CONSUMER ACCEPTANCE OF REDUCED-FAT FOODS – THE EFFECTS OF PRODUCT INFORMATION

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Academic dissertation
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To Paula, Pihla and Pietari

**ABSTRACT**

The effect of product information on the acceptability of reduced-fat foods was studied in four sensory studies and in a survey. Sensory and hedonic ratings of fat spreads, sausages, yogurts and chocolate bars were measured in blind test conditions and in the presence of different types of information. Product information, which was related to the fat content or the taste of the foods, was presented either by simple texts on labels or in pictures of food packages. A total of 743 consumers took part in the studies. The effects of subjects’ age, gender, concern about food and health and involvement with the tested products on sensory and hedonic ratings were measured.

Product information increased acceptance of bologna and frankfurter sausages compared to blind ratings. The acceptance increased similarly regardless of the three types of information studied: regular-fat, reduced-fat and taste-related information. Reduced-fat information increased pleasantness ratings of fat spread for those subjects who were classified as concerned about food and health. Acceptance of yogurts and chocolate bars was not affected by information on fat content or taste. Sensory properties such as fattiness, juiciness and flavour intensity were generally rated lower for foods labelled as reduced-fat compared to foods which were labelled as regular-fat. The survey showed that reduced-fat foods were best accepted by females, older subjects and by subjects who were concerned about food and health. Individual involvement with a specific food was observed to be related to differences in acceptance between regular- and reduced-fat products. The results show that the role of different foods in eating habits and individual differences in food- and health-related ideas, attitudes and practices can be used to plan product information and to understand the effects of information on food acceptance.
This study was carried out at the Department of Food Technology at the University of Helsinki. Professor Hely Tuorila guided me to sensory food science during my undergraduate studies. Thereafter, she introduced me to context effects in sensory evaluation and encouraged me to prepare a study proposal on the effects of information on food acceptance, thus giving me an opportunity to do the research under her supervision. I am grateful to her for leading me to this research area, for placing excellent resources and facilities at my disposal, and for constantly giving me opportunities to establish valuable international contacts in sensory food science. I also sincerely thank Professor Lea Hyvönen for her support during my studies.

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I owe my warmest thanks to my big loving family, whose support and care have encouraged me in my work.

Espoo, April 2000
Päivi Kähkönen
LIST OF ORIGINAL PUBLICATIONS

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


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**ABSTRACT**

**PREFACE**

**LIST OF ORIGINAL PUBLICATIONS**

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INTRODUCTION

REDUCED-FAT FOODS

Reduced-fat foods are new, modified versions of familiar food products. Consumer demand for low-fat, low-calorie food has given rise to a new trend in product development with familiar food products which are made with partly new ingredients. Fat reduction is achieved either by using less fat in food production or by removing fat from raw materials. Reduced-fat foods include all types of foods which originally contain fat, typically different types of dairy, meat and bakery products.

Demand for reduced-fat foods is based on appreciation of health and appearance. Health authorities in Western countries have recommended reduction of fat intake in order to reduce risk for several chronic diseases including diseases connected to being overweight (National Public Health Institute/Department of Nutrition, 1999). Reduced-fat foods are expected to encourage reduced fat intake, help body weight control and thus improve physical health (Alexander and Tepper, 1995; Viaene and Gellynck, 1997). In consumption studies, the use of reduced-fat products has been shown to reduce fat and energy intake and also to decrease body weight (Gatenby et al., 1995; de Graaf et al., 1997). On the other hand, reduced-fat foods are in some cases avoided or the reduction in fat and energy content is counteracted by eating more (Aaron et al., 1995). However, a belief in the positive health effects of reduced-fat products is expected to increase acceptance and selection of reduced-fat foods.

Texture characteristics of many foods are especially due to fat content and are thus sensitive to fat reduction. In a categorisation of food texture attributes, Szczesniak (1963) presented fat and water content as one major category besides mechanical and geometrical properties. Oil- and fat-related texture attributes were also found to form one of the main categories of food texture terminology in the Finnish and English languages (Lawless et al., 1997). The sensory attributes which are used to describe the fat content of a particular food are dependent on product type, for example creaminess and viscosity have been used for dairy products (Pangborn, 1988; Drewnowski et al., 1989). Fat reduction has for instance been shown to decrease the perceived greasy mouthfeel of milk (Tuorila, 1986), glossiness and smoothness of margarine- and butter-based fat spreads (Tuorila et al., 1989), juiciness and tenderness of cooked sausages (Solheim, 1992), thickness and fattiness of cheese soup (Kähkönen et al., 1995), juiciness of Mozzarella cheese (Pagliarini et al., 1997) and to increase the perceived firmness and rubberiness of processed cheese (Drake et al., 1999).

Fat replacers are designed to help maintain the original texture of a regular-fat food in a reduced-fat product version (Drewnowski, 1990). However, the original texture alone is not enough to maintain the sensory properties of a food when fat is replaced. The effects of fat on odour and taste are important for the final sensory quality of food. Fat is also an
important carrier of fat-soluble aroma compounds, and fat content and the type of fat also
affect the rate of the release of aromas in food material (Kinsella, 1989; Shamil et al.,
1991/92; Mialon and Ebeler, 1997). The rate of aroma release affects the intensity and
duration of odour sensation (Lee, 1986; Ebeler et al., 1988). Reduced fat content was also
observed to decrease rated saltiness of cheese soup and sweetness of yogurt compared to
regular-fat foods (Kähkönen et al., 1995; Tuorila et al., 1993). However, the dairy fat that
was used in the cheese soup and in the yogurt also contains aromas which probably
affected the rated taste intensity.

A preference for fat is not innate like the preference for sweetness (Bartoshuk and
Beauchamp, 1994). However, a liking for a smooth, creamy texture is apparently learned
during the first months of life. The fact that fat is an effective source of energy is one
evident explanation for liking fat-containing foods, since each individual needs to learn
food habits early in life, and satiety from a food is a good indication of which food should
be selected (Rozin, 1989; Mela, 1990).

In blind sensory tests, consumers have shown the highest preference for products with
the highest fat content. For example cream, yogurt and cheese soup were rated most
pleasant with the highest fat content (Drewnowski and Greenwood, 1983; Tuorila et al.,
1993; Kähkönen et al., 1995). Obviously, it is not always possible for a consumer to notice
differences in fat content. Mela and Sacchetti (1991) reported that individual ratings varied
considerably between products and it was not possible to predict a liking for one high fat
food on the basis of a liking for another food. Mela (1990) observed that the fat content
which was rated most pleasant varied among the products and, for example, the
pleasantness of tuna was highest with 30% fat and the pleasantness of a dessert increased
as the fat content increased from 0 to 10% but not with higher fat contents. The fattiness of
foods and beverages is generally related to highly accepted odour, taste and texture
characteristics such as full flavour, creaminess and smoothness (Daget et al., 1987). A
pleasant creamy texture of vanilla pudding was recently shown to be related to samples
which were perceived as thick, visually airy, mouth-coating, dense and to melt slowly-
sensory characteristics which were related to high fat content of the samples (Elmore et al.,
1999).

