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Exploring difficult textural properties of fruit and vegetables for the elderly in Finland and the United Kingdom ☆

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Abstract

In the elderly population, one of the restrictive factors in the diet may be that some foods become troublesome-to-eat as muscle strength deteriorates with age. The aim of the study was to explore what characteristics of foods may cause eating difficulties among elderly respondents in Finland and the United Kingdom (UK). Participants ($n = 77$ in Finland and $n = 76$ in the UK) were from two age groups (23–40 and 60+). Troublesome-to-eat and easy-to-eat texture characteristics of 19 fruit and 19 vegetables were elicited using a combination of sorting and laddering interview techniques. Data were analysed separately for the two age groups and the two countries. The attributes that were found to be the most troublesome for both age groups and both countries were the presence of peel or seeds, and hard and fibrous textures. The main consequences of these attributes were a difficulty to bite into, to chew, to swallow, or to prepare. Although, the troublesome texture attributes were perceived almost in the same way in the two age groups, younger respondents were more elaborate than the older age group in describing the difficulties various textures caused them. The British respondents identified more different attributes and troublesome consequences of fruit and vegetable textures than the Finnish respondents. However, the main structures of the hierarchical value maps were very similar.

1. Introduction

Within the next 25 years, it has been projected that the percentage of people over 60 years in Europe will be 27%,; this will be from 5% to 12% more than in the year 2000 (Dichter, 1992; United Nations Statistic Division, 2000). An increasing proportion and number of old consumers can create special demands for food products, since the functioning of senses and muscle force are known to deteriorate with age. The decline in the performance of sense of smell has been well reported (Stevens & Cain, 1993). Duffy, Backstrand, and Ferris (1995) found in the study of 80 free-living elderly women (aged 65–93) that 50% of respondents had olfactory dysfunction. These respondents had lower interest in food-related activities such as cooking, lower preference for sour and bitter-tasting foods and higher intake of sweets. de Graaf, Polet, and van Staveren (1994) found that, on average, elderly subjects (aged 70–82) preferred higher concentrations of food flavours, and they also perceived the higher concentrations as less intense than young subjects (aged 20–25) did. People with olfactory dysfunction may value the texture, along with the taste quality, of foods more than young people do (Duffy et al., 1995).

Although the elderly people may value more the textural attributes in food, ageing also causes changes in ability to process foods in the mouth. Weakening of muscle strength may impair the chewing process. According to Kohyama, Mioche, and Martin (2002) the efficiency of a single chew was weaker for the group with mean age of 68 years compared to a young group with the mean age of 29 years. However, the elderly respondents increased the number of chews in processing in five out of six food samples used in the study. This means that people have ways to compensate the lacking

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strength in their food processing. Furthermore, wearing whole dentures may affect and impair chewing and mouth movements (Duffy, Cain, & Ferris, 1999). In an Australian survey with 1217 over 60 year old respondents over 5% of the dentate and over 10% of the edentulous respondents reported difficulties during chewing and discomfort during eating, and furthermore avoidance of some foods during the previous year (Slade & Spencer, 1994). In USA impaired dental functioning of elderly over 60 years old resulted in reported texture related eating problems, such as difficulties in chewing and swallowing, avoidance of stringy foods, crunchy foods including vegetables and dry solid foods, e.g. bread (Hildenbrandt, Dominguez, Schork, & Loesche, 1997).

The changes in capability to eat may thus reflect on eating behaviour and nutritional quality of the diet. According to Sheiham and Steele (2001), in UK one out of five free-living over 65 years old respondents with their own teeth and over half of the institutionalised respondents with dentures found raw carrots, apples and nuts difficult to eat. In free-living sample with dentures the consumption of the vegetables and fruit was lower than among those who had their natural teeth. Similarly, Nowjack-Raymer and Sheiham (2003) found that in US the dental state was linked with nutritional quality of the diet, which is important for maintaining good health status. Ability to eat nutritionally high quality foods may extend the span of independent living for the elderly. There seems to be a need to develop palatable products for those elderly whose senses, muscular strength or dental performance has impaired so that their special needs can be taken into account. Jellinek (1989) described low calorie content, easy to prepare, easy to digest, and lively taste and texture as food properties that would correspond to the needs and preferences of the elderly.

The foods perceived to be difficult to eat can be characterised by sensory attributes like hard and tough, which reflect the difficulties in biting and chewing. Kälviäinen, Salovaara, and Tuorila (2002) found that the most critical attributes for muesli oat flakes among the elderly age group were adherence to teeth and need for extensive mastication. According to Peleg (1993), it may be difficult for the elderly if the material requires a large force to break down or extensive mastication, is too dry, adheres to the teeth, or breaks into sharp pieces. Kälviäinen et al. (2002) found that elderly subjects with partial or full dentures placed higher value on greater fragility, milk absorption and lack of adhesion to teeth of muesli oat flakes than elderly participants without dentures. Modifying the texture of foods makes it possible to produce food products that the elderly find more palatable to eat.

Vegetables in general (Hildenbrandt et al., 1997), and particularly carrots, apples and nuts (Sheiham & Steele, 2001) have been reported to cause eating difficulties. Vegetables and fruits, however, are good sources of vitamins and nutrients and The Word Health Organization recommends that their daily consumption should be 400 g per person (WHO, 1990). Low consumption of fruit and vegetables is still a major problem in Western countries in general, and in some population segments in particular (Kennedy, Meyers, & Layden, 1996; Lahti-Koski & Kilkkinen, 2001). According to WHO (2002), increasing consumption of fruit and vegetables by one or two servings daily could cut cardiovascular disease risk by 30%. The common barriers among adult and elderly consumers to adequate fruit and vegetable consumption have been related, not only to difficulty in eating, but also to the inability to prepare them (Dittus, Hillers, & Beerman, 1995). The preparation of vegetables and fruits has been contemplated as time-consuming (Brug, Debie, van Assema, & Weijts, 1995; Brug, Lechner, & de Vries, 1995; Kilcast, Cathro, & Morris, 1996). In addition, Kilcast et al. (1996) found that low vegetable consumers were heavy users of convenience foods, which might also be a consequence of an inability to prepare fruit and vegetables or lack of time. However, none of these studies concentrates on the textural characteristics of fruit and vegetables, which might also be a possible barrier to fruit and vegetable consumption.

The aim of the study was to explore what characteristics of fruit and vegetables are perceived as troublesome or easy to eat, what consequences these characteristics have for eating and how these perceptions differ between young and elderly respondents in Finland and in the UK.

