. Likert type summated scales were constructed using factor and reliability analysis. The predictive and cross-national validity of the HTAS was tested using Finnish (n=1005, II; n=144, III; n=467, IV), British (n=361, IV) and Dutch (n=477, IV) respondents. The final form of the HTAS consists of 20 health-related statements on 3 sub-scales (*General health interest*, *Light product interest* and *Natural product interest*) and 18 taste-related statements on 3 sub-scales (*Craving for sweet foods*, *Using food as a reward* and *Pleasure*).

The reliabilities of the HTAS sub-scales were mainly measured by using Cronbach’s alpha coefficient. Coefficients varied from 0.63 to 0.89 among Finnish respondents (II–IV), from 0.39 to 0.84 among British respondents (IV) and from 0.54 to 0.80 among Dutch respondents (IV). The predictive validity of the scales was mainly tested using reported choices and frequency of use and in one study using direct observation of behavior. However, these different types of measures gave similar results. On the basis of testing, all “Health” and two “Taste” sub-scales (*Craving for sweet foods* and *Using food as a reward*) proved to be good tools for characterizing national and cross-national attitudes among consumers.

PREFACE

This study was carried out in the Department of food Technology in the University of Helsinki. My supervisor Professor Hely Tuorila guided me to sensory analysis and food attitude studies already during my undergraduate studies. I greatly appreciate her guidance and support in planning, conducting and reporting all the studies. It was invaluable. I would like to express my deepest gratitude to her. Dr. Liisa Lähteenmäki while working at the University had enormous contribution in the beginning of my studies and in the preparation of my first two papers. I am very grateful for all her support and advice she has given to me during these years. I sincerely thank Professor Lea Hyvönen for placing excellent facilities for carrying out my research. I also want to thank for her support during these years.

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Helsinki, April 2001

Katariina Roininen

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original articles, which are referred to by their Roman numbers I–IV.

I Roininen, K., Lähteenmäki, L. & Tuorila, H. 2000. An application of means-end chain approach to consumers' orientation to health and hedonic characteristics of foods.
Ecol. food Nutr. 39: 61–81.

II Roininen, K., Lähteenmäki, L. & Tuorila, H.1999. Quantification of consumer attitudes to health and hedonic characteristics of foods. Appetite 33: 71–88.

III Roininen, K. & Tuorila H. 1999. Health and taste attitudes in the prediction of use frequency and choice between less healthy and more healthy snacks. Food Qual. Pref. 10: 357–365.

IV Roininen K., Tuorila, H., Zandstra, E.H., De Graaf C., Vehkalahti, K., Stubenitsky, K. & Mela D.J. Differences in health and taste attitudes and reported behavior among Finnish, Dutch and British consumers: a cross-national validation of health and taste attitude scales (HTAS). Appetite (provisionally accepted).

INTRODUCTION

Although health authorities in many Western countries have tried to reduce the gap between dietary recommendations and actual food consumption, high intake of fat (especially saturated fat) and high salt intake coupled with low consumption of fruit and vegetables are still major problems in Western countries in general, and in some population segments inparticular (Kennedy et al., 1996; Nordic Nutrition Recommendations, 1996; Lahti-Koski, 1999). One reason for the discrepancy between recommendations and the actual food consumed might be that, although people are aware that the general population is advised to change their diets towards a more healthy and balanced direction, they do not see this advice as personally relevant for them (Lappalainen et al., 1998). This may be due to their seeing their diet as healthy enough and, for example, low in fat (Lloyd et al., 1993) and seeing themselves as consuming less "unhealthy" food than do other people of the same sex and age. This suggests that many people are unrealistically optimistic concerning diet-related health risks (Sparks et al., 1995). Although, the gap between recommendations and actual consumption has not been closed, effective nutrition counseling has influenced food production and marketing. This has led to a trend to produce foods that are nutritionally modified, such as fat-, sugar- or sodium-reduced products (Kähkönen, 2000).

What about the consumers' attitudes? Are the attitudes positive towards "healthy" eating patterns? What happens to the perceived importance of the taste of food when nutritional aspects become increasingly important? Many researchers have investigated attitudes towards different types of foods, including high-fat (Tuorila, 1987; Tuorila & Pangborn, 1988; Stafleu et al., 1994) or fruit and vegetables (Brug et al., 1995). In all of these studies, the strong predictive power of attitudes and beliefs was found to have an effect on consumption of different types of foods. However, only few studies consider overall attitudes toward healthy eating patterns (Axelson & Penfield, 1983; Steptoe et al., 1995). Instruments that can be used for monitoring changes in food related attitudes (e.g. in response to nutrition education or importance of taste of foods), are helpful for both nutrition and for product marketing education. The literature review of the present thesis concentrates on food- related attitudes and different attitude measurements in Western, industrialized countries. The aim of this thesis is to develop scales that can be used for verbally measuring attitudes towards health and taste and to test validity of these scales nationally and cross-nationally.

LITERATURE REVIEW

Food choice

Food choice is a complex process which involves many different factors. The many attempts made to illustrate the factors influencing this process have resulted in many qualitative food choice models. Pilgrim (1957) advanced the model in which internal (physiological factors of the individual together with external factors) attitudes affect perception of the sensory characteristic of foods. Shepherd (1985) developed the model which includes three factors related to choice: (1) food: its physical properties and nutrient content, (2) the individual: his/her previous experience and learning associated with foods, which in turn will lead to different beliefs, values and habits, (3) social-economic environment: attitudes to sensory properties of food or healthiness of food. One example of a more recent model of food choice is the conceptual model of food choice developed by Furst et al. (1996). It has three main components: (1) life course: person's experiences, (2) influences: ideals, personal factors, resources, social framework and food context, and (3) personal system of strategies for making choices and value negotiations: sensory perceptions, monetary considerations, convenience, health and nutrition, management of relationships and quality. These different factors affecting food choice could be integrated by investigating personal attitudes and beliefs (Shepherd, 1989). Attitudes toward health- and taste-related factors are the central focus of this thesis. Of particular interest is the development of scales that can be easily used for measuring the importance of health and taste aspects in food choice.

The relative importance of the different factors influencing food choice can be determined by using relationships between attitudes, beliefs, subjective norms and intentions (Shepherd & Sparks, 1994). These types of quantitative food choice models include the theory of reasoned action (TRA) developed by Fishbein & Ajzen (1975) and Ajzen & Fishbein (1980), and the extension of this model, the theory of planned behavior (TPB) formulated by Ajzen (1988). Within the theory of reasoned action (TRA), an individual's decision to act in a certain way can be determined from his/her own attitude towards the behavior as good or bad and whether people important to him/her support the behavior. The attitude to the behavior is in turn predicted by the sum of beliefs about the outcomes of the behavior. The TPB extends the behavior covered by the TRA to behaviors that are not totally under the individual's control. The theory of

reasoned action has been applied successfully to the study of food related-attitudes and beliefs to the consumption of several high-fat foods (Shepherd & Stockley, 1985, 1987; Tuorila & Pangborn, 1988; Towler & Shepherd, 1992), high-fat foods and their low-fat alternatives (Stafleu et al., 1994), 20 different foods (Stafleu et al., 1995), and sweet snacks (Grogan et al., 1997).

Attitudes

Eagly & Chaiken (1993) named attitude as one of numerous implicit states or dispositions constructed by psychologists to explain why people react in certain ways in the presence of certain stimuli. According to Eagly & Chaiken (1993) an individual does not have an attitude unless he or she responds evaluatively to an entity on an affective, cognitive, or behavioral basis. An evaluative response can then produce a psychological tendency to respond with a particular degree of evaluation toward an attitude object. An attitude toward the object has been formed after this tendency to respond has been established. Eagly & Chaiken (1993) argued against a common definition of attitudes as acquired or learned. In their view this idea of attitudes as learned should not be included in the definition of the attitude construct. Instead they believe that a definition of attitude should allow for the possibility that some attitudes are unlearned because they derive at least partially from a biological base.

Social psychology has many definitions for attitude concept. Ajzen (1988) describes attitude as a disposition to respond favorably or unfavorably to an object, person, institution or event. Within consumer and food studies, attitude objects are often attributes such as fat, odor, texture or defined brands, or general product categories such as seafood or meat (Olsen, 1999). Eagly & Chaiken (1993) in turn defined attitude as a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor. They also agree with the multi-component definition of attitude advanced by e.g. Rosenberg & Hovland (1960). This conceptualization suggested that attitudes have three components: a) cognitive, which represents a person's information or beliefs about the object; b) affective, which deals with a person's feelings of like or dislike towards the object and c) conative or behavioral, which refers to a person's tendency to behave in a certain way towards the object.

Sims (1981) studied nutrition-related attitudes. She described a theoretical distinction between attitudes and beliefs using a scale labeled affective on the one end and cognitive on the other. Attitudes would be placed closer to the

affective end of the scale while beliefs would lie towards the fact or cognition end. Sims (1981) further illustrated the distinction between attitudes and beliefs by stating that when the clear distinction between rightness-wrongness, correctness-incorrectness, probability-improbability can not be obtained, and evaluations are simply based upon the individual's feelings towards the object, then the investigator is dealing with attitudes. Moreover, Cantin & Dubé (1999) stated that the cognitive component of attitude contains the attributes and beliefs (such as beliefs about its nutritional value and convenience) about the attitude object, whereas the affective component contains emotions, feelings and sensations towards the attitude object.

