

Texture-modified meat and carrot products for elderly people with dysphagia: preference in relation to health and oral status

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Abstract

Background: Reduced taste and smell, chewing problems and swallowing dysfunction are common among elderly people and affect perception, food choice and the ability to eat.

Objective: To study the preference for texture-modified carrot and meat products in elderly people aiming to meet the needs of people with impaired chewing and/or swallowing.

Design: Data were collected using questionnaires focusing on health, oral status and preference for the products. Altogether, 108 elderly people in ordinary housing (OH) and 50 living in special housing (SH) in Malmö (SH-M) and Göteborg (SH-G) participated.

Results: 19% had a body mass index ≤ 22 , predominantly in SH (24%). Stroke was reported by 20% of the subjects in SH. Among those with subjectively experienced difficulties in swallowing (12%), 58% reported coughing, 21% a gurgly voice in association with food intake and 50% obstruction during swallowing. Only 20% with subjective swallowing difficulties had been specifically examined regarding this problem. All the tested products were easy to masticate and swallow. Compared with OH, people in SH-M found the meat products easier to masticate and swallow. Compared with OH, subjects in SH found the carrot products easier to masticate.

Conclusions: There is a need to develop tasty texture-modified nutritious food products for people with mastication and/or swallowing problems. Possible factors for differences in preference between groups, in this study OH and SH, may be related to health status in general and specifically mastication and swallowing functions.

Keywords: carrot product; dysphagia; elderly; health status; meat product; modified texture

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Introduction

Elderly people are a growing part of the population; in Sweden 18% are over 65 years of age (1). According to national recommendations, energy and nutrient intake is generally satisfied among healthy elderly Swedish people (2, 3). However, with age the prevalence of illness increases, including chewing difficulties and swallowing problems, i.e. dysphagia, as well as disease-related malnutrition (4, 5). The prevalence of disease-related malnutrition among elderly people has been reported in several national studies (6, 7)

and found to be associated with increased mortality (8). Furthermore, the prevalence of dysphagia is high (3–50%) and can affect eating habits by reducing appetite and causing anxiety or panic during mealtimes. Many medical conditions are associated with impaired swallowing, most often those with neurological aetiology, such as stroke, Parkinson's disease, Alzheimer's disease, dementia, and also throat cancer (9, 10). Diseases, drugs and self-assessed dissatisfaction with chewing ability are correlated with a reduction in taste and self-assessed dissatisfaction with taste (11, 12). To maintain a

safe oral intake, a changed texture of solid food and liquids may often be necessary in the management of dysphagic patients. A modified diet should be based on an assessment of the actual swallowing dysfunction, thereby avoiding aspiration and related diseases (13–15). Food with a modified texture has been shown to increase weight and thereby improve nutritional status (16).

The research project “Sensory design and optimization of consistency to promote health and comfort in elderly people” focused on how and with which ingredients it was possible to develop innovative and healthy food products for elderly people with dysphagia. Eighteen meat and 17 carrot products with modified texture were developed according to a specific experimental design. The varied parameters were oil content, starch type and content, proportion of egg yolk/white and milling degree/particle size of milled carrot or meat. Three meat products (MPs) and three carrot products (CPs) were then selected by a test panel in focus groups to find the products most easy to masticate and swallow (17). The objective of this study was to study the preferences for the selected texture-modified CPs and MPs in elderly people aiming to meet the needs of people with impaired chewing and/or swallowing.

Materials and methods

Recruitment of participants

The inclusion criteria were: ≥ 70 years of age, voluntary participation, linguistically and cognitively intact subjects, with oral intake of food and the ability to eat meat and egg products. Verbal and written information about the study was given and signed written consent was obtained from the subjects in special housing (SH). The Ethics Committee of the Medical Faculty of the Lund University approved the study (P20510-2, version 2005-10-17). In Göteborg no approval was needed.

Elderly people in special housing

In total, 100 subjects living permanently in SH (defined according to the National Board of Health and Welfare) were included, representing care-dependent elderly people. Fifty subjects were recruited from 10 SH locations in Malmö (SH-M) and 50 from three SH in Göteborg (SH-G). Recruitment was done by the nurse at the unit,

after consultation with the head of the nursing home.