2. Materials and methods

2.1. Subjects

This study was conducted in Finland and in the UK. The respondents in the UK were *young adults* ($n = 36$, age from 23 to 40, mean 31) and *elderly* ($n = 40$, age from 60 to 100, mean 76). Similar age groups were used in Finland (*young adults,* $n = 40$, age from 25 to 40, mean 33) and (elderly, $n = 37$, age from 60 to 79, mean 69). In the UK 71% and in Finland 62% of the elderly respondent groups were at least partial denture wearers. In Finland, the elderly respondents were recruited from travellers on a day ferry between Turku and Stockholm, while the young adult respondents were composed of staff members of VTT and another research institute. In the UK, the young adult group was primarily composed of staff of Leatherhead Food International (LFI), while the elderly group comprised people recruited from local day centres for the elderly.

Based on earlier knowledge, four food categories were chosen for this study: fruit, vegetables, meat and bread. Results of the fruit and vegetables categories are

Table 1
The target foods in different food groups (foods that are only presented in Finland are marked with FIN sign and foods that are only presented in the UK are marked with UK sign)

Fruit	Vegetables
Apple	Avocado (UK)
Apricot (UK)	Broccoli
Banana	Cabbage
Blackberry (UK)	Carrot
Cherry	Cauliflower
Fig (UK)	Celery (UK)
Grapes	Courgette
Kiwi	Cucumber
Mango (UK)	Green beans
Melon (UK)	Leek
Nectarine (UK)	Lettuce
Orange	Mushroom
Peach (FIN)	Onion
Pear	Peas
Pineapple	Pepper
Plum	Potato
Raspberry	Sweetcorn
Strawberry	Swedish turnip (FIN)
Watermelon	Tomato

reported here. For both categories 13–17 products were selected within countries to cover a wide range of texture characteristics (Table 1), and photos of these products as raw and fresh were taken and printed for the interviews. The chosen fruits and vegetables were familiar and readily available in most supermarkets and they were selected to cover the assumed difficult characteristics such as hard, sticky and chewy. Due to familiarity, some of the fruits and vegetables were presented only in UK and some only in Finland.

2.2. Interviews

The one-to-one interviews were divided into two parts: sorting (part A) and texture descriptor elicitation (part B). In part A, the respondents were first told that there were no right or wrong answers to the questions, and that researchers were interested only in respondents' opinions. Respondents were then instructed to sort all 13–17 foods into one of the two different categories: (1) easy-to-eat or (2) troublesome-to-eat. Two of four food categories (fruit, vegetables, bread, and meat) were presented to each respondent, one after the other, in a balanced incomplete block design. In part B, respondents were asked to choose the product they found the easiest to eat/the most troublesome-to-eat and to state the reasons for their choice in terms of texture characteristics. Respondents were then asked to state what made this particular texture easy-to-eat/troublesome-to-eat. They were further asked why the stated consequence was troublesome/easy. The interview was continued in this manner as long as respondent came out with concrete consequences related to the troublesome/easy attribute. This was repeated for each product in the easy-to-eat and in the troublesome-to-eat categories. After part B, the respondents were asked to fill out a background questionnaire on their age, gender, education, use of dentures, use frequencies and desired use frequencies of target foods.

2.3. Data analysis

Frequencies for sorting each fruit or vegetable into the easy or troublesome-to-eat categories were computed separately for the young adult/elderly subjects in the two countries (part A). Information collected during the interviews on easy/troublesome-to-eat foods was content analysed (part B). The used interview technique was a modification of laddering interviews (Reynolds & Gutman, 1988). Instead of asking reasons behind food choices, respondents were interviewed about what makes food troublesome or easy-to-eat. In the content analysis, the attributes and consequences having the same meaning were grouped, and each group was labelled. These groupings formed a scheme that was used to categorise the attributes and the consequences. Categorisation scheme was constructed in English and Finnish data were grouped accordingly without making exact word-by-word translations. After content analysis, laddering data, e.g. attributes and their consequences, were aggregated and interpreted by means of so-called "hierarchical value maps" (HVM), which are graphical representations of the most frequently mentioned links summed across all subjects. These graphic maps were generated using Laddermap software (Gengler & Reynolds, 1993, 1995), which is tailored for analysing means-end chains. The number of links between concepts reflects the complexity of the map, and the strength of line illustrates the number of respondents that mentioned the link. The program forms individual chains and then analyses the number of links across the study population. In this study, a cut-off level of two was chosen, which means that a link is drawn between two concepts if at least two out of 20 respondents mentioned one concept as a direct or indirect link with another concept. With this low cut-off level it is possible to have a rich picture of the possible perceived difficulties in eating vegetables and fruits.

3. Results

Overall, there were only minor differences between young adult and elderly respondents in the classification of the fruits in both countries (Table 2). Bananas, strawberries, raspberries and grapes were found easy-to-eat, whereas pineapples and oranges were perceived as troublesome-to-eat. Young people found watermelon as troublesome-to-eat while the old age group mentioned it less often. Moreover, fruit lists in each

sub-category were very similar between Finnish and British respondents, with some exceptions. For Finnish respondents pineapple presented most often the best description of category 'troublesome-to-eat' while the British respondents had no obvious fruit to nominate. Apples seemed to divide interviewees' responses. In young age group they were found equally often easy or troublesome-to-eat, but in older age group Finnish respondents placed apples mainly in easy-to-eat category whereas the old British participants were divided in their opinion similarly to young people.

As for fruit, there were only minor differences between young adult and elderly respondents in the classification of the vegetables in both countries (Table 3).

Table 2
Sorting frequencies for fruit in Finland and the UK (the number of times each fruit was located in the category and the number of times each fruit was selected as the best representative of the category in both countries)

	Number of times mentioned				Describes the category best			
Age	25–40	25–40	60+	60+	25–40	25–40	60+	60+
Country	FIN $N = 21$	UK $N = 18$	FIN $N = 19$	UK $N = 21$	FIN $N = 21$	UK $N = 18$	FIN $N = 19$	UK $N = 21$
Easy to eat								
Banana	20	18	18	21	6	6	3	9
Strawberry	20	17	17	20	6	2	9	3
Raspberry	19	13	15	17	5	5	1	3
Grapes	17	14	15	19	2	2	1	4
Apple	11	9	17	9	0	0	1	0
Troublesome to eat								
Pineapple	20	9	16	6	15	3	11	4
Orange	15	7	11	7	2	3	2	0
Watermelon	12	10	7	2	1	5	1	0
Kiwi	10	3	5	1	1	0	1	0
Apple	8	9	2	12	0	4	1	6
Blackberry	NA	11	NA	7	NA	1	NA	2
Fig	NA	7	NA	2	NA	0	NA	1

NA means that this food was not available for the sorting in this country.