Attitudes have sometimes been confused with the concept of personality trait in food-related attitude studies (Meiselman et al., 1999). There are some differences and some similarities between these two concepts. Like attitude, personality trait is a hypothetical construct that can not be assessed by direct observation; it must be inferred from measurable responses. Attitudes differ from traits in the nature of responses. In the case of attitudes, these responses are evaluative and they are directed to some object or target, for example a person, institution, policy or event. Personality traits are not necessarily evaluative and they focus on the individual him- or herself and not on any particular external target as attitudes do. These responses can be used to differentiate between individuals and to classify different personality types (Ajzen, 1988). Moreover, attitudes, especially attitudes that are unimportant for the individual, are viewed as more changeable than traits (Eagly & Chaiken, 1993). In addition, attitudes are evaluative by nature and these evaluations can change when new information about the object comes available. Personality traits are more resistant to transformation because they characterize an individual (Ajzen, 1988).

Attitude measurements

Attitudes can not be directly observed, but their existence can be inferred from overt responses or indicators (Eagly & Chaiken, 1993). Because attitudes can be considered as evaluative tendencies, they can be expressed in terms of affective responses such as feelings and emotions, and can be measured through physiological responses that may be linked to emotional processes. Likert (1932) argued that attitudes are most easily detected and expressed in verbal form. Thus, another way for attitude measurement is to use self-report

questionnaires such as those constructed by Likert scaling or by the attitudes model proposed by Fishbein & Ajzen (1975) and Ajzen & Fishbein (1980).

Observing physiological reactions over which people presumably have no control is preferable to self-reports of attitudes if one is to avoid response distortions (for instance, to answering in a way that will obtain social approval or avoid social disapproval, and consequently shading or coloring responses) (Dawes & Smith, 1985). These physiological responses can be measured by using the galvanic skin response (GSR). It detects sweat secretions, which are often a response to stress or emotionalism. Another type of physiological measure of attitudes is pupillary response. It measures dilation of the eye pupils by positive stimuli or constriction by negative stimuli. However, these measures do not only reflect emotionalism, but also surprise, change, novelty, inconsistency or the unexpected, and are thus not reliable measures of attitude (Dawes & Smith, 1985; Eagly & Chaiken, 1993).

One type of self-report attitude questionnaire is the Likert type of verbal response. This is usually measured using summated scales, in which several items are joined in composite measure to represent the concept under investigation. Items with a high correlation on a certain factor are combined to form a new variable using the average score of the items. The benefit of using summated scales is a reduction in the measurement error that might occur in a single question. Furthermore, summated scales give the possibility of representing the multiple aspects of a concept in a single measure (Hair et al., 1998). This technique was developed by Likert (1932), who wanted to develop a technique that was quick but still valid. According to Eagly & Chaiken (1993), Likert accomplished his goal of developing a reliable and valid attitude scaling method. However, in a Likert scaling, a good scale construction needs careful pretesting of items, item analyses and item reduction, which in turn are time-consuming features. Likert items are written and selected so that an agreement with the item represents either a favorable or unfavorable attitude towards the object. Likert scales rely on a person's affective response towards a specific attitude object. Thus, the investigator must employ a different scale, consisting of different items for each attitude object (Sims, 1981). The items are rated in Likert's original approach on 5-point scales ranging from "strongly disagree" to "strongly agree". Additional variations of the Likert procedures can have more or less than five categories on the scale (Eagly & Chaiken, 1993).

Validity of attitude measurements

When attitudes are measured, using either Likert scaling or any other type of attitude measurement, the investigator must establish the validity of the instruments (Sims, 1981). The term validity denotes the degree to which a measuring instrument actually and accurately measures the construct which it is intended to measure. The validity of an instrument can not be proved purely by appeal to authority, deduction from a psychological theory or mathematical proof. Moreover, validity usually is a matter of degree rather than an all-or-none property, and validation is an unending process (Nunnally & Bernstein, 1994). Nunnally & Bernstein (1994) go on to discuss that one validates the use to which a measuring instrument is put rather than the instrument itself. Many measures are valid for one purpose but not another.

Validity has three major meanings: (1) content validity: sampling from a pool of required content, (2) construct validity: measuring psychological attributes, and (3) predictive validity: establishing a statistical relationship with particular criterion (Nunnally & Bernstein, 1994). However, many different terms have been used in literature to describe the three types of validity. Nunnally & Bernstein (1994) stated that content validity has been referred to as “intrinsic validity”, “circular validity”, “relevance”, “representativeness” and “face validity”; construct validity has been referred to as “trait validity” and “factorial validity”; and predictive validity has been described as “empirical validity”, “statistical validity” and “criterion-related” validity. Nunnally & Bernstein (1994) argued that the term “face validity” should not be confused with content validity. Face validity concerns judgements about items after an instrument is constructed, whereas content validity is a formulated plan for test construction before the test is actually constructed. Moreover, face validity is the extent to which the test taker or person who has been trained to look at validity feels that the instrument measures what it is supposed to measure.

Creating a summated scale is always guided by the conceptual definition specifying the type and character of the items that are candidates for inclusion in the scale (Hair et al., 1998). Content validity is the assessment of the correspondence of the variables to be included in a summated scale and the conceptual definition of assessment. The objective is to ensure that the selection of scale items extends beyond empirical issues to include theoretical and practical considerations (Hair, et al., 1998). Nunnally & Bernstein (1994) stated that there is no mathematical proof for a content validity of a measuring instrument; rather it is largely based upon opinions of various users.

Construct validity is evaluated by investigating the qualities the measures possess, i.e., by determining the degree to which certain explanatory concepts or constructs account for performance on the test. Factor analysis is one statistical tool which is useful in establishing the construct validity of an attitude-measuring instrument because this technique can identify the basic dimensions underlying a domain of responses (Sims, 1981). Construct validity is an ongoing process that is based on theory. That is, either on the basis of a specific theory or more general assumptions about attitudes, a valid measure of the underlying attitude should enter into certain relationships and not into other relationships. Thus, the construct validity of a scale is determined by certain theoretically based predictions about how the scale should behave in relation to other measures of the same construct and other constructs (Eagly & Chaiken,1993). Construct validity is composed of convergent and divergent validity (Nunnally & Bernstein, 1994). Convergent validity is the degree to which two measures that are designed to measure same construct actually are related. If two different measures of the same construct have a high correlation, then a convergent validity exists, suggesting that two independent measures lead to similar ends. When the scale has a divergent validity, it measures something different than other measures of similar but conceptually different constructs. Low correlations between these measures is evidence of divergent validity (Bearden et al., 1993; Nunnally & Bernstein, 1994).

Predictive validity measures how well an instrument predicts future behavior (Talmage & Rasher, 1981). Predictive validity concerns the use of an instrument to estimate some criterion behavior that is external to the measuring instrument itself. Some refer to predictive validity as criterion-related validity, which defines the processes involved well (Nunnally & Bernstein, 1994). When the criterion-related validity of an attitude instruments is measured, a good criterion for a measure should be used. In some of the cases, attitude instrument are created to predict some aspect of behavior, such as purchases of a particular product. In these cases, validity is determined by whether the measure predicts this particular behavior (Eagly & Chaiken, 1993).

Reliability of attitude measurements

The “ideal” measurement instrument is relatively free of measurement errors, meaning reproducibility of the same score upon repeated administrations. However, all measuring instruments have errors associated with them. An error can arise from the instrument itself, the administration, scoring, mental and physical

state of the individual filling out the questionnaire, and from distractions in the physical environment. The reliability coefficient is a mathematical estimate of the degree to which an instrument is free from measurement error (Talmage & Rasher, 1981). There are two types of reliability: (1) test-retest reliability, meaning correlation between the same person's score of the same measure at two different points of time, and (2) internal consistency reliability, meaning correlation among items in the scale (Bearden et al., 1993). According to Eagly & Chaiken (1993), Cronbach's alpha (α) (Nunnally & Bernstein, 1994) is the current standard estimate for the internal consistency reliability of a scale composed of multiple items. Alpha is an estimate of the degree to which items on the scale form a homogeneous measure, meaning good intercorrelation with each other.The lowest limit of acceptability of reliability is 0.60 to 0.70 (Hair et al., 1998). When measuring alpha, one must take into account that the measures are a function of the number of items on the scale; thus, high alphas can be obtained when the number of items is large enough. Furthermore, the traditional Cronbach's α underestimates true reliability when its assumptions (for example, one-dimensionality and internal consistency) are violated, while Tarkkonen's (1987) more general method is more appropriate in the context of factor analysis, taking into account the multidimensional structure of measurement (Vehkalahti, 2000).

Food related attitudes

Health attitudes

Extensive nutrition education campaigns in many Western countries during the last few decades have tried to reduce the gap between dietary recommendations and quality of diet. Moreover, many Western populations have been exposed to information about fat in relation to cardiovascular diseases and obesity. Even though fat consumption among Finns in the1990s has still been observed to be too high and carbohydrate and fibre consumption too low compared to national dietary guidelines (Roos et al., 1996; Lahti-Koski, 1998), nevertheless, during the last three decades mortality from circulatory diseases has decreased remarkably in Finland. However, cardiovascular disease still remains the most common cause of death accounting for almost half of all deaths in Finland (National Public Health Institute/Department of Nutrition, 2001). As a result, many studies have tried to explore reasons why this gap still exists and whether there are differ-

ences in health beliefs behavior and beliefs concerning diet health link between different demographic groups (Wardle & Steptoe, 1991; Steptoe & Wardle, 1992; Stafleu et al., 1995; Wardle et al., 1997; Rozin et al., 1999).