Elderly people in ordinary housing

This group consisted of 108 subjects living in ordinary housing (OH) in Göteborg; 104 were recruited from societies for senior citizens and four had home-help service, including home-delivered meals. Information, verbal as well as written, about the purpose of the study was given to all potential participants. Subjects who were interested in participation were told to contact SIK (The Swedish Institute for Food and Biotechnology, Göteborg).

Questionnaire

The questionnaire consisted of three parts. The first part, “Health status”, included questions concerning height, body weight and weight changes during the past 6 months, medical diagnosis and oral medications. The second part, “Chewing and swallowing status”, included questions regarding chewing and swallowing function and oral status. Categories concerning diet modification were classified according to Swedish guidelines (18). For subjects in SH, information was obtained from patient’s care record or by asking the care person or nurse responsible. In the last part, “Acceptance and preference”, the subjects were asked to express their agreement with seven statements concerning colour, taste and ease of taking the product into the mouth, masticating, swallowing, eating and willingness to eat the product again. The items were rated on a nine-point Likert-type scale (19), where 1 = does not agree at all and 9 = fully agrees. In addition, questions concerning age (three categories: 70–79, 80–89 and ≥ 90 years), gender and time since the latest meal were asked. In SH, a dietitian or speech therapist served as the interviewer and filled in the answers in “Acceptance and preference”. Subjects in OH carried out the eating study at SIK or in meeting halls belonging to societies of senior citizens, or at home for those who were unable to come to SIK. They filled in the form independently, although a test leader assisted during the test situation.

Test products

The compositions of the three tested CPs and MPs are given in Tables 1 and 2. The products were cut into pieces (20 g, $6 \times 3 \times 2$ cm) and served in a

Table 1. Proportional composition of ingredients, energy per 100 g and protein content per 100 g of carrot products (CP)

	Product ^a		
	CP 9	CP 10	CP 11
Cooked carrot (%)	60	60	60
Water (%)	16	16	10
Rapeseed oil (%)	14	14	20
Egg powder (%)	5	5	5
Egg yolk/white	70/30	70/30	70/30
Potato starch (warm swelling) (%)	3	3	3
Broth (%)	2	2	2
Milling degree ^b	Purée	2 mm	Purée
Energy (kcal 100 g ⁻¹ product)	180	180	230
Protein (g 100 g ⁻¹ product)	3.2	3.2	3.2

^aLabelled 9, 10 and 11 as in the experimental design.

^bPurée is defined as a thickened, homogeneous consistency that holds its shape after serving and does not separate into liquid and solid components during swallowing.

randomized order, CPs at ambient temperature and MP at 50–60°C.

Data analysis

Completed questionnaires were scanned (FIZZ Biosystèmes, version 2.10) for analysis. For open questions the responses were summarized in Excel (Microsoft Office, 2003). Student's *t*-test (two-tailed with unequal variance) and χ^2 test ($p \leq 0.05$) were

Table 2. Proportional composition of ingredients, energy per 100 g and protein content per 100 g of meat products (MP)

	Product ^a		
	MP 9	MP 13	MP 15
Cooked beef (%)	60	60	60
Water (%)	35	35	25
Rapeseed oil (%)	10	10	20
Egg powder (%)	5	5	5
Egg yolk/white	70/30	70/30	70/30
Potato starch (%)	3 (cold swelling)	3 (warm swelling)	3 (warm swelling)
Broth (%)	2	2	2
Milling degree ^b	Purée	Purée	Purée
Energy (kcal 100 g ⁻¹ product)	220	230	300
Protein (g 100 g ⁻¹ product)	15.3	15.6	15.7

^aLabelled 9, 13 and 15 as in the experimental design.

^bPurée is defined as a thickened, homogeneous consistency that holds its shape after serving and does not separate into liquid and solid components during swallowing.

used to validate statistical differences between SH-M, SH-G and OH [Excel (χ^2 test), Microsoft Office, 2003]. Drugs were grouped according to the ATC code (Anatomic Therapeutic Chemical classification system). The main and secondary diagnoses were classified according to ICD-10 (International Classification of Diseases, 10th revision). Body mass index (BMI; kg m⁻²) was calculated. Underweight was defined as BMI ≤ 22 (18). Length of stay in SH was measured in months. The data are presented as mean and SD (with range in some cases) or as frequency and percentage.