Table 3
Sorting frequencies for vegetables in Finland and the UK (The number of times each vegetable was located in the category and the number of times each vegetable was selected as the best representative of the category in both countries)

	Number of times mentioned				Describes the category best			
Age	25–40	25–40	60+	60+	25–40	25–40	60+	60+
Country	FIN $N = 21$	UK $N = 18$	FIN $N = 19$	UK $N = 21$	FIN $N = 21$	UK $N = 18$	FIN $N = 19$	UK $N = 21$
Easy to eat								
Tomato	18	11	17	17	6	2	6	2
Cucumber	18	16	15	14	6	2	1	0
Potato	14	15	16	17	2	2	8	2
Lettuce	18	18	12	15	1	0	0	0
Cauliflower	19	16	12	16	0	2	1	3
Mushroom	15	16	15	18	1	2	0	2
Avocado	NA	16	NA	13	NA	7	NA	4
Broccoli	NA	13	NA	18	NA	1	NA	2
Troublesome to eat								
Sweetcorn	16	14	14	14	6	7	3	7
Swedish turnip	12	NA	12	NA	6	NA	5	NA
Onion	8	5	7	3	4	0	2	1
Pepper	5	2	8	3	1	0	3	0
Celery	NA	14	NA	14	NA	4	NA	9
Green beans	4	8	8	1	1	2	0	0
Tomato	0	6	1	1	0	2	1	0
Lettucd	1	0	3	3	0	0	0	1

NA means that this food was not available for the sorting in this country.

There was a high agreement about the easy-to-eat vegetables between both the age groups and the countries. Sweetcorn was perceived as troublesome-to-eat in all subgroups. Hard root vegetables were categorised among troublesome-to-eat, namely swedish turnip in Finland and celery in Britain. Contrary to the elderly British respondents young British adult respondents found green beans the third most troublesome-to-eat vegetables. Tomatoes were mainly categorised as easy-to-eat, but a quarter of young British respondents placed it among troublesome-to-eat, similarly lettuce was mainly perceived as an easy-to-eat vegetable, but some of the old respondents in Finland and UK regarded it as troublesome-to-eat.

3.1. Hierachical value maps

In the HVMs, the links between texture attributes and consequences of attributes were more complex among younger respondents than among elderly subjects in both countries. Overall, the number of attributes and consequences described as troublesome in regard to fruit and vegetable textures was higher in the UK than in Finland.

3.2. Hierarchical value maps of fruits

Seeds and peel together with hard and fibrous texture were attributes that made fruits troublesome-to-eat in all subgroups (Figs. 1a–2b). For the young Finnish adults, *seeds* made fruit troublesome-to-eat because it *needs preparing*, which in turn is *time consuming*, *tiring* and *messy* (Fig. 1a). For the Finnish elderly respondents, *seeds* were seen as troublesome in fruits since *they are difficult to eat with dentures, need to remove from mouth* and one *has to be careful* (Fig. 1b). Both the young adults and the elderly respondents regarded *peel* as troublesome-to-eat because it is *needs preparing* and can

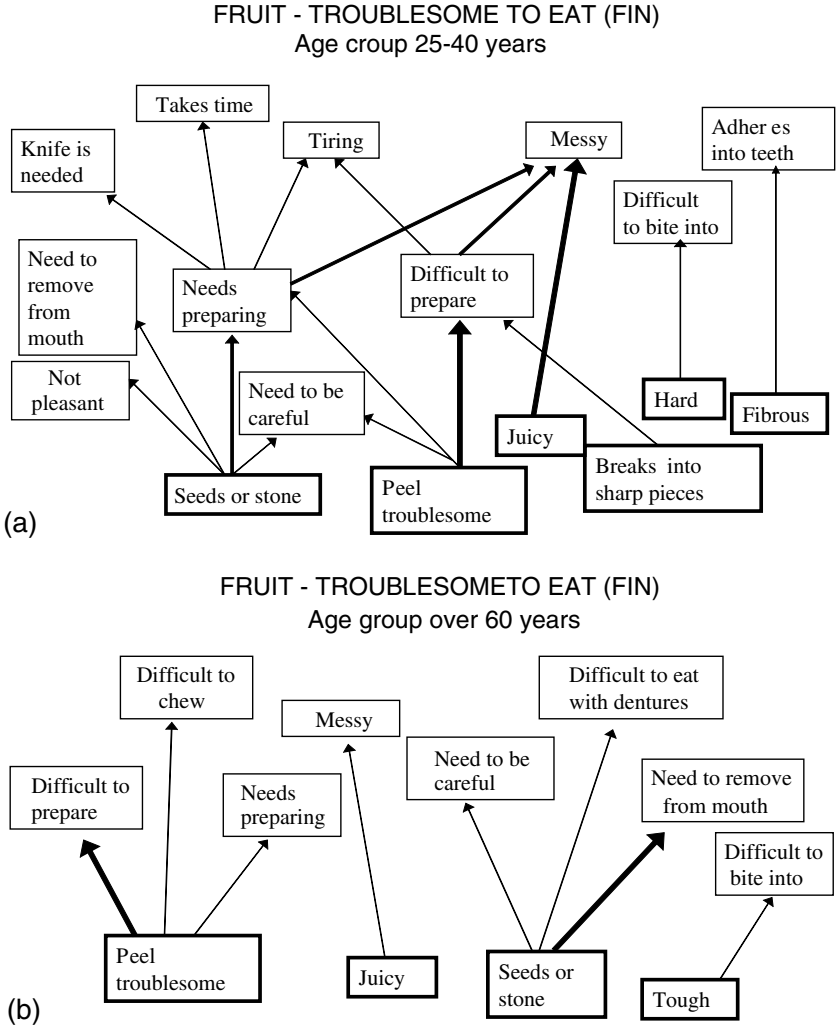

Fig. 1. Hierarchical value map for the troublesome-to-eat fruit of (a) the young adult (aged 25–40) and (b) the elderly Finnish respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