Although there still exists a gap between dietary recommendations and actual food use on a general population level in many Western countries, many studies conducted in Europe or in the United States in the late twentieth century have shown health-related attitudes to be an important factor affecting food choice (Hayes & Ross,1987; Tuorila & Pangborn, 1988; Towler & Shepherd,1992; Richardson et al., 1993; Wardle, 1993; Steptoe et al., 1995; Tuorila, 1997; Lindeman & Stark, 1999). Towler & Shepherd (1992) assessed the attitudes of over 15-year-old UK respondents towards the consumption of meat, meat products, dairy products and fried foods. They found that taste and health beliefs were more closely related to attitudes towards consumption of these food than were other beliefs such as convenience and price. Richardson et al. (1993) found in a survey of 1018 UK adult residents that attitudes toward healthiness, taste, value for money and, to some extent, ethical issues were related to meat consumption. Lindeman & Stark (1999) observed in study of young and middle-aged Finnish females' food choice motives that health was the most important motive of food choice, before pleasure, ideological reasons and weight control. However, it is well known that health is not the only factor affecting food choice, nor is it the only important factor affecting food choice. However, the discrepancy between dietary recommendations and actual food consumption, and the influence of health on food choice, make health-related attitudes a very interesting subject to study.

The reasons for a healthy diet may be different among different people. One can choose a healthy diet for many reasons, among them, to prevent chronic diseases, to reduce weight or for ideological reasons. Rappaport et al. (1992) found that health reasons for eating certain foods consisted of maintaining health and energy, preventing disease or achieving excellent health. Zunft et al. (1997) in the study of perceived benefits from healthy eating conducted in 15 member states of the European Union, found that five out of the nine benefits listed were relevant for approximately half of the population. Those benefits were: stay healthy (66%), prevent disease (66%), control weight (53%), be fit (53%) and quality of life (45%). Goode et al. (1995) found that in Great Britain the most frequently cited reasons for a change in diet were: concern with reducing weight, increased knowledge of healthy diet, new kinds of foods or dishes, or help for a particular health problem. According to Rozin (1997) the same behavior can be

internalized in one person and performed in compliance with another. For example, a compliant vegetarian believes that avoiding meat is healthy but she/he likes the aroma of it and is tempted to eat it. In contrast to a health-oriented vegetarian, a moral vegetarian does not eat meat because she/he does not accept killing animals for food. In addition, a moral vegetarian does not need a reason to stop eating meat, but looks for confirmation of her/his behavior.

Although many earlier studies have not found a close connection between nutrition knowledge and food intake (Shepherd & Stockley, 1987; Stafleu et al., 1996), Wardle et al. (2000) found that nutrition knowledge correlated significantly with vegetable (0.36), fruit (0.23) and fat (-0.21) intake. In addition, they demonstrated that people in the highest nutrition knowledge category were almost 25 times more likely than those in the lowest nutrition knowledge category to be eating a healthy diet which is in accordance with current dietary recommendations. However, the knowledge of different health behaviors does not have an effect on behavior if a person is not motivated to change (Moorman & Matulich, 1993). In the study of Steptoe & Wardle (1992), respondents who were aware of their low health status tried to eat healthily. Moreover, dietary fat avoidance was associated with awareness of health risks and beliefs about the importance of controlling fat intake. Wardle et al. (1997) found that healthy dietary practices such as not eating animal fat, eating fiber, eating plenty of fruit, not adding too much salt, not eating additives, eating breakfast, and not eating too much sugar, were associated with the importance of diet for health. Stafleu et al. (1995) observed that older respondents who had evaluated their health as not good considered health-related beliefs and attitudes more important than younger respondents. In accordance with these findings, Zunft et al. (1997) found that when respondents had to choose the most important benefits for themselves, the significance of these benefits was lower than when it was considered to benefit the general population. Respondents may believe that these benefits are important, but are not relevant to themselves, unless they have a nutrition-related disease.

To sum up these findings on healthy eating behavior, it seems that if a person is to eat foods that meet current dietary recommendations, he/she must believe that these recommendations are personally relevant to him-/herself, and thus be motivated to use these foods. The motivation may come from one's present state of health or one's awareness of present behavior and its impaction health in the future. If a person is motivated, then the knowledge of dietary recommendations can affect his/her behavior. The perceived benefits of healthy

eating also affect behavior but only if a person feels it is relevant for him-/herself, is motivated, and has sufficient knowledge to change his/her behavior. However, other factors such as ideological reasons (concern of ecological welfare, political values or religion) which are not related to a person's health can also change behavior into a healthy eating pattern. Healthy eating in turn may be seen as the amounts of e.g. fruit and vegetables, fat, and fibre consumed to meet current dietary recommendations. When the definitions of healthy eating were assessed in 15 member states of European Union, it was found that about half of the respondents perceived low fat consumption as part of a healthy diet and just over 40% of the respondents perceived more fruit and vegetables as well as balance and variety as definition of healthy eating (Margetts et al., 1997). Moreover, the pan-European survey respondents who believed that good health is a result of healthy eating ranked a low-fat diet (48%) the highest, followed by a balanced diet (43%), the intention to eat more fruit and vegetables (41%) and to the consumption of fresh, natural food (28%) as part a healthy diet (Zunft et al., 1997) . The factors affecting healthy eating are illustrated in Figure 1.

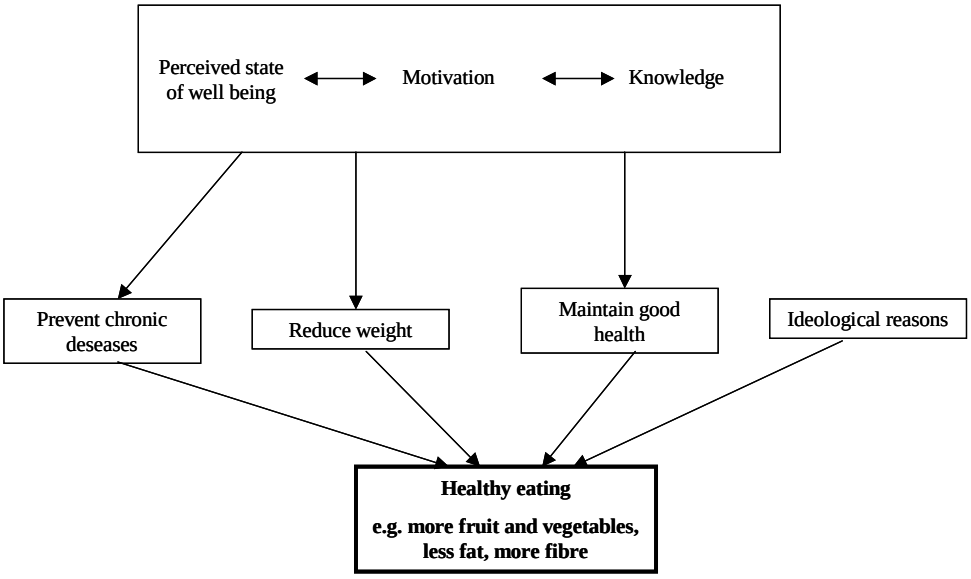

Figure 1. Factors affecting healthy eating

Taste attitudes

In addition to health, taste has also been found to be an important factor affecting food choice. Good taste has been reported as the main reason among Swedish respondents (Koivisto & Sjödén, 1996), the most important attitude factor in relation to fruit and vegetable consumption in the Netherlands (Brug et al., 1995) and an important criterion to buy a particular food in Denmark (Holm & Kildevang, 1996). Tuorila & Pangborn (1988), in their study of American female university students' attitudes towards different fat-containing foods, found enjoyment of these foods to be predominant predictor of their consumption. In addition to taste being the most important predictor of single food consumption, it has been found to be the most important factor affecting food choice overall (Steptoe et al., 1995; Martins & Pliner, 1998). Steptoe et al. (1995) found this in Great Britain using the Food Choice Questionnaire (FCQ) and Martins & Pliner (1998) in Canada using the Food Motivation Scale (FMS). Moreover, in a sample of 86 British family members, Wardle (1993) found that taste affected on food choices more than health.

The health education programs in Western countries may have affected how much people (at least in some population segments) allow good taste and pleasure to influence eating patterns. Rozin (1996) and Rozin et al. (1999) argued that among many female Americans food has become as much a poison and a source of worry as a nutrient. In the study of Lindeman & Stark (1999) Finnish female respondents who mainly appreciated the good taste of food and the pleasure of eating also felt a social pressure to be thin and beautiful and were quite dissatisfied with their appearance and weight. McFarlane & Pliner (1997) found that Canadian high school and collage-age subjects who were concerned with general nutrition were not interested in the positive taste information provided on the novel foods. The authors suggest that these subjects have adopted a concern for health and are willing to sacrifice taste for healthy food consumption.

Eating behavior scales

Several instruments that measure food-related attitudes or traits have been developed. One example of a validated instrument is the Food Neophobia scale developed by Pliner and Hobden (1992), which measures the tendency to avoid "unfamiliar" foods. They conceptualized the measurement as a trait. Respondents who had been classified as more neophobic on this scale were less willing to

taste or choose novel foods (Pliner & Hobden, 1992; Pliner et al., 1995; Pliner et al., 1998). Another scale which also measures traits, is the VARSEEK-scale. It has been developed for measuring consumers' instrinsic desire for food variety (van Trijp, 1995). The relationship between the use of foods and the Variety Seeking Tendency scale has not been studied as much as, for example, the relationship between willingness to taste novel foods and the Neophobia scale. Some relationships, however, have been observed between the variety seeking tendency and the reported use of a greater variety of cheeses (van Trijp et al., 1992). Another concept that describes food orientations is restraint eating, which relates to dieting behavior. Dietary restraint is usually considered as a tendency. Therefore it is normally treated as an attitude (Meiselman et al., 1999). Several restraint scales are available (Herman & Polivy, 1980; Stunkard & Messick, 1985; and van Strien et al., 1986). In a study of British university students' eating behavior Meiselman et al. (1999) found significant positive correlations (0.38 to 0.49) between food intake and restrained eating as measured by the Dutch Eating Behavior Questionnaire (DEBQ) (van Strien et al., 1986).