Since higher fat content of many foods has been linked to higher acceptability, and
typical high fat foods such as cheese, chocolate and ice-cream are also generally well liked
(Tuorila and Pangborn, 1988), acceptance of reduced-fat foods seems very unlikely.
However, several blind sensory tests show that reduced-fat foods have actually been rated
pleasant and acceptable. Reduced-fat cooked sausages with 12% fat (Solheim, 1992), fat-
free pound cake and fat-free saltine crackers (Tuorila et al., 1994a) were liked equally
compared to corresponding regular-fat foods with 20, 18 and 14% fat, respectively.
Reduced-fat pork sausages and milk chocolate snack bars were even observed to maintain
high acceptance during consumption at home over a period of 12 weeks (Stubenitsky et al.,
1999). Reduced-fat American cheese (Tuorila et al., 1994a), milk chocolate snack bar, and
potato chips (Stubenitsky et al., 1999) were rated a bit lower in liking compared to regular-fat foods, but the reduced-fat products were still liked, not disliked. Previous results of blind consumer tests suggest that sensory reasons do not have to affect acceptance and consumption of reduced-fat foods negatively and it is possible to produce reduced-fat foods which are just as acceptable as corresponding regular-fat foods.

In conclusion, many different types of positive and negative attributes, as well as consequences of these attributes, can be related to reduced-fat foods while evaluating consumer acceptance (Fig. 1). Some of the attributes are clear and objective, such as reduced fat and energy content and different texture. However, most attributes and all consequences are conditional: we cannot say exactly how much, if any, reduced-fat food would result in reduction of body weight for an individual or if it is possible to define which people actually benefit from using these products.

![Figure 1](image.png)

**Figure 1.** Properties of reduced-fat foods which may decrease (-) or increase (+) food acceptance.

**FOOD ACCEPTANCE**

Humans are omnivores, but each individual only selects some of the foods that are available and generally acceptable in the culture. In sensory food science, food acceptance is used as a measurable concept that is closely related to food choice. Acceptance refers to an individual experience, a feeling or an emotion with a hedonic aspect (Cardello, 1996). Food acceptance can be verbally operationalised as a measure of rated pleasantness or liking, for which the 9-point degree-of-liking scale is a validated and reliable measure (Peryam and Pilgrim, 1957; Cardello, 1994; Lawless and Heymann, 1998, p. 450).

Acceptance of a food is measured in affective sensory tests with potential consumers of the product or service. Sensory consumer studies are used in product design to develop products which are well accepted, and also in food and nutrition research to study the effects of different factors related to food acceptance (Schutz, 1999). Sensory consumer testing follows the same procedures as sensory laboratory testing, including the use of blind codes, random order of presenting the actual samples for tasting, individual evaluations and the use of scales (e.g. Lawless and Heymann, 1998, pp. 83-115).
contrast to laboratory testing, a consumer panel intends to measure consumer opinions rather than properties of foods (Schutz, 1999). A clear difference between sensory consumer studies and marketing studies is that sensory tests concentrate on the properties of the food product, while marketing studies test the whole marketing concept, including packaging etc. (van Trijp and Schifferstein, 1995).

The degree of acceptance of different foods is dependent on experience. Studies on both children and adults show that increasing experience increases acceptance, thus familiar foods are generally liked more than unfamiliar foods (Zellner, 1991). As children have less experience of different types of food, they typically accept less types of food compared to adults. Also adults are to some extent suspicious to unknown foods (food neophobia) which decreases acceptance of those foods about which we have no experience (Rozin and Vollmecke, 1986). However, the effect of experience and exposure on food acceptance has been shown to interact with physiological and social factors. First of all, consumption of a well-accepted food needs to have positive physiological consequences, such as feeling well and satiated after eating (Rozin and Vollmecke, 1986; Birch, 1991). Furthermore, food acceptance needs to be motivated by the social and cultural context in which the foods are experienced. Seeing other people in the family and in the community having foods and beverages motivates individual acceptance of these products. Pleasant social situations connected to eating, and social acceptance and appreciation of the foods of the culture contribute to food acceptance (Birch, 1991; Zellner, 1991).

**Effects of Context on Food Acceptance**

A food product may be rated pleasant in a laboratory setting or in an everyday meal but not acceptable for a dinner party. Pleasantness of a single product is not only dependent on the food itself but also on the situation in which the food is eaten (Meiselman and Bell, 1993; Meiselman, 1996). Situational factors include variables of eating environment, properties of other foods which are available, other people and how the food is served (Rozin and Tuorila, 1993; Meiselman, 1996). Schutz (1994) discusses the situational level of acceptability by introducing an appropriateness scale for different foods for different purposes and situations (e.g. ‘when I am not feeling well’, ‘for guests’, ‘in summer’). It was clearly seen that different foods and beverages were perceived to be appropriate in different situations.

All the foods which are tasted or available at the same time are part of the eating situation. In sensory tests, usually several samples are evaluated one after another during one session. The properties of the samples which are rated first have been observed to affect both the sensory and hedonic ratings of the other samples. For example, the saltiness of soups and the sourness of tartaric acid solutions were rated higher when they were evaluated together with low intensity samples than when rated with high intensity samples (Lawless and Clark, 1992). Hedonic ratings have also been observed to be higher when
rated in a sample set of unpleasant samples than when rated with pleasant samples (Schifferstein, 1995).

**Product Information**

Food selection and evaluation are not only based on sensory properties of food but also verbal information about the product. Verbal information is also part of the context of food selection, and such information has been observed to influence sensory and hedonic ratings. Pleasantness ratings of a juice increased when the subjects were told that the juice had been earlier rated pleasant by ‘other consumers’ compared to a situation with information about low ratings by the ‘others’ (Cardello and Sawyer, 1992). Levin and Gaeth (1988) reported that information about reduced fat content had a positive effect on acceptance if the information emphasised the fat-free properties of the food (75% lean meat) and not the amount of fat (25% fat). A positive effect of reduced-fat information on the acceptance of sausages was also reported by Solheim (1992). This effect was, however, not observed with all types of sausages, but varied between different producers of the sausages.

Many studies also suggest a general positive effect of information on food acceptance. Cardello et al. (1985) reported that precise information about unfamiliar products increased pleasantness ratings and acceptance of the foods in several situations. Zellner et al. (1988) reported an increase of acceptability of an unfamiliar fruit drink at room temperature when the subjects were told that it was the typical serving temperature of the product. Tuorila et al. (1994b) studied the acceptability of unfamiliar ethnic foods and it was observed that a special black Finnish Easter pudding was more acceptable among US consumers when information was given about how the food was prepared and how it was eaten in Finland (Tuorila et al., 1994b). Pelchat and Pliner (1995) discovered that the observed and rated willingness to taste an unfamiliar food increased as information about the taste and the nutrient contents of an unfamiliar product was provided. However, no effect of information on the rated pleasantness was observed (Pelchat and Pliner, 1995).

**Expected Acceptance**

Preceding samples and verbal information about the tested product influence consumer expectations about product characteristics (sensory expectations) and the hedonic value of the product (hedonic expectations) (Cardello and Sawyer, 1992). The effects of the eating environment, other tasted products and product information on evaluations can be analysed by classifying the expectations which are evoked by these context factors. It is especially interesting to look at a situation in which consumer expectations do not match the actual product properties, i.e. a product is expected to be more/less pleasant or to have more/less intense sensory properties compared to reality. The models of assimilation and contrast have been used to explain the observed effects of too high and too low, and thus
disconfirmed expectations on actual ratings. Assimilation effect means ‘a bias in evaluation in the direction of expectation’, and contrast effect means ‘a bias in the opposite direction from the expectation’ (Anderson, 1973; Cardello, 1994).