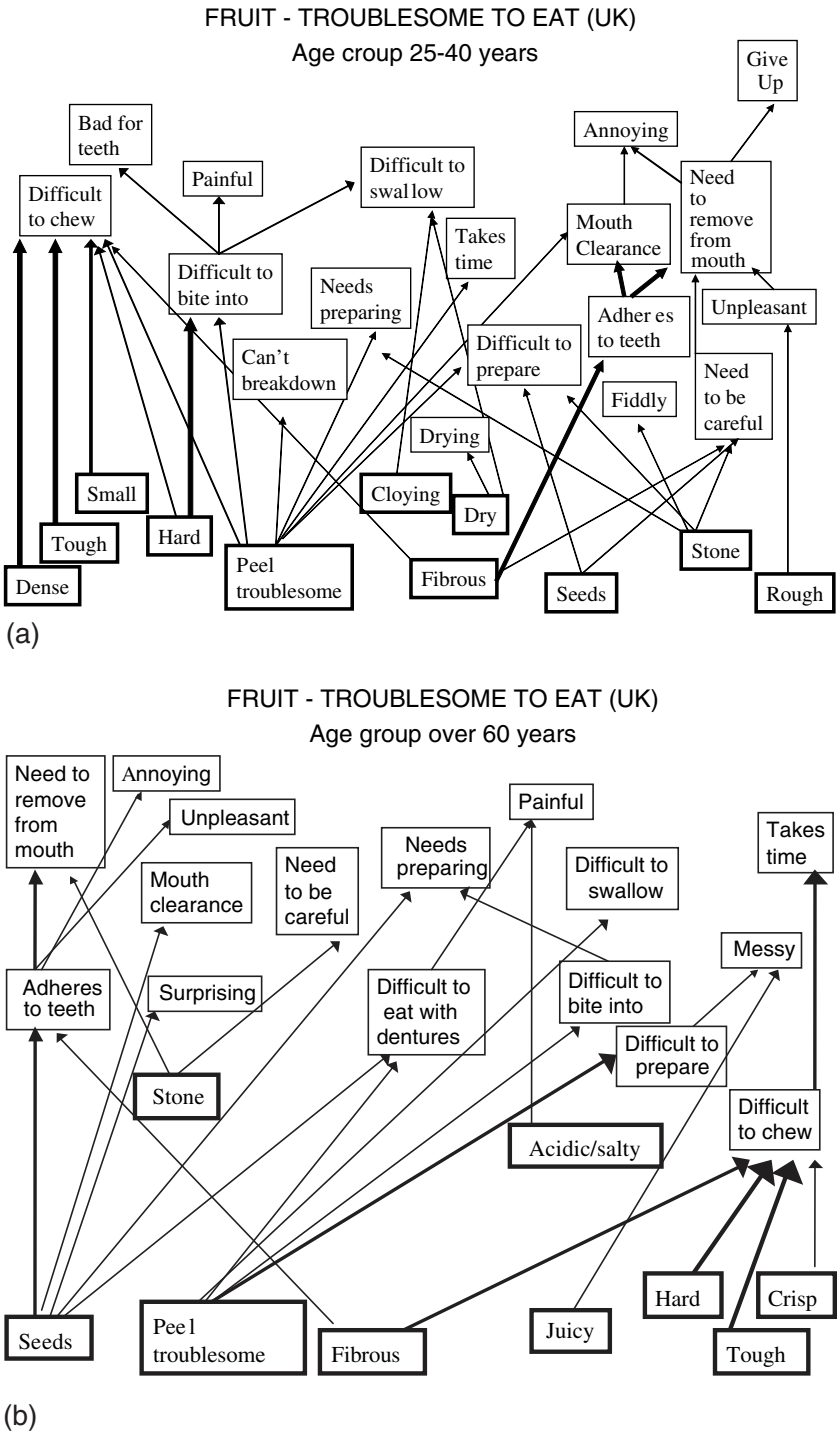

Fig. 2. Hierarchical value map for the troublesome-to-eat fruit of (a) the young adult (aged 23–40) and (b) the elderly British respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

be *difficult to prepare*, which in turn makes peels *tiring* and *messy* for the young respondents (Fig. 1a and b). *Peel* and *seeds* were also considered troublesome-to-eat by the British young adult and the elderly respondents since they *need preparing* or are *difficult to prepare*, and for the elderly they are also *difficult to eat with dentures* (Fig. 2a and b). Moreover, both the young adults and the elderly in UK linked *fibrous*, *hard*, and *tough* fruits to *difficulties in chewing*, which among the old group lead to *more time consumed* in the chewing process. In Finland young age group related troublesome-to-eat strongly with effort required in preparation and messiness of eating where as in the elderly group and both age groups in UK related troublesomeness to difficulties in

processing food in mouth. Dentures were mentioned by some older respondents in both countries as a reason for peels or seeds being difficult to process. Both the young and the old respondents mentioned toughness and hardness as troublesome attributes leading to difficulty to bite or difficult to chew, but there was no difference between age groups (Figs. 1a–2b). One aspect coming out specifically among young British respondents (Fig. 2a) was attributed to *dryness* which made fruits *difficult to swallow*.

For all respondents fruits that were easy to process (*easy to bite*, *easy to chew*, *quick to chew*, *easy to swallow*) were regarded as easy-to-eat (Figs. 3a–4b). These easy-to-eat fruits were described with attributes *soft* and *juicy*. For British respondents attribute *smooth* meant that the fruit *melts in mouth* and is therefore *easy to swallow* (Fig. 4a and b). Another commonly shared aspect of easiness was *does not need preparation*. For Finnish young and old respondents this meant fruits that are *ready to eat*, in addition to young respondents *nice size* and *soft when prepared* made fruit *easy to prepare*, whereas for the elderly *easy to prepare* meant that fruit is *not messy* (Fig. 3a and b). For British *small* and *seeds* (*lack of*) made preparation easier. *No seeds or stone* made fruits easy-to-eat for young Finnish respondents because they *do not adhere into teeth* (Fig. 3a), for old Finnish respondents because they *do not have to be removed from mouth* (Fig. 3b) and for old British respondents because one *does not need to be careful* (Fig. 4b).

3.3. Hierarchical value maps of vegetables

Vegetables that were *hard* or *contained peel* were perceived to be troublesome-to-eat by all respondent groups (Figs. 5a–6b). Hardness meant mainly that the