A good example of validated food choice attitude questionnaire is the Food Choice Questionnaire (FCQ), which was developed and validated by Steptoe et al. (1995). In addition to other motives related to food choice, this questionnaire assesses the importance of health and taste. The authors found sensory appeal, health, convenience and price to be the most important factors affecting food choice. Rozin et al. (1999) used a questionnaire with beliefs about the diet–health link, worry about food, the degree of using foods modified to be "healthier" (e.g. salt- or fat-reduced foods), the importance of food as a positive force in life, the tendency to associate foods with nutritional vs. culinary contexts, and satisfaction with the healthiness of one's own diet. Validated behavioral scales used to describe different dietary behaviors are shown in Table1. These scales have been chosen as good examples for measuring different types of eating behavior. However, none of these scales have focused primarily on measuring health and taste attitudes. Because our interest was to study health and taste attitudes alone, and as widely as possible, the scales mentioned above were not used in the research on health and taste attitudes in the present thesis.

Table1. Examples of verbal scales used in describing dietary or food related behavior.

Questionnaire	Target behavior	Number of items	Scale	Validity measure	Reliability	Authors
The Food Neophobia Scale	Reluctance to eat and/or to avoid novel foods	10	disagree strongly – agree strongly, 7-point	Behavioral validity	Cronbach's α=0.88	Pliner and Hobden, 1992
The Variety Seeking Tendency Scale	Person's intrinsic desire to food variety	8	completely disagree – completely agree, 5-point	Cross-validation	Cronbach's α=0.83-0.88*	van Trijp, 1995
The Restrained Eating from the Three-factor Eating Questionnaire	Tendency to restrict food intake	20	true or false, multiple choice on 4-point and 5-point scales	Exploratory factor analysis	Cronbach's α=0.92	Stunkard and Messick, 1985
The Restrained Eating Scale of the Dutch Eating Behavior Questionnaire	Tendency to restrict food intake	10	never – very often, 5-point	Behavioral validity	Cronbach's α=0.93-0.95*	van Strien et al., 1986
Nutritious – healthful attitude factor	Nutrients important in maintaining good health	5	strongly disagree – strongly agree, 5-point	Exploratory factor analysis	Cronbach's α=0.81	Axelson and Penfield, 1986
Health factor from the Food Choice Questionnaire	Diet-health link	6	not at all important – very important	Confirmatory factor analysis	Cronbach's α=0.87	Steptoe et al., 1995

*Reliability not reported by the authors. The measure is from Meiselman et al. (1999)

Effect of age and gender on food related attitudes

Many attempts have been made to address attitudes toward different foods and dietary practices. In many of these studies, females have been found to have more negative attitudes than males towards high-fat foods in the UK (Shepherd & Stockley, 1985; Towler & Shepherd, 1992) and more positive attitudes than males towards low-fat foods in the Netherlands (Stafleu et al., 1994). Among over 15-year-old European females, the percentage of energy from fat has been found to be lower (Wardle et al., 2000), and the reported fruit and vegetable intake (Fagerli & Wandel, 1999) as well as interest in avoiding fat and cholesterol, higher than in the corresponding male population (Monneuse et al., 1997). Similarly, in a study of dietary intakes of married couples in the US, it was found that when the intake was evaluated on an energy-adjusted basis, wives' intake of carbohydrate, protein, dietary fiber, vitamins and minerals was higher than their husbands' intake (Louk et al., 1999). European male students, in turn, have been more skeptical about the health benefits of certain dietary practices (such as avoiding animal fat, eating fiber, eating fruit, avoiding sugar, avoiding salt) than females (Wardle et al., 1997). A common finding of studies that have investigated food likes and dislikes has been females' great liking for vegetables and males' great liking for meat. This has been found in American subjects ranging from 14 to 68 years of age (Longue & Smith, 1986), in both younger (under 18 years) and older age groups (18 years and over) (Longue et al., 1988), and in French-Canadian adults ranging in age from 19 to 69 years (Letarte et al., 1997).

European females (age from 17 to 30 years) have also been found to have healthier behavior patters in general than males (Steptoe & Wardle, 1992) and are more likely to have and maintain better eating patterns than males (age from 18 to 30 years) (Wardle & Steptoe, 1991). European female respondents perceived that "quality/freshness", "price", "trying to eat healthy" and "family preferences" were the most important influences affecting food choice, whereas "taste" was the most frequently selected factor affecting food choice of European male respondents (Lennernäs et al., 1997). American female adults have also been found to be more willing than males to make desirable changes in their diets (Contento & Murphy, 1990). Rozin et al. (1999) found that females in all countries studied (US, Japan, Flemish Belgium and France) scored higher than males on the extent of worry about: the fattening effects of food as opposed to the savoring of food, concern of healthiness of food habits of self and others, non-culinary associations, and consumption of foods modified to be "healthier" (eg. salt- or fat-reduced foods). Furthermore, in a pan-European survey, 65% of

Finnish females (age from 35 to 54 years) believed that " weight control" is a benefit of healthy eating, compared to 47% of males of the same age (Zunft et al., 1997). McElhone et al. (1999) found in a study of 15 member states of the EU that 63% of Finnish respondents wished to lose weight while 29% were satisfied with their weight, whereas on average 54% of European respondents wanted lose weight and 39% of EU respondents were content with their weight. The percentage of Finnish respondents wishing to lose weight was almost the same as EU female respondents on average (64%).

Even in the case of children, there is a major difference in dieting interest between boys and girls. In a study of British children's (age from 11 to 18 years) concerns about weight and eating, Wardle & Marsland (1990) found that many more girls than boys indicated that they were trying to lose weight. In addition, girls scored higher than boys on the Restraint Scale of the Dutch Eating Behavior Questionnaire (DEBQ). Wardle & Beales (1986) also found a gender difference in DEBQ scores in British children (age from 12 to 17 years), suggesting higher scores for girls than boys. When attitudes towards foods were assessed, it was found that in general children knew that fattening foods were less good for them, but still liked fattening foods best. However, a gender difference was found. Girls valued slimming foods more, thought fattening and neutral foods to be less good for them and felt more guilty than boys did about eating fattening or neutral foods. Also, in a study of British schoolchildren's eating behavior, Wardle et al. (1992) found that more girls than boys rated slimming foods as better for them.

Interest in keeping the body in good shape may be one of the reasons for healthier eating habits among females than among males. In a study by Steptoe et al. (1995) British females (age from 17 to 89 years) scored higher on a health scale which consisted of items related to general nutrition and well-being and appearance. Furthermore, female's concern for appearance predicted healthy dietary choices in a study of American subjects' (age from 18 to 83 years) concern with appearance, health beliefs and eating habits (Hayes & Ross, 1987). In the study by Steptoe et al. (1995), scores on the Food Choice Questionnaire (FCQ) *weight control* scale were higher among respondents who reported that they valued health highly. Moreover, Mori et al. (1987) found American female university students restricting their food intake in order to influence their male partner's perception of their femininity. Thus, the authors suggest that females are sensitive to the way other people think they should eat in order to fulfill the standards and expectations regarding appropriate feminine behavior and appearance.

Although American females have been found to have healthier patterns of behavior in general and in healthier dietary practises than males, they also report having more cravings for food than males do (Pelchat, 1997). In a study of food choice motives among young and middle-aged Finnish females by Lindeman & Stark (1999), six food choice clusters (gourmets, indifferents, health fosterers, ideological eaters, health dieters and distressed dieters) were found. The biggest cluster was formed from respondents who were mainly motivated by the good taste of food and getting pleasure from eating. Although these females stressed the taste and pleasure of foods important in their food choice, they also felt social pressure to be thin and beautiful. Thus, it seems that females have more ambivalent attitudes towards food than males have.

Health and diet-related attitudes also vary between younger and older persons. In the Steptoe et al. (1995) study of British respondents' (age from 17 to 89 years) food choice motives, significant positive correlations were found in females between age and "health", age and an interest in using foods that contain natural ingredients, and age and "sensory appeal". These results indicate more interest in healthy dietary practices and greater importance of the taste of the food in older than younger British females. Zunft et al. (1997) found in the pan-European survey of perceived benefits of healthy eating that the highest percentage of Finnish males who believed that "to stay healthy" and "prevent disease" were the most personally significant benefits of healthy eating was in the middle age group (age from 35 to 54 years). Among Finnish females, on the other hand, the youngest group (age from 15 to 34 years) and oldest group (age 55+) believed that "to stay healthy" and "prevent disease" were the most personally significant benefits of healthy eating.

Contento & Murphy (1990) found significant positive correlations between the "self-change" variable and age (0.22) and gender (0.28). Older American participants seemed to be more likely to make desirable changes in their diets than were younger participants and females were more likely to make changes than males. Moreover, in the US a higher age was significantly associated with good eating habits (Hayes & Ross, 1987), and healthier food choices also in the US (Hunt et al., 1997), and in Ireland with positive attitudes to fiber (Barker et al., 1995). In the pan-European survey, older EU respondents age from 35 to 55 and 55+ selected "trying to eat healthy" more frequently than younger respondents (age from 15 to 34 years) as one of the important factors affecting their food choice. Younger respondents in turn selected "taste"more frequently than older respondents as one of the important factors affecting their food choice (Lennernäs, et al., 1997).

Stafleu et al. (1994) did not find any significant difference between attitudes towards fat among age groups in the Netherlands. However, they found a difference among age groups in fat intake, with a significantly higher fat intake among younger respondents (age from 18 to 35 years) than among older respondents (age from 35 to 55 years). Although, young respondents have generally been found to have unhealthier eating patterns than older respondents, in the UK, US, and in the Netherlands, Betts et al. (1995) found that 18 to 24-year-old respondents in the US considered health and nutrition aspects important when choosing foods. Moreover, in a study by Betts et al. (1997) 18 to 24-year-old respondents had strong positive perceptions about the healthiness of food and strong negative perceptions about food as fattening. However, the correlations between the views about food as healthy or fattening and the frequency of food consumption tended to be relatively weak, but in many cases statistically significant.