Results

The population consisted of 208 healthy elderly volunteers, 66% women and 34% men, aged 70–99 years. Subjects in SH were on average older than OH and predominantly women (Table 3).

Health status

BMI, length of stay in SH and number of oral drugs are summarized in Table 3. In the study population, 19% (35 of 183) had a BMI ≤ 22 , predominantly in SH (24%). Overall, most subjects were stable in weight. However, data for weight loss/gain were missing for 23%, mostly in SH. Of the whole population, 14% of women and 17% of men reported a weight loss of ≥ 0.5 kg during the past 6 months. One-third of the women with reported weight loss of ≥ 0.5 kg had BMI ≤ 22 and their prescription of drugs was higher (mean 7.7) than that of the women in the whole population (mean 6.7). The majority of the prescribed drugs belonged to group N (nervous system). Overall, significantly more drugs were prescribed to women than to men. The most frequent reasons for admission to SH were increased need for care, risk of falling and/or loneliness. Stroke was reported by 20% of the subjects in SH.

Chewing and swallowing status

Impaired swallowing was most frequently reported in SH-M (22%) (Table 4). In the whole population, only five people out of 24 who experienced swallowing difficulties had been examined for their problem. Among these 24 subjects, 58% reported coughing in association with food intake, 21% a gurgly voice when eating and 50% obstruction during swallowing; 25% reported difficulties in chewing and 58% wore dentures. Among those with no reported swallowing dysfunction, 11%

Table 3. Gender, age, body mass index (BMI), length of stay and drugs

	OH (n = 108)	SH-M (n = 50)	SH-G (n = 50)
Gender			
Women	58 (54)	41 (82)	39 (78)
Men	50 (46)	9 (18)	11 (22)
Age group (years) ^a			
70–79	63 (61)	5 (10)	12 (24)
80–89	38 (37)	25 (51)	18 (36)
≥90	3 (3)	19 (39)	20 (40)
BMI ^b			
Women	24.4 ± 3.3 (17.8–31.6)	23.4 ± 4.4 (16.0–33.2)	25.3 ± 6.0 (13.8–39.4)
Men	26.8 ± 3.0 (21.8–37.6)	25.8 ± 2.6 (23.3–30.2)	26.9 ± 3.1 (22.5–30.8)
Length of stay ^c (months)			
Women	–	32.5 ± 27.9 (1–136)	32.7 ± 32.6 (2–188)
Men	–	13.8 ± 12.9 (1–36)	25.3 ± 16.1 (1–47)
Drugs (number) ^d			
Women*	2.4 ± 2.2 (1–10)	11.0 ± 5.2 (1–23)	7.1 ± 2.5 (3–13)
Men*	2.0 ± 2.0 (1–7)	9.4 ± 1.8 (7–11)	4.8 ± 3.1 (1–10)

Data are shown as n (%) or mean ± SD (range).

OH: ordinary housing; SH-M: special housing in Malmö; SH-G: special housing in Göteborg.

^a104 responses from OH, 49 from SH-M.

^b101 responses from OH, 38 from SH-M, 44 from SH-G.

^c49 responses from SH-M, 49 from SH-G.

^d47 responses from SH-M, 48 from SH-G.

*Significant difference ($p \leq 0.05$, Student's t-test) between OH, SH-M and SH-G.

reported coughing, 1% a gurgly voice, 7% obstruction; 8% reported difficulties in chewing and 31% wore dentures. As a texture-modified diet, timbale was generally most frequent in SH, while chopped food was most common in OH.

Table 4. Distribution of responses to “Chewing and swallowing status”

	OH (n = 108)	SH-M (n = 50)	SH-G (n = 50)
Texture-modified diet*	2 (2)	8 (16)	6 (12)
Swallowing problems**	6 (6)	11 (22)	7 (14)
Symptoms related to swallowing disorders ^a †	17 (16)	19 (38)	9 (18)
Personal assistance when eating*	0 (0)	13 (26)	7 (14)
Difficulty chewing**	6 (6)	8 (16)	6 (12)
Partly edentulous*	20 (19)	31 (62)	33 (66)
Dentures*	20 (19)	28 (56)	23 (46)
Dentures fit loosely†	0 (0)	9 (18)	0 (0)

Data are shown as frequency (%).