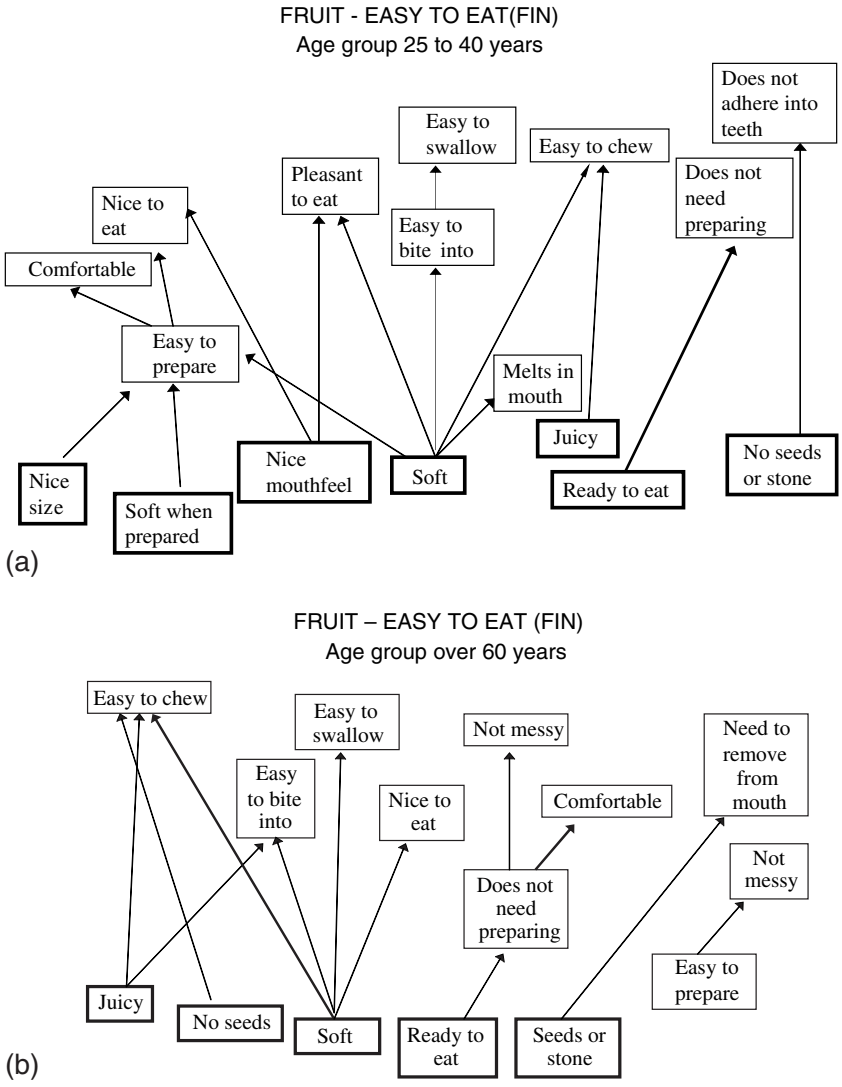

Fig. 3. Hierarchical value map for the easy-to-eat fruit of (a) the young adult (aged 23–40) and (b) the elderly Finnish respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

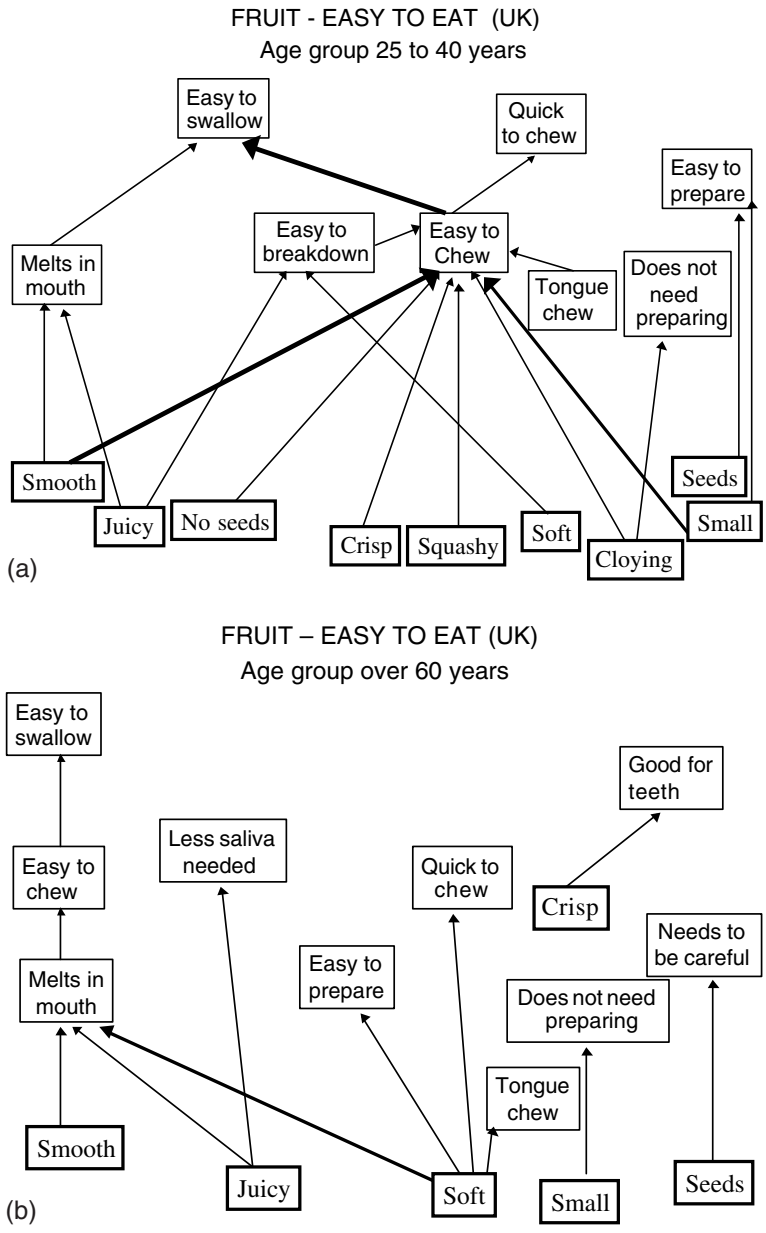

Fig. 4. Hierarchical value map for the easy-to-eat fruit of (a) the young adult (aged 23–40) and (b) the elderly British respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

vegetable was *difficult to bite into* (Figs. 5a, b and 6a) and *difficult to chew* (Figs. 5a, 6a and b). For Finnish respondents hardness also related to *difficult to prepare* (Fig. 5a and b) and for old Finnish *respondents difficult to eat with dentures* (Fig. 5b). For young British group hard was also related to slow *mouth clearance* and could therefore be *annoying* (Fig. 6a), while the old British respondents linked *hard* with *painful* (Fig. 6b). In addition to hardness, British young respondents mentioned many attributes that made vegetables *difficult to chew*, such as tough, rough, big and dense (Fig. 6a). *Troublesome peel* made vegetables *difficult to prepare* for Finnish respondents (Fig. 5a and b) or *needing preparation* among the old British group (Fig. 6b). In young groups both in Finland and UK peel also *adhered to teeth* (Figs. 5a and 6a). In UK, peel was associated with *difficult to chew* (Fig. 6a and b). Attribute *fibrous* came out as a central attribute among British respondent and made vegetables to *adhere to teeth*, *difficult to chew or swallow or to break down* (Fig. 6a and b). The old group also found *fibrous* needed *removing from mouth*, *was unpleasant* and *socially not acceptable* (Fig. 6b). The *cob* was also found troublesome in UK, but not in Finland. For young respondents it meant *need to tear or pull* (Fig. 6a), while for the old group it would be *difficult to eat with dentures* (Fig. 6b). Old Finnish respondents mentioned vegetables *breaking into sharp pieces not being pleasant* (Fig. 5b). The *sliminess or juiciness* that was