Whereas in the US elderly respondents (65 years or older) have generally shown more interest in healthy dietary practices, young respondents (age from 18 to 35 years) are more likely than elderly respondents to report at least one craving (Pelchat, 1997). Craving has been defined by Pelchat (1997) and Pelchat & Schaefer (2000) as an intense desire or longing to eat a particular food. In the study of monotony and food cravings in young and elderly adults, Pelchat & Schaefer (2000) found that young adults reported more cravings during the monotony period as compared to the baseline period, whereas elderly men reported having almost no cravings at any time of the study. Elderly women had as many food cravings as young adults during the baseline period, but the monotony period did not increase the amount of cravings.

AIM OF THE STUDY

The studies described in this thesis focus on the definition of healthy and pleasure-giving eating (I), developing scales that can be used for verbally measuring these concepts, and testing the preliminary validity of these scales (II). Studies III and IV concentrate on establishing the predictive and cross-national validity of these instruments by examining the relationships between attitudes observed by these scales and actual (III) and reported behavior of respondents (III and IV).

The aims of the studies have been presented in detail in original publications (I–IV). The aims of the experiments on a general level were:

- to define the construct underlying healthy and pleasure-related eating (I)
- to develop attitude scales for measuring an individual's degree of interest in health and taste aspects of eating (II)
- to validate these scales nationally (II–III) and cross-nationally (IV)
- to measure the health and taste attitudes between genders, and in different age groups and nationalities (II–IV)

SUBJECTS AND METHODS

General description of the studies

The development of Health and Taste Attitude Scales (HTAS) was started by using an adapted laddering technique (I) to identify the way consumers perceive health and hedonic aspects of foods. Health and taste attitude statements were generated in study II. The three health dimensions and the three taste dimensions were formed on the basis of statement generation. These dimensions were based on the results of study I along with previous research relating to the importance of health and taste in food choice. After the scales were constructed, the preliminary predictive validity of the HTAS was tested in study II and the testing of the predictive validity of HTAS was continued in study III. Cross-national validation of HTAS was done in study IV.

Data description and subjects

A summary of subjects, data collection methods and scales used in the studies is presented in Table 2. Respondents in study I were staff from two Finnish companies and staff and students from the University of Helsinki (age from 23 to 64 years). Data for study II were collected by a nationwide marketing research agency (MDC Food & Farm Facts, Helsinki) from respondents who regularly answer research questionnaires in their homes and submit their data using a personal computer and a modem provided by the agency. In study II the respondents were representative of the Finnish population (age from 18 to 81 years). Respondents in study III were staff from the main post-office of Helsinki and from a construction site nearby and staff and students from the Faculty of Agriculture and Forestry at the University of Helsinki, (age from 15 to 60 years). The data for study IV were collected by a local marketing research agency (Taloustutkimus Oy, Helsinki) in Finland and by employees from the Institute of Food Research (IFR) in Great Britain. The data were collected in both countries using postal surveys, while in the Netherlands respondents were invited to come to the research agency (OP&P Product Research, Utrecht). In study IV we initially aimed to get three distinct age groups (18–25, 35–45 and 65–75 years) in each country. However, this could not be accomplished in GB. Therefore, due to the different sample sizes in age groups and no effect of age on the main variables, we decided to use all respondents from 18 to 75 years of age in each country.

Table 2. General description of the studies.

Study	Subjects n	female %	male %	mean age, years	Data collection methods	Scales
I	47	57	43	38	Semi-structured interview using modified Laddering method.	–
II	1005	53	47	44	Questionnaires filled out at respondents homes. Data was submitted using personal computers with a modem.	Health and taste attitude statements, healthiness, pleasantness of 17 foods and 'paper and pencil' choices of 13 food pairs
III	144	63	37	32	Questionnaires filled out at the main post-office canteen or at the sensory laboratory at the University.	HTAS, healthiness, pleasantness and use-frequency of apple and chocolate bars, choice of apple or chocolate bar
IV	FIN n=467	57	43	45	Postal surveys in Finland (FIN) and Great Britain (GB). In the Netherlands (NL) respondents filled out the questionnaire at the research agency.	HTAS, healthiness, pleasantness and use-frequency of 8 foods and 'paper and pencil' choices of 4 food pairs
	GB n=361	59	41	49		
	NL n=477	61	39	42		

The respondents in studies I, III and IV were not statistically representative of any Finnish, British or Dutch population. The respondents were not paid for participating, but they received a small reward after completing the study, except in studies II and IV, where they took part in a lottery for gift certificates.

Development of Health and Taste Attitude Scales (HTAS)

Likert-type summated scales were generated for measuring the importance of healthiness and taste of foods in study II. In the first phase, 38 health- and 34 taste-related statements were generated by the authors, using health and sensory characteristics of foods that were identified in a qualitative interview study (study I) and from previous research. In the two pretest phases some statements were reformulated, some removed and some new statements were generated. In the final testing of statements, 37 health- and 44 taste-related statements were scored on seven-point Likert scales with the categories ranging from “disagree strongly” to “agree strongly”. The distributions of the items were evaluated. Based on the distributions of the 37 health-related items and the 44 taste-related items, items either not differentiating respondents or with a severely skewed distribution were discarded. The remaining items (37 health-related and 34 taste-related items) were factor analyzed using the Maximum Likelihood method with Varimax rotation, and the internal reliability of each factor was tested using Cronbach’s alpha.

The construction of the scales was based on the results of factor and reliability analysis, resulting in 20 health-related statements on 3 sub-scales and 18 taste-related statements on 3 sub-scales in the final form of HTAS. Each sub-scale was composed of an equal number of positively and negatively worded statements in order to minimize the respondents’ tendency to answer yes or to agree with the items. In addition to these six sub-scales there were a few items that loaded on a factor which could be interpreted as Feeling guilty about eating. Owing to the correlation with *General health interest* and the unbalanced number of negative and positive worded items, this dimension was not added as a separate sub-scale.

The sub-scales measuring health attitudes are (Table 3): *General health interest*, *Light product interest* and *Natural product interest*. *General health interest* (eight statements) deals with an interest in eating healthily; *Light product interest* (six statements) relates to an interest in eating reduced-fat foods and *Natural product interest* (six statements) relates to an interest in eating foods

that do not contain additives and are unprocessed. The Taste scale sub-scales are (Table 4): *Craving for sweet foods*, *Using food as a reward* and *Pleasure*. *Craving for sweet foods* (six statements) describes the strength of cravings for chocolate, sweets, and ice-cream. *Using food as a reward* (six statements) considers the use of food for indulging or comforting oneself and *Pleasure* (six statements) relates to the importance of obtaining pleasure from food. Each sub-scale is composed of an equal number of positively and negatively worded statements. Health and Taste sub-scales of the HTAS are presented in Finnish (Appendix A1), in Swedish (Appendix A2) and in Dutch (Appendix A3).

Attitude measurements

In study II respondents rated 37 health- and 44 taste-related statements and in studies III and IV respondents rated 20 health-related statements and 18 taste-related statements (the final form of HTAS) on a seven-point Likert scale with the categories ranging from “strongly disagree” to “strongly agree”. The presentation order of the statements was randomized separately for each study (II, III and IV). In study IV, the statements were presented in the same randomized order in all three countries.

Validity measurements

Convergent Validity

To demonstrate that Health sub-scales have convergent validity, correlation between the Health sub-scales and the Dutch Restraint Eating Scale of the Dutch Eating Behavior Questionnaire (DEBQ) (van Strien et al., 1986) was assessed.

Predictive validity

Choices of snacks

In order to test the predictive validity of the scales, a choice task in which respondents reported their choice of 13 snack food pairs was conducted in study II. A choice task of four snack food pairs was conducted in study IV. In study III respondents actually chose an afternoon snack (chocolate bar or apple) after completing the questionnaire. The choice of a snack food was conducted two weeks after the second set of statements was tested (II) and in study IV the choices were presented at the beginning of the questionnaire before rating the

Table 3. Health sub-scales of the HTAS. Negatively worded statements are marked with an "R"(meaning recoding) after the statement.

GENERAL HEALTH INTEREST	LIGHT PRODUCT INTEREST	NATURAL PRODUCT INTEREST
1 I am very particular about the healthiness of food.	I believe that eating light products keeps one's cholesterol level under control.	I do not eat processed foods, because I do not know what they contain.
2 I always follow a healthy and balanced diet.	I believe that eating light products keeps one's body in good shape.	I try to eat foods that do not contain additives.
3 It is important for me that my diet is low in fat.	In my opinion by eating light products one can eat more without getting too many calories.	I would like to eat only organically grown vegetables.
4 It is important for me that my daily diet contains a lot of vitamins and minerals.	In my opinion, the use of light products does not improve one's health.R	In my opinion, artificially flavored foods are not harmful for my health. R
5 I eat what I like and I do not worry about healthiness of food. R	In my opinion light products don't help to drop cholesterol levels. R	In my opinion, organically grown foods are no better for my health than those grown conventionally. R
6 The healthiness of food has little impact on my food choices. R	I do not think that light products are healthier than conventional products.R	I do not care about additives in my daily diet. R
7 The healthiness of snacks makes no difference to me. R		
8 I do not avoid any foods, even if they may raise my cholesterol. R		

Table 4. Health sub-scales of the HTAS. Negative worded statements are marked with an "R" after the statement.