OH: ordinary housing; SH-M: special housing in Malmö; SH-G: special housing in Göteborg.

^aCough and/or gurgly voice when eating and/or obstruction during swallowing.

Significant differences ($p \leq 0.05$, χ^2 test): *OH vs SH-M and SH-G; **OH vs SH-M;

†SH-M vs OH and SH-G.

Acceptance and preference

Overall, subjects perceived the three CPs as easy both to masticate and to swallow, regardless of the composition of the ingredients or the milling degree of the carrot (Table 5). SH subjects, however, perceived the products as significantly easier to masticate compared with those in OH. However, mean values regarding “taste” indicated that people in OH had a higher preference for the three CPs compared with SH.

Overall, the three MPs were perceived as easy to masticate and swallow regardless of the composition of the ingredients (Table 6). However, SH-M subjects perceived them as significantly easier to masticate and swallow than did those in OH. Subjects in SH-G were more willing to eat the three MPs again compared with those in OH.

Discussion

The aim was to study health status, chewing and swallowing function of elderly people in relation to their preference for texture-modified CPs and MPs. Differences between the three groups regarding both oral and health status were found, which

Table 5. Preferences for carrot products (CP)

	OH (n = 108)	SH-M (n = 50)	SH-G (n = 50)
CP 9			
Colour*	7.0 ± 1.5	6.6 ± 1.6	7.3 ± 1.4
Taste**	6.4 ± 1.9	5.3 ± 2.3	5.9 ± 2.1
Easy to masticate†	8.6 ± 0.8	8.8 ± 0.5	8.8 ± 0.5
Easy to swallow	8.5 ± 0.8	8.7 ± 1.1	8.7 ± 0.9
Easy to eat‡	8.3 ± 1.0	8.7 ± 1.1	8.6 ± 0.6
Easy to take into mouth	8.4 ± 0.8	8.3 ± 1.7	8.6 ± 0.7
Willing to eat again	5.4 ± 2.4	5.5 ± 2.7	5.5 ± 2.7
CP 10			
Colour‡	7.1 ± 1.8	6.4 ± 1.9	7.3 ± 1.4
Taste	6.3 ± 2.2	6.0 ± 2.1	6.0 ± 2.2
Easy to masticate†	8.5 ± 1.0	8.8 ± 0.4	8.7 ± 0.5
Easy to swallow	8.4 ± 0.9	8.6 ± 1.0	8.6 ± 0.9
Easy to eat	8.3 ± 1.0	8.6 ± 1.1	8.4 ± 0.7
Easy to take into mouth	8.4 ± 0.9	8.6 ± 1.3	8.6 ± 0.7
Willing to eat again	5.7 ± 2.3	5.9 ± 2.6	5.3 ± 2.8
CP 11			
Colour*	7.0 ± 1.7	6.6 ± 1.8	7.3 ± 1.5
Taste	6.4 ± 2.1	5.6 ± 2.5	5.8 ± 2.1
Easy to masticate†	8.5 ± 1.0	8.8 ± 0.5	8.8 ± 0.4
Easy to swallow	8.6 ± 0.9	8.7 ± 1.1	8.7 ± 0.9
Easy to eat	8.4 ± 1.0	8.7 ± 0.9	8.5 ± 0.7
Easy to take into mouth	8.3 ± 1.1	8.4 ± 1.7	8.6 ± 0.7
Willing to eat again	5.7 ± 2.5	5.6 ± 2.7	5.5 ± 2.5

Data are shown as mean ± SD.

OH: ordinary housing; SH-M: special housing in Malmö; SH-G: special housing in Göteborg.

Significant differences ($p \leq 0.05$, Student's *t*-test): *SH-M vs SH-G; **OH vs SH-M; †OH vs SH-M and SH-G; ‡SH-M vs OH and SH-G.

might explain differences in preference for the tested products.