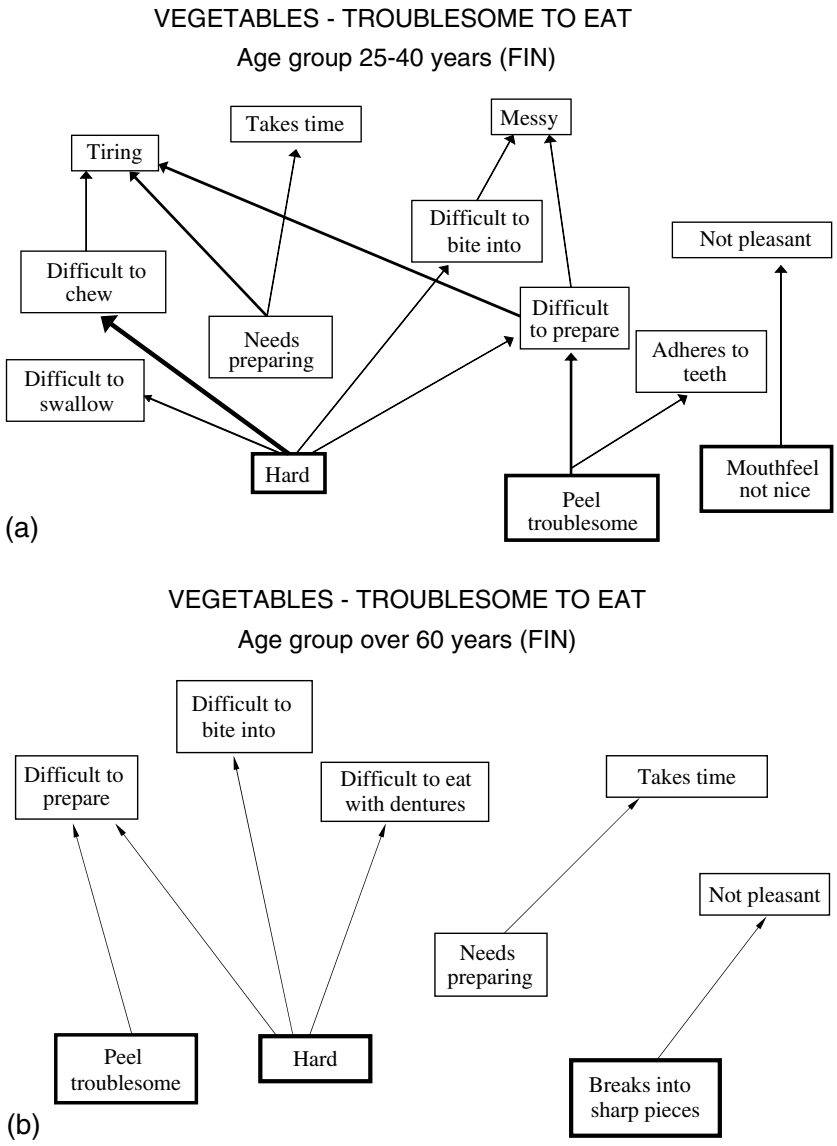

Fig. 5. Hierarchical value map for the troublesome-to-eat vegetables of (a) the young adult (aged 25–40) and (b) the elderly Finnish respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

commonly mentioned with fruits, was mentioned only among young British respondents making the vegetables *messy or fiddly* (Fig. 6a).

There was wide consensus about the attributes that made vegetables easy-to-eat (Figs. 7a–8b). *Soft*, *juicy* and *crisp* vegetables made food *easy to bite*, *easy to chew*, *quick to chew* or even *melt in the mouth*, and also *easy to swallow*. The British respondents used also words *smooth* which makes vegetable *to melt in mouth* and *small* which is *easy to process* (Fig. 8a and b). For the old respondents in Britain *easy to chew* was considered to be *digestible*. In Finland both young and old respondents mentioned *ready to eat* to present easiness, as the vegetable *needs no preparing* and is *nice to eat* (Fig. 7a and b). For young Finns the easiness also meant *nice mouthfeel* that was *easy to bite to* and created *no mess* (Fig. 7a).

4. Discussion

In this study, a modified version of laddering interviews was used to study which texture-related attributes are troublesome-to-eat and what kind of difficulties they cause. Altering the traditional laddering interview questions provided a rich set of data on characteristics that make fruits and vegetables either easy or troublesome-to-eat, and furthermore also on the consequences these attributes had while eating the foods. The Laddermap sofware (Gengler & Reynolds, 1993) allowed to

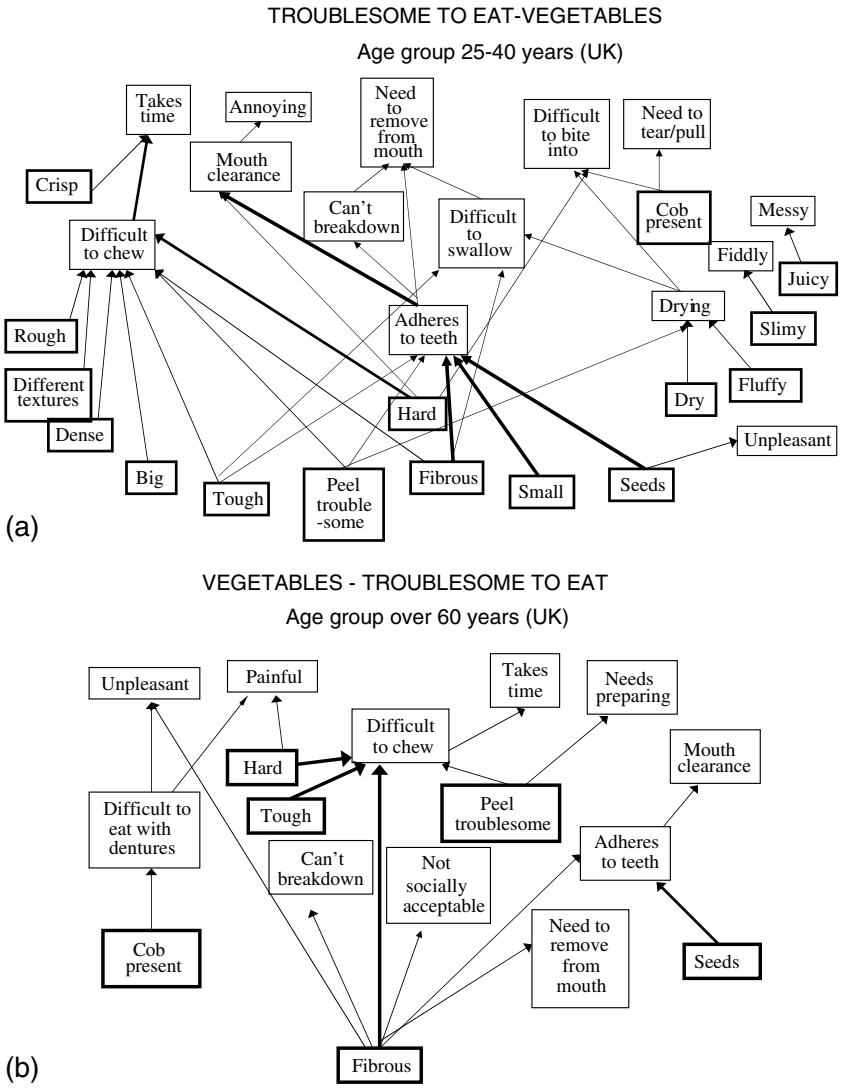

Fig. 6. Hierarchical value map for the troublesome-to-eat vegetables of (a) the young adult (aged 23–40) and (b) the elderly British respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