CRAVING FOR SWEET FOODS	USING FOOD AS A REWARD	PLEASURE
1 I often have cravings for sweets.	I reward myself by buying something really tasty.	The appearance of food makes no difference to me. R
2 I often have cravings for chocolate.	I indulge myself by buying something really delicious.	When I eat, I concentrate on enjoying the taste of food.
3 I often have cravings for ice-cream.	When I am feeling down I want to treat myself with something really delicious.	I do not believe that food should always be source of pleasure. R
4 In my opinion it is strange that some people have cravings for sweets. R	I avoid rewarding myself with food. R	It is important for me to eat delicious food on weekdays as well as weekends.
5 In my opinion it is strange that some people have cravings for chocolate. R	In my opinion, comforting oneself by eating is self-deception. R	An essential part of my weekend is eating delicious food.
6 In my opinion it is strange that some people have cravings for ice-cream. R	I try to avoid eating delicious food when I am feeling down. R	I finish my meal even when I do not like the taste of a food. R

HTAS. This choice task, thirteen food pairs, including 17 different foods described by name, were presented to the respondents on a computer screen (study II) and four food pairs as a“paper and pencil task” in study IV. Four of the food pairs in study II (eight foods: full-fat chocolate bar, reduced-fat chocolate bar; full-fat cheese, reduced-fat cheese; full-fat milk, reduced-fat milk; soft drink, artificially sweetened soft drink) were used for assessing the predictive validity of the HTAS. In study II “healthy – not pleasant choices” and “pleasant – not healthy choices” were counted from each four of the food pairs. The effect of the Health sub-scales on the number of “healthy – not pleasant” food choices and the effect of the Taste sub-scales on the number of “pleasant – not healthy” foods choices, were tested by one-way analysis of variance (II). All four pairs in study IV (reduced-fat cheese sandwich, full-fat cheese sandwich; reduced-fat chocolate bar, full-fat chocolate bar; non-fat (skimmed) milk, full-fat (whole) milk; light soft drink (no sugar), regular soft drink (sugar-sweetened)) were used for assessing the predictive validity of the HTAS. In study IV “healthy food choices” or “pleasant food choices” were counted from each food pair. To test predictive validity, the correlations were computed between the Health sub-scales and the number of “healthy food choices” and the Taste sub-scales and the number of “pleasant food choices”.

Reported frequency of consumption

The predictive validity of the questionnaires developed was also tested using the reported frequency of use of snack foods in study III. This was done by testing the product (chocolate bar or apple) as the within-subject effect and sub-scales (low, moderate and high) as the between-subjects factors on ratings of use of foods using repeated measures analysis of variance. In study IV predictive validity was tested by computing correlations between Health and Taste sub-scales and the self-reported frequency of use of foods. Frequency of use of chocolate bars and apples (study III) and the same eight foods as in the choice task (IV) were rated on five point scales with the categories ranging from “hardly ever” to “every day” (III) and “rarely/never” to “almost every day” (IV).

Pleasantness and healthiness ratings

The respondents rated the pleasantness and the healthiness of the same 17 foods in study II, the two foods in study III and the eight foods in study IV that were used in the choice tasks. These ratings were used to demonstrate how attitudes affect the perceptions of these characteristics. The foods were rated on

seven-point scales ranging from “extremely unpleasant” to “extremely pleasant”, and “extremely unhealthy” to “extremely healthy” in all three studies (II, III and IV).

Data analysis

The data were analyzed using standard statistical procedures as described in the individual papers (I–IV). Correspondence analysis was used for analyzing the laddering data in study I. Statements were factor analyzed using the Maximum Likelihood method in studies II and IV and the Principal Axis method in study III with Varimax rotation; the internal reliability of each sub-scale was tested using Cronbach’s alpha in studies II, III and IV. In addition to Cronbach’s alpha, the reliability measure developed by Tarkkonen (1987) was used in study IV. The statistical programs used were Ladder Map (I, Ladder Map User’s Manual, 1995), Survo (I, Mustonen, 1992) and SPSS (II, III and IV, (SPPS Inc., 1994a and 1994b).

RESULTS

Health and hedonic characteristics of foods

The health benefits of perceived naturalness, good fat quality, and vitamin, mineral, fiber and low fat content of foods were found to be important characteristics for healthy foods, while sensory appeal and taste were naturally important for pleasure-giving foods. The health and hedonic characteristics of foods observed in study I formed the basis of statement generation for the HTAS.

Results of the performance of the Health and Taste Attitude Scales (HTAS)

The three-factor solution of the Health Scale accounted for 45.6% (II), 48.5% (III), 45.0% in Finland, 34.4% in the Netherlands and 36.2% in Great Britain (IV) of the total variance. The three taste-related factors accounted for 41.1% (II), 42.8% (III), 39.2% in Finland, 30.8% in the Netherlands and 33.3% in Great Britain (IV) of the total variance. Means, standard deviations, Cronbach's alpha (α) and Tarkkonen's reliability coefficient ρ for the Health and Taste sub-scales in studies II, III and IV are presented in Table 5.

National and demographic differences

A main country effect was found in all Health sub-scales except *General health interest,* and in all Taste sub-scales, indicating that the ratings of Finnish, British and Dutch respondents were similar only on the *General health interest* subscale. Finnish respondents rated highest on *Light product interest*. Finnish and English respondents rated *Natural product interest* higher than did Dutch respondents. Dutch and English respondents rated *Craving for sweet foods*, *Using food as a reward* and *Pleasure* higher than Finnish respondents (IV: Table 5).

Associations with gender and age

Females rated on *General health interest* and *Natural products interest* higher than males in all three countries (II–IV), and *Light product interest* in Finland and Great Britain, but not in the Netherlands (III, IV). A higher rating by females than males was also found on *Craving for sweet foods* in Finland and GB (II–IV), *Pleasure* (II, IV) and *Using food as a reward* in Finland (IV).

Table 5. Means, standard deviations and Cronbach's alpha (α) for Health and Taste sub-scales in studies II, III and IV and reliability coefficient ρ of Tarkkonen (1987) in study IV.

Sub-scale	**Study II** Finland n=1005			**Study III** Finland n=144			**Study IV** Finland n=467				Great Britain n=361				The Netherlands n=477			
	Mean	Std.	α	Mean	Std.	α	Mean	Std.	α	ρ	Mean	Std.	α	ρ	Mean	Std.	α	ρ
General Health interest	4.5	1.3	0.89	4.5	1.2	0.81	4.7	1.3	0.87	0.86	4.6	1.3	0.84	0.83	4.8	1.0	0.80	0.82
Natural Product Interest	4.2	1.1	0.76	4.5	1.3	0.75	4.5	1.3	0.76	0.84	4.5	1.1	0.65	0.77	4.0	1.1	0.69	0.79
Light Product Interest	4.4	1.1	0.82	4.3	1.4	0.84	4.7	1.2	0.78	0.71	4.2	1.1	0.66	0.68	3.9	1.1	0.70	0.69
Craving for sweet foods	3.8	1.5	0.87	4.4	1.5	0.85	3.7	1.6	0.84	0.85	4.2	1.4	0.77	0.85	4.1	1.2	0.74	0.80
Using food as reward	3.9	1.2	0.79	4.2	1.2	0.75	3.4	1.3	0.74	0.87	4.1	1.2	0.67	0.81	4.0	1.1	0.67	0.81
Pleasure	4.7	1.0	0.67	4.9	1.0	0.67	4.6	1.0	0.63	0.67	5.0	0.9	0.39	0.65	5.1	0.9	0.54	0.62

Older respondents rated on *General health interest* and on *Natural products interest* higher than younger respondents (II). However, younger respondents rated higher on *Craving for sweet foods* and on *Using food as a reward* than did older respondents (II).

Validation results

Convergent validity

To demonstrate that Health sub-scales have convergent validity, correlation between the Health sub-scales and the Dutch Restraint Eating Scale (DEBQ) (van Strien et al., 1986) was assessed. All Health sub-scales of the HTAS correlated positively (from 0.28 to 0.54) with the DEBQ.

Predictive validity

Choices of snacks

In the Health Scale findings, respondents who rated on *General health interest*, *Light product interest* and *Natural product interest* high made more “healthy – not pleasant” food choices than those who rated moderate or low on Health sub-scales (II: Fig. 5a). The *General health interest* and *Light product interest* sub-scales correlated positively with the “healthy food choice“ and negatively with the “pleasant food choice” (IV: Table 6). In the actual choice situation, two of the Health sub-scales (*General health interest* and *Light product interest*) interest were good predictors of the choices between an apple and chocolate bar. Respondents rating *General health interest* low chose chocolate bars more often than apples and respondents rating *General health interest* high chose apples more often than chocolate bars. Respondents rating *Light product interest* high chose apples more often and chocolate bars less often than respondents low on that scale. No significant effect was found in *Natural product interest* (III: Figs. 3 a–c).
Respondents who rated *Craving for sweet foods* low made fewer “pleasant – not healthy” food choices than those who were moderate or high on this sub-scale. Respondents low or moderate on *Using food as a reward* made fewer “pleasant – not healthy” food choices than those high on that sub-scale. Ratings of the *Pleasure* sub-scale were found to have no effect “pleasant – not healthy” food choices (II: Fig. 5b). The *Craving for sweet foods* and *Using food as a reward* sub-scales had weak but significant positive correlations with the “pleasant choice” (IV: Table 6). In the actual choice situation, *Craving for sweet foods* was a

good predictor of the choices between apple and chocolate bars. Respondents rating *Craving for sweet foods* high chose chocolate bars more often and apples less often than respondents low on that scale. In *Using food as a reward* and *Pleasure* no significant difference was found in the choices between a chocolate bar and apple (III: Figs. 4 a–d).

Reported frequency of use

Respondents with positive attitude towards *General health interest* indicated a less frequent use of chocolate bars (III) and a more frequent use of apples (III) than respondents with a negative attitude towards *General health interest*. No significant differences were found in the frequency of use of apples between respondents low and high on *Light product interest* and in the frequency of use of chocolate bars and apples between respondents low and high on *Natural product interest* (III: Table 4, Figs. 5 a–c). In study IV the *General health interest* and *Light product interest* sub-scales had significant positive correlations with the reduced-fat or sugar free foods and significant negative correlations with the full-fat or sugar-containing foods. The correlation between *Natural product interest* and frequency of use of foods followed the same pattern as in the two other Health sub-scales, except no correlation was observed between *Natural product interest* and light soft drinks and reduced-fat chocolate bars (IV: Table 6).