As far as sensory context is concerned, the most typical effect of context on the ratings of a sample is contrast, i.e. any sensory attribute of a sample is rated more intense after a sample with a weak intensity of the sensory attribute compared to a sample with a stronger intensity of the attribute (Lawless and Clark, 1992). An explanation for contrast effect is that the rated sample is compared to the other samples which are present, and the intensity of a sensory property seems more intense after a weak stimuli than after a strong stimuli. However, the opposite effect, assimilation effect of expectations on sensory ratings, is most often observed when sensory or hedonic expectations are based on verbal product information (Deliza and MacFie, 1996).

Cardello and Sawyer (1992) studied the effects of high and low expected pleasantness and sweetness intensities on actual sensory ratings of a juice. Subjects were provided different types of verbal information about the intensity of sweetness and the pleasantness of juice in order to create high and low expectations. The expected pleasantness and sweetness intensities of the juice were measured prior to tasting and compared to the actual sensory ratings. Both pleasantness and sweetness ratings, in this case, were biased in the direction of the expectation and the result thus supported the assimilation model. On another occasion, a cola beverage was rated more pleasant with a higher expectation and less pleasant with a lower expectation compared to the actual blind rating (Cardello and Sawyer, 1992).

Consumer expectations are important factors in the acceptance and choice of food since purchase decisions are often done without complete information about the product properties (Goering, 1985). However, expectations about the sensory properties of food are not always based on direct information about pleasantness or the intensity of sensory attributes but on more technical information about food ingredients, brand, manufacturer etc. Prior assumptions about food properties have an important role in forming sensory and hedonic expectations based on product information.

Knowledge of product brand, reduced fat content of food and package information, for example, have been observed to affect sensory and hedonic expectations of food (Cardello and Sawyer, 1992; Tuorila et al., 1994a; Schifferstein et al., 1999). Providing information that cake, crackers and cheese contained no fat resulted in low expected liking but also low expected intensity of sensory attributes such as odour intensity, sweetness and colour intensity of these fat-free foods compared to the corresponding regular-fat products (Tuorila et al., 1994a). No effects of the low expectations were seen in mean ratings of actual products, but assimilation effects of disconfirmed expectations were indicated when individual comparisons were made: the level of disconfirmation correlated positively with the difference between blind and informed ratings.
Schifferstein et al. (1999) observed that either a product package or a complete list of product information printed on the package evoked a variety of expectations about natural yogurt samples. Disconfirmed expected overall quality, buying probability and intensity of sensory properties all assimilated to expectations. However, it was also observed that the intensity of the assimilation effect was dependent on the direction of disconfirmation: a low expectation compared to blind rating resulted in stronger assimilation effect than assimilation to a higher-than-blind expectation. A suggested explanation for the asymmetric effect of disconfirmation is that the effect of a disappointment (quality not as high as expected) is stronger than a nice surprise (better than expected) in peoples’ minds. A stronger effect is seen in actual ratings which are far from expectation, i.e. close to blind rating (Schifferstein et al., 1999).

**Consumer Background Factors**

Food is selected on a different basis by different consumers. Perceived sensory pleasantness and healthfulness of food have been shown to be important factors in food choice. Tuorila and Pangborn (1988) found that both liking and beliefs about the consequences of food for health predicted choice of different fat-containing foods. Reasons for food choice were studied with a large set of foods by Wardle (1993), who observed that for some of consumers, high-rated liking correlated to frequent consumption, while for others, high-rated healthiness for a set of foods correlated to high consumption. Furthermore, Roininen and Tuorila (1999) observed in a real choice task between an apple and a chocolate bar that ‘good taste’ and ‘healthfulness’ were the most frequently mentioned reasons of choice.

Many attempts have been made to divide consumers into different sub-groups which would predict their food choices on a continuum from less healthy to more healthy foods. In many of these studies, gender differences have been reported showing that females are generally more concerned than males about food, health and appearance. Alexander and Tepper (1995) report that although reduced-fat foods were consumed just as much by females as by males, females based their food selection on weight concerns more than males. Females also reported restricting their eating more than males did (Alexander and Tepper, 1995). Wardle and Marsland (1990) reported that weight concerns were more frequent among girls than boys. Overall, food-related advice and expectations of social environment may affect food selection of females more than males. Females were for example reported to perceive more pressure than males from health experts not to eat sweet snacks (Grogan et al., 1997). However, in a recent study, males and females were both reported to consider food as an important contributor to health, while females, again, found it more important to follow recommendations given by health experts (Fagerli and Wandel, 1999).

Several studies report that the effect of reduced-fat information on acceptance varies among consumer sub-groups. For example, low-fat information about samples of flavoured
milks logically increased liking for the samples by a subject sub-group that had a more positive attitude to reduced-fat milks (Shepherd et al. 1991/2). A similar effect was observed with information that milk was high in fat among subjects with a positive attitude towards high-fat milks. Aaron et al. (1994) also reported a similar type of interaction effect of attitude towards reduced-fat and full-fat margarines and reduced-/full-fat label information on pleasantness ratings of spreads. However, the other tested background scale, Eating restrained, did not discriminate between subjects according to their responses to fat content labelling (Aaron et al., 1994). Westcombe and Wardle (1997) reported that the subjects’ rate of general health concern and labelling foods as lower-, normal- or higher-fat had an interaction effect on pleasantness and likelihood of buying ratings. However, the relation of several different food behaviour and attitude scales to the effect of fat-content labelling on liking scores was found nonsignificant by Westcombe and Wardle (1997). Thus, the predicting value of attitude scales varies between the scales and the experiments in which the scales have been used.

Individual reasons for selecting reduced-fat foods has been mainly related to an aim to avoid fat because of the believed negative consequences of fat-containing foods. Tuorila and Pangborn (1988) created a set of belief items about different types of fat-containing foods. Negative beliefs about milk, cheese, chocolate, ice-cream and ‘high-fat foods’ included a set of concerns about consuming fat and calories and gaining weight. These concerns were among other items rated relatively important for the selection of the tested foods (Tuorila and Pangborn, 1988). The relevance of individual tendency to select reduced-fat foods was recognised by Kristal et al. (1990). A scale for Substituting high-fat foods with specially manufactured lower-fat foods that was developed as a part of a dietary behaviour questionnaire proved to be able to predict individual fat consumption. Roininen and Tuorila (1999) showed that low ratings on General health interest and Light product interest scales were connected to high probability to select a fat-containing snack (chocolate bar) instead of a non-fat snack (apple) in a real selection situation.

Personal interest in different foods is an other type of approach to individual differences in perception and acceptance of reduced-fat foods. People definitely differ in their sensitivity to sensory differences between foods, how much effort they put on food choice and how conscious they are about the different alternatives while selecting food. Miller et al. (1981) observed that sensitivity to caffeine could be predicted by general consciousness of body, while a method was developed to measure private and public body consciousness by using a questionnaire. The questions on private body consciousness included statements dealing with awareness of private aspects of body, such as thirst, hunger, body temperature and heart beat. The result suggests that people differ in their awareness of food taste, aroma and temperature.