produce graphs that illustrate links between attributes and their consequences in respondents' minds. Adapting laddering technique questions for different target problems could provide in the future a feasible tool for studying other sequences in consumers' thinking than reasons behind choices, as it has been typically used for (Reynolds & Gutman, 1988). The technique gave a lot of information about the reasons why some textural characteristics are regarded as easy and why some are perceived to be troublesome. This gives a good background for understanding what kind of texture attributes may be barriers to fruit and vegetables consumption.

In earlier studies perceived difficulties have been very similar to those perceived troublesome in this study (Hildenbrandt et al., 1997; Kälviäinen et al., 2002; Peleg, 1993; Sheiham & Steele, 2001). Hard and tough textures that require a lot of force and time in chewing or textures that adhere to teeth were found to be difficult. However, there are two main differences in this study compared to earlier ones: firstly, the study used word troublesome as the target point and secondly, the responses given by the old group were compared with those acquired from young respondents.

The word troublesome brought forward the perceived difficulties, but it also brought forward attributes that related to effort and ability to handle food before eating. The attributes that were found to be the most troublesome for both age groups and both countries were presence of peel or seeds, and hard and fibrous textures. The main consequences of these attributes were either difficulties in processing food in the mouth or effort required in eating the food, such as difficult to prepare or messy to eat. Preparation or cooking method, e.g. longer boiling time, could help to overcome the problem of processing the food in the mouth. The elderly respondents referred easiness in eating to fruit and vegetables

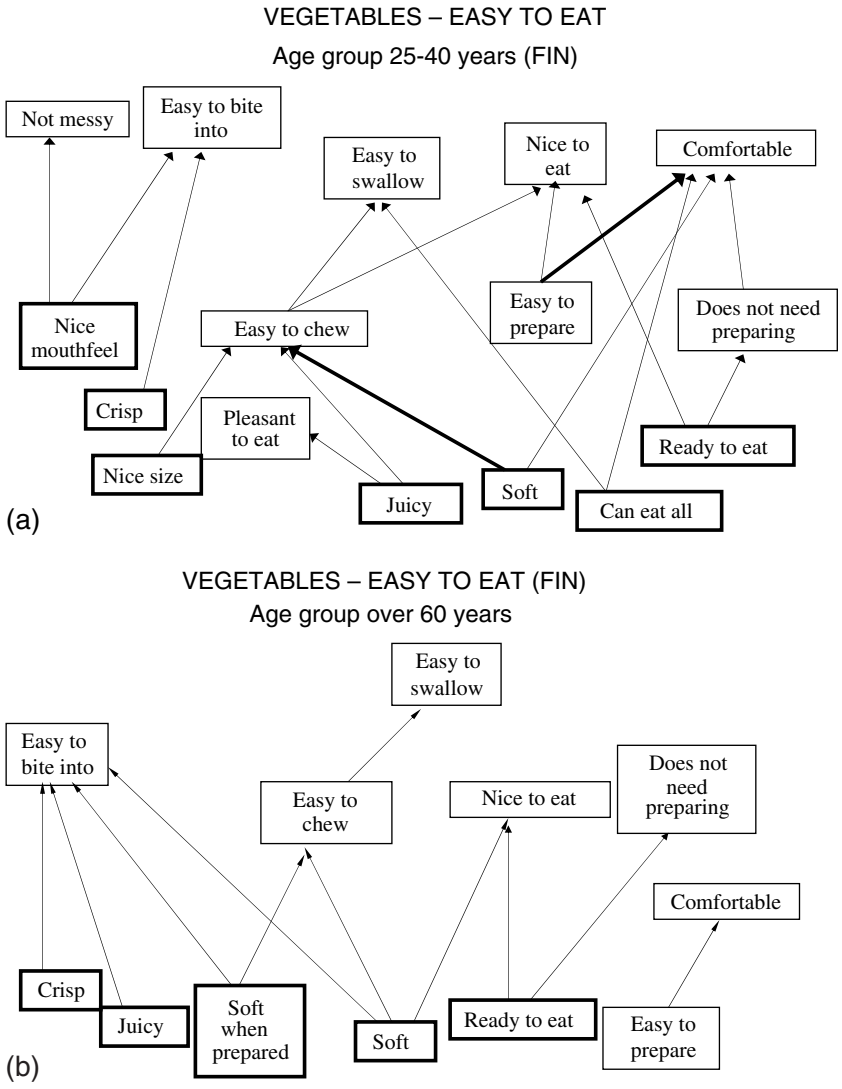

Fig. 7. Hierarchical value map for the easy-to-eat vegetables of (a) the young adult (aged 23–40) and (b) the elderly Finnish respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

that were either ready to eat or were easy to prepare. Earlier studies on barriers to consumption of fruit and vegetables have also indicated that inability to prepare may be one of the obstacles in the case of both young adult and elderly respondents (Brug & Debie, et al., 1995; Brug et al., 1995; Dittus et al., 1995). Therefore dietary intake and nutrient status of both the elderly and the young people could be improved by providing pre-processed ready-to-eat vegetables on the market.

The characteristics of foods that cause troubles for elderly subjects (aged over 60 years) were found to be mainly the same as in the younger age group (aged from 20 to 40 years) in both countries. Finding foods troublesome-to-eat is not exclusive to the elderly people or to people with deteriorated dental condition. Young people used the same attributes as the older respondents and furthermore, they were more elaborate in describing the difficulties and the structure of the map was complex containing more links between words. The reason for this more complex network among young adult respondents may be that this kind of interviewing technique requiring verbal skills favours young adults who are likely to have higher level of formal training compared to the old respondents. Although the expressed troublesome attributes were largely shared by both age groups their consequences illustrate some distinct differences.

The attributes *takes time* and *annoying* were more likely to be cited by young respondents in relation to unpleasantness and embarrassing social situations, whereas elderly respondents were more concerned about difficulties in the chewing process and difficulties in chewing with dentures. This is in accordance with earlier findings with muesli oat flakes; elderly respondents preferred easy eating experiences but, when easy eating was fulfilled, they accepted textural variety in product

modifications such as lumpy textures (Kälviäinen et al., 2002). In addition, (Brug & Debie, et al., 1995; Brug et al., 1995) found that respondents under 66 years old found eating fruit awkward and messy.