Respondents who scored high on the *Craving for sweet foods* and *Using food as a reward* sub-scales reported using chocolate bars more frequently and apples less frequently (III) than respondents who scored low on those sub-scales. The *Craving for sweet foods*, *Using food as a reward* and *Pleasure* sub-scales were positively correlated with the reported use of full-fat chocolate bars (IV). No significant differences were found in the frequency of use of chocolate bars and apples (III) in the different *Pleasure* subgroups.

The summary of the predictive validity results is presented in Table 6. In Table 6, the sub-scale is marked with (+) if a significant between-subjects (low, moderate and high) effect on choice tasks or ratings of use of foods was observed using analysis of variance or if significant correlations (over 0.10) between Health and Taste sub-scales and self-reported frequency of use of foods was observed. In study IV the average of the countries was calculated and used in the predictive validity measures reported in Table 6.

Table 6. Predictive validity of sub-scales using different measurements in studies II to IV. If the predictive validity was observed in the measure it is marked with (+) and if it was not observed in the measure it is marked with (-).

	frequency of use (III)	frequency of use (IV)	reported choices (II)	reported choices (IV)	actual choice (III)
General health interest	+	+	+	+	+
Light product interest	-	+	+	+	+
Natural product interest	-	-	+ *	+*	-
Craving for sweet foods	+	+	+	-	+
Using food as a reward	+	+	+	+	-
Pleasure	-	+	-	-	-

* “healthy - not pleasant”(II) and “healthy” (IV) food choices may not be accurate testing methods for *Natural product interest* sub-scale

Pleasantness and healthiness ratings

Respondents who scored high on the *General health interest* sub-scale rated non-fat milk and reduced-fat cheese as healthier than respondents who scored low on that sub-scale. In addition, respondents who scored high on the *Light product interest* sub-scale rated non-fat milk, reduced-fat cheese and artificially sweetened soft drinks as healthier (as compared with full-fat products or sugar soft drinks) than did respondents who scored low on that sub-scale. Respondents who scored high on *Natural product interest* considered artificially sweetened soft drinks less healthy than did respondents who scored low on *Natural product interest* (II: Figs. 3 a–c).

The pleasantness of the full-fat chocolate bar, reduced-fat chocolate bar, full-fat cheese, regular soft drink, and artificially sweetened soft drink was rated highest by the respondents high on the *Craving for sweet foods* and *Using food as a reward* sub-scales. The high ratings of pleasantness for full-fat cheese sandwiches were related to higher scores on *Pleasure* and the high ratings of pleasantness for full-fat milk were correlated with lower scores on *Pleasure* (II: Figs. 4 a–c).

DISCUSSION

Verbal reports

The laddering interview technique was used to gain information about consumer perceptions of health and hedonic characteristics of foods. This method was useful in observing the dimensions that lie under the construct of healthy eating. The advantage of the method was that it showed structures among expressed beliefs and consequences. Moreover it allowed respondents more freedom than structured interviews. However, there were also some negative aspects associated with the technique, such as difficulties in the content analysis to distinguish between attributes and consequences. In addition, it may be difficult for people to objectively verbalize the attributes and consequences influencing particular cognitive processes (Nisbett & DeCamp Wilson, 1977). This view is supported by the finding that many explanations and reasons for certain foods being considered healthy or not healthy were identified, but taste was almost the only reason for a food being categorized as pleasure-giving or not pleasure-giving. It may be easier for people to express characteristics that are learned from nutrition education or are current topics in the media. Of course, other verbally-based behavioral science approaches, such as the theory of reasoned action (Fishbein & Ajzen, 1975), suffer from the same limitation. However, in this way, the whole belief structure is assessed and the reason why people think a certain food does or does not give pleasure is assessed. This is not the case when an overall attitude alone is measured.

There are some limitations in the qualitative study (I), such as assessing the importance of the health and taste aspects in the food choice process with such a small number of respondents. However, many food choice studies have paid attention to the theory of testing rather than the method of building a quantitative questionnaire (Stafleu et al., 1991/ 2). There are only a few studies in the food area that have integrated qualitative and quantitative methods (e.g. Brug et al., 1995; Steward & Tinsley, 1995). According to Stafleu et al. (1991/ 2), more such studies could be useful. In this thesis the qualitative method was used in the initial phase, together with previous research, for helping to develop a quantitative instrument to be validated in subsequent studies.

There are also some limitations in the measure of the cross-national validity of the HTAS. The samples were not representative of any Finnish, Dutch or British population. Furthermore, the total number of respondents and age

distribution of respondents varied between countries. In Great Britain there was no age record available, thus making it more difficult to obtain this specific number of respondents in the three distinct age groups (18–25; 35–45 and 65–75 years). In addition, the data collection method varied between countries. Respondents filled out the questionnaire at the research agency in the Netherlands, whereas in Finland and Great Britain the questionnaire was sent to their homes by mail. Although the statements were directly translated into English and Dutch (except one statement in the Netherlands), the factor structures were found to be almost equal in all three countries, suggesting that the statements of the Health and Taste sub-scales may be understood in a similar way in these three Middle and Northern European countries. This might not happen if the scales are used in Southern European countries, which differ from Finland in many ways in terms of their food related behaviors.

Reliability of the HTAS

Cronbach's alpha (α) in studies II to IV and reliability coefficient ρ developed by Tarkkonen (1987) together with α in study IV were used for mathematical estimates of the degree to which the HTAS is free from measurement error. Cronbach's α varied from 0.63 to 0.87 among Finnish respondents, from 0.39 to 0.84 among British respondents and from 0.54 to 0.80 among Dutch respondents. Tarkkonen's reliability coefficient ρ varied from 0.67 to 0.87 among Finnish respondents, from 0.65 to 0.85 among British respondents and from 0.62 to 0.82 among Dutch respondents. Thus the reliabilities of the HTAS were moderate or high, except in the case of α on the *Pleasure* sub-scale in Great Britain (0.39) and in the Netherlands (0.54). In spite of the two low reliabilities of Cronbach's α, most of the values correspond to those obtained in food-related attitude studies (Axelson & Penfield, 1983; Stunkard & Messick, 1985; Pliner & Hobden, 1992; Steptoe et al., 1995; Meiselman et al., 1999) or are above the lowest limit of acceptability of reliability (0.60 to 0.70) (Hair et al., 1998). When the reliabilities of the HTAS were measured using coefficient ρ developed by Tarkkonen (1987), the coefficient ρ was in all cases over 0.60, which is above the acceptable limits of reliability. This might be a result of better suitability of ρ on multidimensional measures. The values of Cronbach's α are usually lower than the values of ρ, because the assumptions of one-dimensionality and internal consistency are nearly always violated (Vehkalahti, 2000). However, the problem of using Tarkkonen's reliability coefficient ρ might be that it measures the reliability of scales that

are constructed using factor scores, and not summated scales, which according to Eagly & Chaiken (1993) are usually used in constructing attitude instruments.

A measure needs to be reliable to be valid because in an unreliable instrument, true relationships between variables are difficult to observe (Eagly & Chaiken, 1993). Although we did not study test-retest reliability of the HTAS with the same respondents, we observed good reliability from one measure to another with different respondents. Moreover, Nunnally & Bernstein (1994) argued against the retest method because the first test influences the second. Respondents tend to repeat their responses as well as they can remember. Thus, relatively high correlations can be obtained even without a high internal consistency of the measuring instrument.

Validity of the HTAS

Convergent validity

To demonstrate that Health sub-scales have convergent validity, correlation between the Health sub-scales and the Dutch Restraint Eating Scale of the Dutch Eating Behavior Questionnaire (DEBQ) (van Strien et al., 1986) was assessed. All Health sub-scales of the HTAS correlated positively (from 0.28 to 0.54) with the DEBQ Restraint score. According to van Strien et al. (1986) restraint eating means that an individual eats less than he or she actually would like to eat. Significant positive correlations have been found between the DEBQ Restraint score and the obesity index (from 0.22 to 0.34) (Wardle & Marsland, 1990) and between the DEBQ Restraint score and BMI (from 0.44 to 0.55) (Wardle & Beales, 1986), suggesting that restrained eating and dieting are similar processes. Since dieting is associated with a considerably lower reported energy intake and with lower fat consumption (van Strien et al., 1986;Wardle et al., 1992), we predicted that the *Light product interest* sub-scale, which contains two statements concerning either body shape or lower energy intake, would correlate positively with the DEBQ Restraint score. This correlation would thereby imply the convergent validity of the *Light product interest* sub-scale. This prediction proved accurate, but the correlation was lower than the correlation between *General health interest* and restraint score and almost the same as the correlation between *Natural product interest* and the DEBQ Restraint score. The reason why our *Light product interest* did not have a high correlation with the DEBQ Restraint score might be that our *Light product interest* items concern the use of light products in general but not for the respondent her- or himself (Wardle & Beales, 1986). The positive correlation of

General health interest with the DEBQ Restraint score reflects the fact that individuals with a high interest in eating healthily are more likely to control their diet, which is in agreement with Tepper et al. (1997). Individuals with high restraint scores were more likely than those with low restraint scores to eat 'healthy' foods. The correlation of *Natural product interest* with restraint scores suggests the preference for natural foods such as fruits and vegetables over processed foods among persons who restrict their food intake. This is in agrees with the findings of Steptoe et al. (1995), whose Natural content factor correlated positively (r = 0.42) with their Weight control factor of the FCQ.