The construct of involvement has been used in consumer and marketing research to explain and predict consumer choices of products and services. Involvement is seen as a part of individual product-related cognitive structures, and a dichotomy of high and low
involvement has been used to explain the variation in the degree of effort a consumer is willing to devote to consumption-related activities (Zaichkowsky, 1985; Laaksonen, 1994). Involvement has been defined as a stage of energy (arousal) that a person experiences in regard to a consumption-related activity (Wilkie, 1994), and, as the perceived relevance (importance) of an object based on individual needs, values and interests (Zaichkowsky, 1985; Peter and Olson, 1987; Mittal, 1995). High consumer involvement has been connected to active efforts to find product information, detailed comparisons of product attributes and perception of differences between brands (Zaichkowsky, 1985). As perception of both sensory properties of food and product information requires active concentration on product properties, use of the involvement concept may well offer an opportunity to predict the effects of sensory quality and product information on acceptance. Juhl et al. (1997) had previously observed that consumers with high involvement with a product (frozen green peas) were able to discriminate between different types of products better than subjects with low involvement.

**AIM OF THE STUDY**

Information about food products has previously shown partly inconsistent effects on food acceptance (Table 1). However, it seems quite clear that having objective and correct information creates realistic expectations about a product and thus increases acceptance. This can be seen in studies on novel foods. Information on reduced fat content has been shown to have increasing, decreasing and no effect on food acceptance, which is due to variables that are connected to the characteristics of foods and food consumers.

**Table 1.** Review of the observed effects of product information on rated acceptance of food products

<table>
<thead>
<tr>
<th>ACCEPTANCE</th>
<th>PRODUCT</th>
<th>INFORMATION</th>
<th>REFERENCE</th>
<th>NOTE</th>
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<tr>
<td>Increase</td>
<td>Fruit juice</td>
<td>Temperature</td>
<td>Zellner et al., 1988</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meat</td>
<td>75% lean</td>
<td>Levin &amp; Gaeth, 1988</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flavoured milk</td>
<td>Low-fat</td>
<td>Shepherd et al., 1991/2</td>
<td>If positive attitude</td>
</tr>
<tr>
<td></td>
<td>Cola</td>
<td>Favourite brand</td>
<td>Cardello &amp; Sawyer, 1992</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sausage</td>
<td>Reduced-fat</td>
<td>Solheim, 1992</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Novel, ethnic</td>
<td>Origin, normal use</td>
<td>Tuorila et al., 1994b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Margarine</td>
<td>Reduced-fat</td>
<td>Aaron et al., 1994</td>
<td>If positive attitude</td>
</tr>
<tr>
<td>No change</td>
<td>Sausage</td>
<td>Reduced-fat</td>
<td>Solheim, 1992</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Novel foods</td>
<td>Nutrition</td>
<td>Pelchat &amp; Pliner, 1995</td>
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<td></td>
<td>Cake, cracker</td>
<td>Fat-free</td>
<td>Tuorila et al., 1994a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yogurt</td>
<td>Lower fat</td>
<td>Westcombe &amp; Wardle, 1997</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Novel food ‘koerrtas’</td>
<td>Lower fat</td>
<td>Westcombe &amp; Wardle, 1997</td>
<td></td>
</tr>
<tr>
<td>Decrease</td>
<td>Meat</td>
<td>25% fat</td>
<td>Levin &amp; Gaeth, 1988</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cheese</td>
<td>Fat-free</td>
<td>Tuorila et al., 1994a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cake, cracker, cheese</td>
<td>Fat-free</td>
<td>Tuorila et al., 1994a</td>
<td>Expectation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower fat</td>
<td>Westcombe &amp; Wardle, 1997</td>
<td></td>
</tr>
</tbody>
</table>
The variation in effects of information on rated pleasantness can in many cases be partly explained by consumer background variables. Consumers can probably be divided into sub-groups, some of which are eager to select reduced-fat foods, are aware of advantages of the use of reduced-fat foods and expect high acceptability. Information about reduced fat content is assumed to increase acceptance ratings by these subjects. Those subjects who are more receptive to negative properties of reduced-fat foods or who find reduced-fat foods irrelevant, most probably rate foods labelled as Reduced-fat less acceptable or equal to foods labelled as Regular-fat. It is also anticipated that reduced-fat information might act as a type of objective and clear information which increases acceptance.

In the present study, consumer acceptance of different types of reduced- and regular-fat foods was systematically compared between blind sensory tests and tests with fat- and taste-related information present. The effects of sensory and hedonic expectations and consumer background variables on pleasantness ratings were measured (Fig. 2). Several different types of fat-containing foods were needed to find out how information affects acceptance of different foods. Five different health- and product-interest-related consumer background scales were used to get information about the relation between consumer background factors and the effects of information on food acceptance. Fat reduction was selected as a theme for the study since that is a commonly discussed aspect of food and since it offered a good possibility to create product information which would have relevance for subject consumers. Use of different fat contents also allowed us to buy or produce different modifications of the same commonly used foods with somewhat different sensory properties.

![Diagram](image)

**Figure 2.** Measuring the effect of information on pleasantness ratings.
The study was done in five separate experiments (I-V), all conducted with Finnish consumers. The aims of the experiments were to find out

- the effect of different types of product information on acceptance and sensory ratings of different types of reduced-fat foods (I-V)
- the role of consumer demographics and concern about food and health in the influence of product information on acceptance (I-V)
- the role of consumer concentration on and interest in food in the influence of product information on acceptance (II, V)
- the effect of reduced- and regular-fat information on expected acceptance and ratings of sensory attributes, and the role of these expectations in food acceptance (III, IV)
- the effect of different ways of presenting product information on acceptance and sensory ratings (I-IV)
MATERIALS AND METHODS

GENERAL DESCRIPTION OF THE STUDIES

The experiment included four sensory consumer tests (I-IV) and one survey (V). Commercial and experimental reduced- and regular-fat foods were used as the testing material variables (Table 2). The sensory tests included ratings of pleasantness and the intensity of sensory attributes under blind conditions and in the presence of different types of product information variables (Table 2). Expected pleasantness and attribute intensities were rated in studies III and IV. Each of the tests included a questionnaire on consumer background variables (Table 2). Blind ratings, rated expectations and the ratings with different types of information were compared in a within-subject experimental design in studies I, IV and V, and in a between-subjects design in studies II and III.

SUBJECTS

A total of 743 subjects took part in the four different consumer panels and the survey. The consumer panels were recruited at five places where people worked or studied on the basis of interest and availability. The subjects were not paid for participating but, except in study III, they were given coffee after each session and/or a small gift afterwards. The panels were used to compare consumer reactions to different treatments, i.e. information conditions, and they were not representative samples of the population of Finland.

SAMPLES AND PRODUCT INFORMATION

Different types of everyday foods were used as the testing material. Each of the selected foods was available both as regular- and reduced-fat product versions. Reduced-fat products always contained at least 30% less fat compared to the corresponding regular-fat product. All the products are well known and frequently used by Finnish consumers. The bologna sausages (III) and the chocolate bars (IV) were specially made in pilot production for the relevant study, and the fat spreads (I), yogurts (II) and frankfurters (IV) were commercial products.