Age may not be the only factor affecting the perception of easy-to-chew and easy-to-prepare products among the elderly. In many studies dental condition has been related to dietary habits (Hildenbrandt et al., 1997; Sheiham & Steele, 2001; Smithers et al., 1998) and to masticatory efficiency (Nagao, 1992). Wynne (1999) found that those without their own teeth had poorer nutritional status than those with their own teeth and they were less likely to choose foods that needed chewing, such as apples, oranges and raw carrots. In this study, about half of the older age group were denture wearers and hardness, seeds or stones and cob in sweetcorn were linked with difficulty eating with dentures. Separating the roles of dental condition and ageing is challenging as they are relatively robustly linked together. With the improved dental care, however, in the future there may be a great number of elderly people with their own teeth.

Although the main structures of HVMs were very similar in the two countries, the overall number of different attributes and consequences produced for troublesome fruit and vegetable textures was higher in the UK than in Finland. The difference in number of different attributes and consequences may be partly due to interviewer behaviour. Interviewers in the UK and Finland may have differed, for example, in persistence

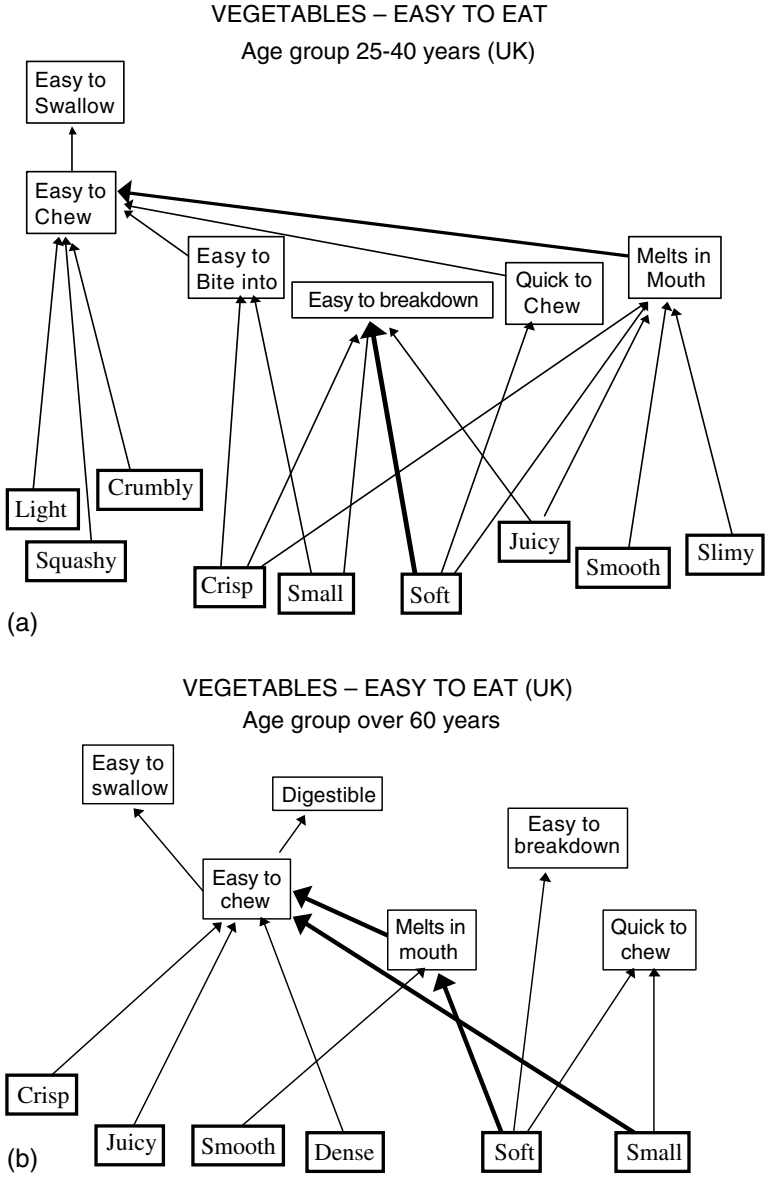

Fig. 8. Hierarchical value map for the easy-to-eat vegetables of (a) the young adult (aged 23–40) and (b) the elderly British respondents (aged 60+). Attributes are marked with thick boxes and consequences in thin boxes.

and ability to elicit descriptions from respondents. Another reason for fewer attributes and consequences in Finland could be that Finnish respondents were less talkative or could not express themselves so exactly; e.g. Finnish respondents used only the phrase "mouthfeel not nice", while British had "rough", "slimy" and "dense" for describing an unpleasant mouthfeel. Some dissimilarities in responses are likely to reflect the cultural habits. The cob was mentioned as a troublesome attribute in Britain, but not in Finland. This may be due to the fact that sweetcorn in Finland is typically sold as a frozen vegetable already torn from the cob, whereas in UK it is often served as whole. In British sample, fibrous in fruits and vegetables was a more central attribute than in Finnish results may be due to higher consumption of leeks, green beans, pineapple and other fibrous fruit and vegetables. Finnish respondents put more emphasis on factors that were related to preparation, which may mirror the lower availability of pre-processed fruit and vegetable products.

This study was planned to explore how the old respondent groups in two countries perceived the texture attributes that make fruit and vegetables either easy or troublesome-to-eat. The used method produced a rich set of data that demonstrates that both young and old respondents perceive the same attributes as difficult and requiring effort. However, this study does not relate the perceived troublesomeness into possible preferences for texture attributes or avoidance of certain foods. Further research is required to understand how denture wearing is related to the extent of difficulty and liking for foods and whether the elderly and young people differ in their preferences. This study gives an idea of the possible barriers that hamper the consumption of fruits and vegetables both among the young and the old consumers. The results suggest that both age groups identify similarly the attributes that make fruit and vegetables easy to prepare and easy to bite into, but whether perceived trouble as such is a negative or a positive thing for preferences remains unanswered.

5. Conclusion

Both the elderly and the young respondents found fruit and vegetables easy to eat if they were ready to eat, easy to prepare, easy to bite into, and easy to chew. Fruits and vegetables that were hard, fibrous, adhere to teeth and required preparation were considered to be troublesome. Although for young people troublesome meant more effort and possible social inconvenience than actual difficulty in eating, both young and elderly respondents would benefit from fruit and vegetable products that need no preparation, are ready-to-eat, and not too difficult to eat. This kind of products may promote the consumption of nutritionally recommended fruit and vegetables in whole population without having to stigmatise the products with the label 'specially targeted for the elderly'.

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