Predictive validity of the HTAS

The predictive validity of the HTAS was mainly assessed using intentions of snack food choices and self-reported consumption of different snack foods. In addition, in one case direct observation of behavior was used. These different types of measures gave similar results. Nevertheless, attitude measures that rely on self-reports of beliefs can have problems, such as the possibility of response distortions. Respondents may answer a questionnaire to obtain social approval or to avoid social disapproval, and to protect particular identities or personalities (Eagly and Chaiken, 1993). The use of filler items, items that are not concerned with the study, has been suggested as a way to reduce response distortions. Thus, respondents' efforts to provide answers in accordance with their perception of the researcher's interest is reduced. Moreover, Ajzen & Fishbein (1980) argued that self-reports can be quite accurate, but their accuracy cannot be taken for granted. In addition, self-reports are sensitive to respondents' memory biases and potential for social desirability bias (Fisher, 1993). Underreporting is an example of memory bias in nutritional dietary surveys. Hirvonen et al. (1997) observed that micronutrient intakes and energy density values were distorted by underreporting. However, it did not distort the main conclusions in macronutrient lever. Furthermore, self-reports have some advantages, such as easier repeatability, money- and timesaving properties (Anderson, 1995).

Of course, the narrow range of food used in the self-reports reports and in direct observation also affects the results. In the case of *Natural Product Interest* in particular, the "healthy" foods used in the consumption and choice tasks, except for apples, were usually lower in fat or sugar, but not actually free of additives or organically grown. Furthermore, these foods did not produce a good criterion (Eagly & Chaiken, 1993) for measuring the predictive validity of that sub-scale. Thus the predictive validity of *Natural Product Interest* should be further tested using

foods that are more or less in their natural state. According to Eagly & Chaiken (1993), a particular measure could be valid for predicting one criterion but not another. Furthermore, Nunnally & Bernstein (1994) noted that obtaining a good criterion may actually be even more difficult than obtaining a good predictor instrument. The *Pleasure* sub-scale did not predict choices but weakly predicted frequency of use in one study (IV). This might indicate that the predictive validity of this sub-scale is not good or that the measurements of this validity were not suitable for this purpose. The *Pleasure* sub-scale means were higher and standard deviations lower than in other sub-scales, suggesting that the items of the *Pleasure* sub-scale items are not strong enough. Most of the respondents can easily agree with the scale. The problem with the measurement of validity was that the differences between the pleasantness of the foods used in the choice tasks were not big enough; all foods were valid choices for someone looking for pleasure.

Eagly & Chaiken (1993) argued that attitudes appear in cognitive, affective and behavioral responses and are formed on the basis of any one of the these three types of processes. When the attitude is acquired through the cognitive route it is assumed to derive from the favorability of the beliefs that are acquired directly or indirectly. How much attitudes predict behavior is similarly dependent on the way they are learned, i.e., indirectly or directly. Eagly & Chaiken (1993) also suggested that the route through which attitude is acquired also affects the cognitive, affective or behavioral responses that the object of the attitude subsequently elicits. For example, an attitude acquired via the behavioral route might tend to elicit primarily behavioral responses. It may also be that attitudes related to the importance of getting pleasure from foods are not acquired via the behavioral route, which would explain why the *Pleasure* sub-scale did not predict behavior.

A wider variety of choice tasks and foods would, of course, have resulted in a broader picture of choice and the predictive validity of scales, but it also would have required more in terms of setting. However, Zandstra et al. (2001) found, using a wider range of foods (104-item food frequency questionnaire), that *General health interest* had, a clear negative association with fat intake, and a clear positive association with consumption of fruit and vegetables. *Light product interest* was positively associated with consumption of low-fat dairy products and fruit and vegetables. In addition, *Craving for sweet foods* predicted consumption of high-fat sweet snacks. Situational factors may also have affected the results of the present studies. When respondents were asked the reasons for their choice (apple or chocolate bar), it could be clearly seen that some of these reasons were based on momentary or situational factors and were not truly repre-

sentative of an individual's general behavior. Moreover, Kähkönen (2000) stated that the selection of some foods such as chocolate are based on emotion and some foods such as spreads are selected based on more awareness and cognitive involvement.

Food choice prediction

The most frequently mentioned reasons for choosing either apples or chocolate bars were related to health, energy content, good taste, momentary desire, and price. This is consistent with the findings of Rappoport et al. (1992) who, in an interview study, asked the reasons for people's recent food consumption. The four general categories derived from the interviews were pleasure, health, tradition and convenience. It is interesting that the complexity of food choice can be demonstrated in a single actual choice situation, such as ours in the present study.

In general, if the snack was considered pleasant it was chosen in the snack food choice task. Similarly, in the study of Tuorila et al. (1990), respondents' beliefs matched with their consumption of different soft drinks. People like the food they choose and thereby avoid conflict between attitudes and behavior. Behavior that is inconsistent with individual attitudes or beliefs causes cognitive dissonance (Festinger, 1957). In order to avoid this, people attempt to behave in a manner which is consistent with their attitudes or beliefs.

Gender effects

Findings regarding the tendency among women to eat more "healthily" and "lightly" are in agreement with the results obtained earlier. European females have shown more positive attitudes toward diet-related health behaviors and benefits than European males (Wardle & Steptoe, 1991; Steptoe et al., 1995; Wardle et al., 1997). The gender difference in *Light product interest* also agrees with the results of Shepherd and Stockley (1985) and Towler and Shepherd (1992), who found that British females have more negative attitudes towards high-fat foods than British males, and with Wardle et al. (1992), who found that British girls rated slimming foods as better for them than did boys. In addition, many studies have found British and Finnish females are more interested than

males in controlling their weight (Steptoe et al., 1995; Lindeman & Väänänen, 2000). Findings similar to of British and American females concerns about weight and eating have even been reported in children and adolescents (Wardle & Beales, 1986; Wardle & Marsland, 1990; Contento et al., 1995). The results also agree with the findings of Stafleu et al. (1994), according to which Dutch females have more positive attitudes than males towards low-fat foods. Rozin et al. (1999) found females to have more negative attitudes towards foods and to be more health-oriented than males in a study on the role of food in life in the US, Japan, Flemish Belgium and France.

Females' higher ratings on the *Craving for sweet foods* sub-scale are also in agreement with previous research. Pelchat (1997) found that American females and young subjects were more likely than males and elderly subjects to report at least one craving. Furthermore, chocolate has been found to be the food most craved food among American and Canadian females (Rodin et al., 1991; Weingarten & Elston, 1991). The more positive attitudes towards eating healthily and yet higher craving scores among females, in comparison with men, suggest more ambivalent attitudes towards eating. This is in line with the study by Grogan et al. (1997), who found that females, more than males, felt that eating sweet snacks was more pleasant yet also worse for their health. Furthermore, Beardsworth et al. (1999), in their study of nutritional attitudes and practices in Great Britain, found that females had a more problematic (they felt guilty about eating, were dissatisfied with their body shape, ate when bored) relationship to food than males did.

CONCLUSIONS

Evidence of the importance of both health and taste factors in the food choice process (Contento et al., 1988; Steptoe et al., 1995) has resulted in the demand for more tools to study these relationships. Thus, Health and Taste Attitude Scales (HTAS) were developed. Important characteristics for healthy foods were found to be naturalness, good fat quality, vitamin, mineral, fiber and low fat content of foods, while sensory appeal and taste were important for pleasure-giving foods. Finnish respondents scored higher on *Light product interest* than English and Dutch respondents, indicating more positive attitudes toward reduced energy foods among Finnish respondents than among English and Dutch respondents. Finnish respondents scored lower than English and Dutch respondents on *Craving for sweet foods*, on *Using food as a reward* and on *Pleasure*, suggesting a lower interest in the pleasure aspects of foods on the part of Finnish respondents when compared with English and Dutch respondents.

In general Finnish females scored higher than males on Health sub-scales, they also scored higher than Finnish males on Craving for sweet foods, and on Pleasure in all our studies. This suggests that Finnish females' attitudes toward food may be more ambivalent than males'.

The predictive validity of the *General health interest* and *Light product interest* sub-scales was evaluated by their relationship with "healthier" food choices and the frequency of use of reduced-fat and sugar-free food. As predicted, respondents high on *General health interest* made "healthier" food choices and reported consuming more reduced-fat and sugar-free foods than respondents low on that scale in all the five measures of predictive validity. *Light product interest* predicted "healthy" food choices and frequency of use in four out of five cases. Thus the results support the use of *General health interest* and *Light product interest* sub-scales to predict consumers' use of low-fat or reduced-fat and -sugar foods. Also the *Natural product interest* sub-scale predicted "healthy" food choices, which was the sum of reduced-fat and sugar-free choices. This may be due to the lack of "natural" – "less natural" food pairs in choice tasks, and as a result, respondents chose foods that were healthier in terms of lower fat or sugar content, since foods were generally not different in terms of perceived naturalness. If we want have more information about *the Natural product interest* sub-scales', the ability to predict the use of "natural" products over "processed" foods should be tested using a wider range of foods. It was expected that full-fat or -sugar foods would be more pleasant and respondents

with more cravings, who use food for rewarding themselves or seeking pleasure would have chosen this type of food over reduced-fat or sugar-free foods. This expectation proved correct in the case of *Craving for sweet foods* and *Using food as a reward* but not in the case of the *Pleasure* sub-scale.

In this study all "Health" and two "Taste" sub-scales (*Craving for sweet foods* and *Using food as a reward*) proved to be good tools for characterizing attitudes within and between consumers cross-nationally. These scales can be used in measuring the importance of the perceived health and taste aspects of foods in relation to food choice. The HTAS can therefore be potentially helpful in monitoring changes in food-related attitudes (e.g. in response to nutrition education), and it may also be used to characterize and segment populations in food marketing studies.

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