The product information which was given to the subjects was either related to the fat content of the product (reduced or regular) or to the taste of the product. Furthermore, information on reduced salt content was used in the study of fat spreads (I). All the information was presented as product claims which might be used in product packages variables (Table 2). In studies I and III, the information was presented both on the dishes where the samples were presented and on the questionnaires. In the sensory experiment on yogurt (II) and in survey (V), the information was only presented on the questionnaires. In study IV, information was presented on photographs of frankfurter and chocolate bar...
packages. The subjects were shown one picture at a time and they were told that they were going to taste a product which was packaged like the product in the picture.

**PROCEDURE**

In each of the sensory consumer studies (I-IV), the products were tasted blind (blind condition) and with information (informed condition), and the effect of the information was derived from the difference between the two ratings. The blind ratings were either done on the same subjects which later got the product information (within-subject design) (I, IV), or the two ratings were measured using different subjects (between-subjects design) (II, III). Expected pleasantness and attribute intensities were rated before tasting the products, either in the same session with the blind and informed tasting (III) or in the same session with blind ratings only (IV). Furthermore, the effect of exposure to a reduced-fat food on food acceptance was studied (I): two groups of consumers used reduced-fat, reduced-salt spread at home for 7 days. One of the groups was given product information before and during the home use period while the other group rated the spreads under blind conditions before and after the home use period, and they had a blind sample to use at home.

Five multi-item consumer background scales were used to measure food- and health-related consumer opinions and awareness. *Concern about food and health* (modified from Tuorila and Pangborn, 1998) was measured in each of the studies (I: Table 2, II: Table 2, III: Table 2, V: Table 3). Subjects' involvement with regular-fat foods was measured in the survey by using a modified version of Zaichkowsky's *Personal involvement inventory* scale (Zaichkowsky, 1985; McQuarrie and Munson, 1991) (V: Table 3). The *Body consciousness* scale (Miller et al., 1981) and a sensory modification, the *Food sensation* scale, were included in one study (II: Table 2), and the *Substitution* scale (modified from Kristal et al., 1990) was used in two studies (II: Table 2, III: Table 2). The frequency of use of the products which were used as samples in the different studies was rated for a reduced-fat spread (I), fat-free yogurt (II) and bologna (III). The correspondence of the scores on each background scale with the reactions to the provided product information was studied by grouping the subject consumers of each study based on high and low scores for each scale and using the subject sub-groups as between-subjects factors in the data analysis.
Table 2. General description of the studies.

<table>
<thead>
<tr>
<th>STUDY</th>
<th>SAMPLES</th>
<th>SUBJECTS</th>
<th>INFORMATION TRANSLATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A  Reduced-salt and reduced-fat spread (40% fat)</td>
<td>n=50</td>
<td>A  Reduced-salt, reduced-fat spread (40% fat)</td>
</tr>
<tr>
<td></td>
<td>B  Regular-salt and reduced-fat spread (40% fat)</td>
<td></td>
<td>B  Regular-salt, reduced-fat spread (40% fat)</td>
</tr>
<tr>
<td></td>
<td>C  Regular-salt and regular-fat spread (80% fat)</td>
<td></td>
<td>C  Regular-salt margarine (80% fat)</td>
</tr>
<tr>
<td></td>
<td>D  High-salt and regular-fat spread (80% fat)</td>
<td></td>
<td>D  High-salt margarine (80% fat)</td>
</tr>
<tr>
<td>II</td>
<td>A  Strawberry yogurt (0.5% fat)</td>
<td>n=234</td>
<td>A  Strawberry yogurt</td>
</tr>
<tr>
<td></td>
<td>B  Fat-free strawberry yogurt</td>
<td></td>
<td>B  New, tasty fat-free strawberry yogurt</td>
</tr>
<tr>
<td></td>
<td>C  New, tasty fat-free strawberry yogurt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>A  Reduced-fat bologna sausage (10% fat)</td>
<td>n=115</td>
<td>A  Light bologna (10% fat)</td>
</tr>
<tr>
<td></td>
<td>B  Regular-fat bologna sausage (20% fat)</td>
<td></td>
<td>B  Regular type of bologna (20% fat)</td>
</tr>
<tr>
<td>IV</td>
<td>A  Frankfurter sausage (13% fat)</td>
<td>n=91</td>
<td>A  Reduced-fat</td>
</tr>
<tr>
<td></td>
<td>B  Chocolate bar (16% fat)</td>
<td></td>
<td>A  Flavourful meat taste</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B  Flavourful chocolate taste (no added information)</td>
</tr>
<tr>
<td>V</td>
<td>Product names:</td>
<td>n=253</td>
<td>A-D  Regular-fat</td>
</tr>
<tr>
<td></td>
<td>A  Fat spread</td>
<td></td>
<td>A-C,D  Reduced-fat (at least 30% fat reduction)</td>
</tr>
<tr>
<td></td>
<td>B  Yogurt</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C  Frankfurter sausage</td>
<td></td>
<td>B  Fat-free</td>
</tr>
<tr>
<td></td>
<td>D  Chocolate bar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Continues.

<table>
<thead>
<tr>
<th>STUDY</th>
<th>INFORMATION ORIGINAL IN FINNISH</th>
<th>BACKGROUND SCALES</th>
<th>SENSORY VARIABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Vähäsuolainen kevytlevite (40% rasvaa)</td>
<td>• Concern</td>
<td>• Pleasantness</td>
</tr>
<tr>
<td></td>
<td>Normaalisuolainen kevytlevite (40% rasvaa)</td>
<td>• Use of reduced-fat spreads</td>
<td>• Saltiness</td>
</tr>
<tr>
<td></td>
<td>Normaalisuolainen margariini (80% rasvaa)</td>
<td></td>
<td>• Melting rate</td>
</tr>
<tr>
<td></td>
<td>Runsassuolainen margariini (80% rasvaa)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Mansikkajogurtti Rasvaton mansikkajogurtti</td>
<td>• Concern</td>
<td>• Pleasantness</td>
</tr>
<tr>
<td></td>
<td>Uusi, maukas rasvaton mansikkajogurtti</td>
<td>• Food sensation</td>
<td>• Sweetness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Body</td>
<td>• Sourness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• consciousness</td>
<td>• Thickness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Substitution</td>
<td>• Smoothness</td>
</tr>
<tr>
<td>III</td>
<td>Kevyt lauantaimakkara (10% rasvaa)</td>
<td>• Concern</td>
<td>Expected and actual:</td>
</tr>
<tr>
<td></td>
<td>Tavallinen lauantaimakkara (20% rasvaa)</td>
<td>• Use of bolognas</td>
<td>• Pleasantness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Substitution</td>
<td>• Juiciness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Saltiness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Fattiness</td>
</tr>
<tr>
<td>IV</td>
<td>Rasvaa vähennetty Täyteläinen lihan maku</td>
<td>• Concern</td>
<td>Expected and actual:</td>
</tr>
<tr>
<td></td>
<td>Täyteläinen suklaan maku (ei lisättyä tietoa)</td>
<td></td>
<td>• Pleasantness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Fattiness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Flavour intensity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Juiciness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(frankfurter)/</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Melting rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(chocolate)</td>
</tr>
<tr>
<td>V</td>
<td>Normaalirasvainen</td>
<td>• Concern</td>
<td>• Pleasantness</td>
</tr>
<tr>
<td></td>
<td>Vähärasvainen (rasvaa vähennetty vähintään 30%) Rasvaton</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Buying probability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Involvement</td>
<td></td>
</tr>
</tbody>
</table>
**Data Analysis**

Repeated measures analysis of variance was used to test the differences between the mean sensory and hedonic ratings in different information conditions. The analysis of variance models were formed with several between-subjects and within-subject factors. Gender, age and the sub-groups which were formed on the basis of the background questionnaires were used as between-subjects factors, and the information condition (blind vs. informed) was, depending on the experimental design, used either as a within-subject or as a between-subjects factor. The structures of the background scales were analysed using item analysis (I-V), principal component analysis (II, III) and factor analysis (V).
RESULTS

THE EFFECTS OF PRODUCT INFORMATION

Ratings of the products with the reduced-fat information present were compared either to the ratings of the same product under blind rating conditions or under regular-fat information conditions, depending on the design of each study (I-V). The pleasantness of reduced-salt, reduced-fat spread increased and the pleasantness of high-salt, regular-fat spread decreased when information was presented with the product (I). Information only affected pleasantness before the period of home use of the spreads and not afterwards, and home use did not affect sensory or hedonic ratings of the spreads (I: Fig. 5a). Pleasantness of both regular- and reduced-fat bologna sausages increased when information was presented (III: Fig. 1). Information also increased pleasantness of frankfurter sausages (IV: Fig. 1). In the survey, reduced-fat information decreased the pleasantness of chocolate bars and yogurts, and increased the buying probability of margarines (V: Fig. 1). A summary of the observed effects of product information on rated acceptance is presented in Table 3.

The saltiness and fattiness of bolognas decreased when the reduced-fat information was presented, and juiciness increased with both regular- and reduced-fat information (III: Fig. 1). The fattiness of frankfurters decreased and juiciness increased with all types of tested information (reduced-fat, flavourful, basic) (IV: Figs. 1a, 1c). The fattiness of chocolate bars decreased when they were labelled as Reduced-fat (IV: Figs. 1b, 1d). Sweetness, sourness, thickness and smoothness of strawberry yogurts were rated equally intense with all types of tested information (II: Fig. 1).

EXPECTATIONS AND ACTUAL RATINGS

The subjects rated the pleasantness and intensities of sensory attributes of bolognas, frankfurters and chocolate bars before tasting the products (III, IV). These expectations of reduced-fat products were compared to expectations of regular-fat products and to the blind actual ratings of the product. The expected pleasantness, juiciness, saltiness and fattiness of reduced-fat bolognas were lower compared to the regular-fat bolognas (III: Fig. 1). Compared to the blind actual ratings, the expected saltiness and fattiness of bolognas were lower, and pleasantness and juiciness higher (III: Fig. 1). The expected pleasantness of frankfurters and chocolate bars was not different from blind actual ratings with any type of product information (reduced-fat/flavourful/basic) (IV: Fig. 3). Expected fattiness, flavour intensity and juiciness of reduced-fat frankfurters were lower than the expected sensory attributes of frankfurters which were labelled with other types of information (IV: Fig. 2). Expected attribute intensities (fattiness, flavour intensity and melting rate) of
**Table 3.** The effects of different types of information on acceptance in studies I-V.

<table>
<thead>
<tr>
<th>ACCEPTANCE PRODUCT</th>
<th>INFORMATION</th>
<th>STUDY</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spread</td>
<td>Reduced-fat &amp; reduced-salt</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Bologna</td>
<td>Reduced-fat</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular-fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frankfurter</td>
<td>Reduced-fat</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular-fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flavourful</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Spread</td>
<td>Reduced-fat</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>*Frankfurter</td>
<td>Reduced-fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Buying probability</td>
</tr>
<tr>
<td>Yogurt</td>
<td>Fat-free</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tasty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate bar</td>
<td>Reduced-fat</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular-fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flavourful</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spread</td>
<td>Regular-fat &amp; high-salt</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>*Yogurt</td>
<td>Fat-free</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>*Frankfurter</td>
<td>Reduced-fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Chocolate bar</td>
<td>Reduced-fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Males</td>
</tr>
</tbody>
</table>

*The marked products were evaluated by product names in the survey (V).

Chocolate bars were low with reduced-fat information as well (IV: Fig. 2). Expected juiciness of frankfurters, and fattiness and flavour intensity of chocolate bars were higher than in blind test conditions, but the effect was not observed for foods which were labelled as reduced-fat (IV: Fig. 3). All three types of information increased the expected melting rate of chocolate bars (IV: Fig. 3).

Regular- and reduced-fat information increased the expected and actual pleasantness and juiciness of bolognas compared to the blind actual ratings, while reduced-fat information decreased the expected and actual saltiness and fattiness (III: Fig. 1). Thus, the ratings assimilated to the expectations. Correspondingly, the rated juiciness of frankfurters increased when the expectation increased, and the rated fattiness of chocolate bars decreased when the expectation decreased (IV: Fig. 3). However, the decrease of the expected flavour intensity of reduced-fat frankfurters and the fattiness of reduced-fat chocolate bars did not affect the actual ratings of the products (IV: Fig. 3). The increase of the expected fattiness, flavour intensity and melting rate of chocolate bars did not affect the actual ratings of the products (IV: Fig. 3).
In the survey, the pleasantness ratings for reduced-fat yogurts and chocolate bars were lower than for regular-fat products, and the buying probability for reduced-fat margarines was higher than that for regular-fat margarines (V: Fig. 1).

**The Role of Consumer Background**

Females rated reduced-fat frankfurters more pleasant than frankfurters which were labelled with flavourful and basic information (IV). Males rated chocolate bars more pleasant when labelled with flavourful information than with reduced-fat and basic information (IV). In the survey, reduced-fat information decreased the pleasantness ratings of frankfurters and yogurts by males, and females rated the buying probability for reduced-fat frankfurters and margarines higher than for regular-fat products (V: Fig. 2). Reduced-fat information increased pleasantness and buying probability of spreads in the oldest age group (V: Fig. 3).

High scores on the Concern scale increased pleasantness of reduced-salt, reduced-fat spreads (I: Fig. 4). In the other sensory experiments, concern ratings did not affect pleasantness (II, III, IV). In the survey, low scores on the Concern scale decreased the pleasantness of reduced-fat frankfurters and yogurts, and high concern scores increased the pleasantness of reduced-fat margarines and buying probability of reduced-fat margarines and frankfurters (V: Fig. 4).

Increasing rated involvement on the PII scale (McQuarrie and Munson, 1991) measuring personal interest in and importance of all the tested regular-fat products was related to increasing pleasantness and buying probability for both regular- and reduced-fat foods (V: Fig. 6). The interaction effect of involvement and fat content information was observed in the ratings of frankfurters and chocolate bars: the subjects who were more involved with frankfurters rated regular-fat frankfurters more pleasant than reduced-fat frankfurters, while there was no difference between the products in the lower involvement groups. Respectively, the difference in rated pleasantness and buying probability between regular- and reduced-fat chocolate bars increased as involvement with chocolate bars increased (V: Figs. 6g, 6h). In the high involvement group, buying probability for reduced-fat margarines was higher compared to regular-fat products (V: Fig. 6f).

The relevance of Food sensation, Body consciousness and Substitution scales (II: Table 2, III: Table 2) on the ratings of fat-free yogurts and bolognas was marginal. The results for these scales are reported in the original articles II and III.
DISCUSSION

The present data shows that product information has a different role in the acceptance of different foods. It was clearly seen that the provided information was relevant for the acceptance of sausages and irrelevant for the acceptance of fruit yogurts, for example. The importance of the content of product information also varied between products. Reduced-fat information increased the pleasantness of spreads while both regular- and reduced-fat as well as taste-related information improved the acceptance of sausages. The reasons for the different effects of information can be further analysed by finding out what type of similarities and differences are related to the selection of the products of the present study.

Yogurts and chocolate bars were examples of products whose pleasantness in the sensory studies was independent of the information provided about fat content and taste. In the survey, reduced-fat information decreased pleasantness. As fat-free strawberry yogurt is a normal everyday food and it was rated pleasant by the subjects with and without fat-free and taste information, it was probably perceived as a familiar and well accepted product. On the other hand, yogurt was apparently perceived as a light and healthy product even without any particular information. Lähteenmäki and Tuorila (1995) previously observed that yogurt consumption was independent of dieters’ dietary restraint scores, while consumption of cheese, butter and margarine decreased with increasing restrained scores. Yogurt was also mentioned as a diet food among US students (Sobal and Cassidy, 1987). The observed lack of effect of information was thus probably due to the low relevance of the provided information with respect to a yogurt which was perceived as a familiar, well accepted and healthy product. In general, consumers do not pay much attention to information which is not necessarily needed (Lannon, 1986).

Chocolate is one of the most preferred and craved foods which is at the same time considered unhealthy (Rozin et al., 1991; Tuorila and Pangborn, 1988; Roininen et al., in press). It was thus predicted that a high expected pleasantness would be connected to a chocolate bar and a considerably lower expectation to a reduced-fat chocolate. However, no difference was observed in expected or actual pleasantness between the chocolates in the sensory study. Similar reasons for the weak effect of reduced-fat information may be offered for chocolate bars as for yogurts, but for opposite reasons. Perceptions of chocolate differ from those of yogurt with respect to healthfulness: the former is considered unhealthy regardless of any fat-content information. Roininen et al. (1999) also reported that reduced-fat chocolate bars were rated unhealthy by both those subjects who scored low and those who scored high on General health interest and Light product interest scales. This general assumption about the properties of chocolate may have blocked the effect of information.

Pleasantness of bolognas and frankfurters increased compared to blind ratings when information was given about the products. Information overall changed ratings compared
to blind ratings, but there was no difference between the different types of information, regular-fat, reduced-fat and taste information. It seems clear that for product acceptance, availability and the way the information is given are more relevant than information content. A possible explanation for the difference between ratings for sausages (bolognas and frankfurters) and chocolate bars is that different types of expectations are originally related to these foods. People are generally less willing to taste unknown meat products than unknown fruits and vegetables for example (Pliner and Pelchat, 1991). In addition, the general high acceptance of chocolates (Rozin et al., 1991) may cause a chocolate bar with no information to be rated without bias while a sausage in a blind tasting condition is always rated less acceptable than when presented with product information. Items referring to sausage in general or reduced-fat sausage were most often sorted into category ‘not healthful and not pleasure-giving’ while chocolate was most often sorted into the ‘not healthful and pleasure-giving’ category in a sorting task (Roininen et al., in press). Forty-seven Finnish subjects completed the sorting task with 32 fruits and vegetables, milk products, staples, meat and fish, beverages and sweets. The subjects were asked to sort the foods into four categories on the basis of two aspects with two levels: Yes/No Healthful and Yes/No Pleasure-giving (Roininen et al., in press). The study was focused on the reason behind the categorisation but it also gives an idea of differences in how sausages and chocolates are perceived.

Based on the present results consumers seem to have partly different reasons for the acceptance of fat spreads than for the other tested products. The fat spread was the only product whose pleasantness increased when especially reduced-fat information was presented. A positive effect of health concern and involvement with spreads on the pleasantness of reduced-fat product was also remarkable for this product. These results suggest that health-related reasons are emphasised in spread selection. In the period immediately prior to the present study on spreads (spring 1994), an increase in the use of reduced-fat spreads and a decrease in the use of regular-fat butter and margarine were observed in Finland (Kleemola et al., 1996; National Public Health Institute/Department of Nutrition, 1999). Furthermore, 2% of adults used a totally new margarine which is designed to decrease blood cholesterol level (Helakorpi et al., 1996). The present result that spread is a food which is selected on the basis of nutritional reasons, is in accordance with these changes in the Finnish food habits. The reduced-salt information which was added to reduced-fat information in the sensory study may have emphasised the result. However, the effect of reduced-fat information was confirmed in the survey.

Product information influenced rated intensity of sensory attributes more clearly than rated pleasantness. Thus, the differences in rated fattiness and saltiness of regular- and reduced-fat bolognas, or in fattiness of chocolate bars, did not affect pleasantness. Respectively, Schifferstein (1995) reported that a sensory context (sweetness intensity) affected rated sweetness but not pleasantness. His conclusion was that a substantial hedonic difference is needed between samples to create a contextual shift in pleasantness.
ratings. In the present study, a different context was created for each product by labelling them ‘regular’, ‘reduced-fat’ or ‘tasty’. The differences between these contexts were probably not big enough for the consumers to result in differences in rated pleasantness.

A connection between reduced-fat information and decreased expected pleasantness was observed in two parts of the present study: reduced-fat bolognas were expected to taste less pleasant than regular-fat bolognas, and, in the survey, reduced-fat chocolate bars, yogurts and frankfurters (by males) were rated less pleasant than regular-fat products. The subjects who were classified as having low concern about food and health also rated pleasantness of reduced-fat frankfurters and yogurts low compared to regular-fat products in the survey. These results on low expected acceptance of reduced-fat foods by a subgroup of subjects were in line with a previous study where negative expectations were observed for reduced-fat foods (Tuorila et al., 1994a).

The effects of expected pleasantness and attribute intensities on actual ratings were only observed in a few sensory attributes of bolognas, frankfurters and chocolate bars. Each of these effects supports the assimilation model of the effect of context on ratings, i.e. the actual rating was biased in the direction of the context (expectation) compared to the blind rating. Assimilation effect has been also reported in other sensory studies of the effects of expectations on actual ratings (Deliza and MacFie, 1996). The expected pleasantness ratings were observed to be difficult to influence. Especially the use of real food packages had no effect on expected pleasantness, which may be due to other types of information - such as colour, shape of the package and the lack of brand name - besides the tested verbal information. The small or non-existent effect of expectations on actual ratings was thus due to small differences between expectations and actual ratings. In addition, the differences between expectations related to information on regular- and reduced-fat content and taste were small. It is anticipated that product information has to be stronger, or the products less familiar to the subjects, to create more extreme expectations, as has been observed in previous studies (Cardello et al., 1985; Cardello, 1994; Tuorila et al., 1994b). Overall, the meaning of the concept of expectations in the present study with real familiar foods was to show that the information did not create big differences between the samples and that in the combination of product and information the sensory properties of products dominated acceptance ratings.

The five studies were all designed a bit differently. The use of both within-subject and between-subjects experimental designs allowed methodological comparisons between them. It was evident that a within-subject design resulted in bigger differences between the studied treatments: the effect of the type of product information was observed with spreads, bolognas and in the survey. From the subjects’ point of view the main difference between within-subject experiments and between-subjects experiments is that in former the subject can make comparisons between several samples. A single sample presentation was used in the yogurt experiment, as well as in the frankfurter and chocolate experiments, in which no differences were observed between the samples named as regular- and
reduced-fat. Presenting several samples side-by-side has been also previously suggested to increase the possibility of finding differences between samples (McBride, 1986). However, the advantage of using a within-subject design and multiple sample presentation is that all the subjects are making comparisons between the same products or information and not with respect to their own experiences, which may be different for each subject.

The findings regarding gender differences corroborated those of previous studies (Wardle and Marsland, 1990; Alexander and Tepper, 1995; Fagerli and Wandel, 1999; Roininen et al., 1999). The different effects of fat content depending on gender were seen in ratings of all other products but chocolate in the survey. The observed effect was a systematic effect of males giving regular-fat products and females reduced-fat products a more favourable rating. The observed positive ratings of reduced-fat foods by females promotes the assumption that females in general pay more attention to fat in food and experience more need to control their eating than males (Fagerli and Wandel, 1999; Roininen et al., 1999).

High scores on the Concern scale were related to increased pleasantness upon receiving reduced-fat information. Although the relationship was seen in the sensory study on spreads and in the survey (all products except chocolate) it was not apparent in the other three sensory studies. Some inconsistencies have also been observed in previous studies on the effect of consumer attitude background on the acceptance ratings of regular- and reduced-fat foods (Aaron et al., 1994; Shepherd et al., 1991/92; Westcombe and Wardle, 1997). It should also be noted that the measures of consumer attitudes used in these former studies were mostly focused on the particular product being studied. Fat content information increased liking for low-fat flavoured milk among subjects who had a positive attitude towards low-fat flavoured milks (Shepherd et al., 1991/92). Correspondingly, a positive attitude to reduced-fat spreads was reported to result in increased pleasantness of a reduced-fat spread when fat content information was provided (Aaron et al., 1994). In fact, these subjects responded positively to questions about the use and usefulness of a reduced-fat food and gave high pleasantness ratings when the same product was rated in a sensory test. Westcombe and Wardle (1997) used several types of background measures to determine dietary behaviour and motivation and attitudes towards fat in foods, and only a single question about the influence of health concerns on food selection showed an interaction with the effect of fat content information on pleasantness ratings.

Involvement with the products of the present study was measured using a multi-item scale developed by McQuarrie and Munson (1991). The scale offered an opportunity to measure involvement by using a validated and documented scale which was observed to be related to the effects of information on pleasantness and buying probability in the survey. However, the fact that involvement is measured for only one product at a time makes it unsuitable to assess a general background variable for all foods, for example. It was observed that the effect of regular-/reduced-fat information on acceptance was strongest in subject sub-groups which were involved with the studied product. The effect of
involvement was observed with frankfurters, spreads and chocolate bars, but not with yogurts. It was observed that changes in fat content of those products which consumers were most involved with caused differences in acceptance ratings. It was noteworthy that, while those subjects who were involved with the rated product rated regular-fat frankfurters and chocolate bars more acceptable, they rated reduced-fat spreads more acceptable. This may again tell about the special attitude to spreads (see above): those who are involved with spreads place value on reduced fat content. The present results also show that high involvement increased pleasantness for all the tested products. This suggests that for foods, hedonic values and involvement are related with each other. Generally, the hedonic value of a product or consumption decision may be related to involvement but this not necessary if the product has some other values for the consumer (Mittal, 1995).

The present results, together with previous research, show that as food selection criteria vary even within-subject, depending on the product, it is a demanding task to create a general consumer background measure to predict selections. The present study measured the effect of a cognitive factor, information on fat content, on acceptance. Concern about food and health was used as a background measure to explain which subjects would react to reduced-fat information, and what the direction of their reaction in pleasantness ratings would be. It was however noticed that concern was not a relevant measure for all products. The results show that the selection of all foods is not related to health concerns, not even selection of all fat containing foods. Some of the foods are simply perceived as "too healthy" (yogurt) or "too unhealthy" (chocolate, sausage) to be evaluated on a healthiness continuum. The use of concern scale in the present study gave an opportunity to find out which type of products tend to be more and which tend to be less selected for health reasons. The different role of fat content information in acceptance of different products can be explained by the different reasons for selecting foods. Both affective and cognitive factors are recognised to affect consumer acceptance and choice (Zajonc, 1980; Zajonc and Markus, 1982; Schutz, 1994). The present data shows that some foods are apparently selected with more awareness and cognitive involvement while the selection of some foods is more based on emotion.

Cantin and Dubé (1999) analysed reasons for liking and consumption frequency of different beverages by dividing the reasons into two groups, affective and cognitive. Affective reasons included sensory, emotional and social aspects, while cognitive reasons included physiological, functional and symbolic aspects related to each product. It was observed that liking was mostly based on affective reasons while cognitive reasons were better predictors of consumption of beverages (Cantin and Dubé, 1999). Roininen et al. (1999) have used a similar type of dichotomy of affective and cognitive reasons of food selection as a basis when analysing subjects’ food related attitudes. Several scales were developed to measure individual attitudes towards the importance of taste and healthiness of food. Health- and taste-related attitudes were observed to affect self-reported use frequency and observed food selections but not pleasantness ratings (Roininen et al.,
1999). The Personal involvement inventory scale which was used in the present study (McQuarrie and Munson, 1991) included items related to importance of and interest in the studied products. The scale was seen to be able to measure both the hedonic (chocolate) and the cognitive (spread) importance of the products. The Personal involvement inventory scale also makes it possible to find those products and subjects to which not much selection-related effort is related. In these cases, information cannot be expected to have much effect on selection.

The present results together with previous studies suggest that fat-content information changes acceptance of such products which are selected more on a cognitive than on an affective basis. Information and knowledge about product properties, together with sensory pleasantness and other affective aspects, influence acceptance. However, actual choice is probably influenced more by information than pleasantness ratings and it will be interesting to concentrate future research more on the effects of information on actual food choice. The usability of the Personal involvement inventory scale should also be tested in a sensory study. Information should be obtained about those properties which are relevant for the selection of a particular food. When affective factors are important, information about them is effective. When cognitive aspects are dominant in selection, fat content and other cognitive aspects will affect acceptance.
**Conclusions**

The effects of product information on the acceptance of foods varies between different types of products. All types of tested information affected pleasantness of some foods, while information on reduced fat content was relevant for some, and the acceptance of some products was not affected by any information. Sensory properties of reduced-fat foods were rated a bit different than those of regular-fat foods, but the perceived sensory differences had no effect on pleasantness. Only minor effects of information and food packaging on expected pleasantness were observed and the expectations had no effect on actual acceptance. Fat content information does not affect the acceptance of those foods which are generally clearly considered either as healthy or unhealthy or which are not at all liked or liked very much. Information and concern about food and health influence the choice of those foods that are selected more for objective cognitive reasons than for their pleasantness or other affective reasons. Consumer involvement with the studied products was a relevant measure of how much attention was paid to the information since involvement increased the effect of fat-content information on pleasantness. In future research, the effect of information on actual food selection and consumption should be measured together with pleasantness. The results show that it is important to know the reasons for the selection of different foods and to provide product information on those cognitive and affective properties which affect selection.
REFERENCES


CONSUMER ACCEPTANCE OF REDUCED-FAT FOODS-THE EFFECTS OF PRODUCT INFORMATION