Limitations

The limitations of this study included the use of self-reported data for people in OH concerning chewing and swallowing function, weight and height. It has previously been found that self-reported data on weight were underreported, and height was overreported in an elderly population (20). According to those findings, there might have been an underestimation of true BMI in this study, causing overestimation of the prevalence of low BMI. Data on actual weight and weight change were missing for several subjects, mainly in SH-M. The nurses' selection of appropriate participants might have differed, causing sampling biases between Malmö and Göteborg. Another reason could be

Table 6. Preferences for meat products (MP)

	OH (n = 108)	SH-M (n = 50)	SH-G (n = 50)
MP 9			
Colour†	3.6 ± 2.1	4.9 ± 2.1	5.2 ± 2.2
Taste	4.8 ± 2.2	5.3 ± 2.2	4.8 ± 2.2
Easy to masticate**	7.8 ± 1.5	8.3 ± 1.3	8.2 ± 1.1
Easy to swallow**	7.7 ± 1.6	8.2 ± 1.6	8.0 ± 1.5
Easy to eat**	7.5 ± 1.7	8.2 ± 1.7	7.6 ± 1.6
Easy to take into mouth	8.0 ± 1.4	8.4 ± 1.7	7.8 ± 0.8
Willing to eat again§	3.9 ± 2.4	4.3 ± 2.6	5.1 ± 2.5
MP 13			
Colour†	3.4 ± 2.0	5.3 ± 2.1	4.8 ± 2.3
Taste	4.6 ± 2.3	5.0 ± 2.3	4.7 ± 2.3
Easy to masticate†	7.8 ± 1.7	8.5 ± 1.3	8.3 ± 0.7
Easy to swallow**	7.7 ± 1.7	8.4 ± 1.5	8.1 ± 1.4
Easy to eat‡	7.6 ± 1.8	8.5 ± 1.2	7.6 ± 1.4
Easy to take into mouth	8.0 ± 1.6	8.4 ± 1.7	7.8 ± 0.8
Willing to eat again§	3.8 ± 2.3	4.4 ± 2.7	4.8 ± 2.5
MP 15			
Colour†	3.5 ± 2.1	5.2 ± 2.3	4.9 ± 2.4
Taste	4.7 ± 2.3	5.3 ± 2.4	4.9 ± 2.0
Easy to masticate	7.9 ± 1.4	8.6 ± 0.7	8.3 ± 0.7
Easy to swallow**	7.8 ± 1.6	8.5 ± 1.2	8.0 ± 1.5
Easy to eat**	7.5 ± 1.8	8.3 ± 1.5	7.7 ± 1.4
Easy to take into mouth	8.0 ± 1.5	8.3 ± 1.7	7.8 ± 0.9
Willing to eat again§	3.9 ± 2.4	4.7 ± 2.6	4.8 ± 2.4

Data are shown as mean ± SD.

OH: ordinary housing; SH-M: special housing in Malmö; SH-G: special housing in Göteborg.

Significant differences ($p \leq 0.05$, Student's *t*-test): **OH vs SH-M; †OH vs SH-M and SH-G; ‡SH-M vs OH and SH-G; §OH vs SH-G; ||OH, SH-M and SH-G.

that people are older and sicker when they move to SH in Malmö compared with Göteborg.

Information on people in SH was obtained from care documentation since medical documentation was not available at the residences. Medical diagnosis was not always described by ICD-10 codes in the care documentation, which complicated the identification.

The target group for texture-modified food is individuals with dysphagia. However, dysphagia is often associated with other dysfunctions, such as impaired verbal and cognitive ability, and verbal and cognitive ability was a prerequisite for managing the test.

Populations

Women were in majority in SH. This is in accordance with the gender distribution in higher age

groups (21). Subjects in OH were younger, which resulted in a more even distribution in gender.

The subjects in SH-M and SH-G differed in several aspects, even though the inclusion criteria were identical. Those in SH-M were prescribed significantly more drugs, and the frequency of symptoms related to swallowing dysfunction and the proportion of subjects with BMI ≤ 22 were higher than in SH-G. This was probably due to differences in health status between residents in Malmö and Göteborg. A higher frequency of swallowing-related problems in SH-M could also depend on the professionals' ability to identify these problems at mealtimes (9). However, only a minority of those who reported swallowing problems had been evaluated according to their problem, despite related symptoms. According to previous studies, swallowing dysfunction is prevalent among elderly people and often underdiagnosed (9, 22). Dysphagia has been correlated with low BMI and weight loss, indicating a risk of malnutrition (8, 14).

A low prevalence of chewing and swallowing dysfunctions and a lower use of medications among OH subjects were associated with better health status compared with SH, predominantly SH-M subjects. A high prevalence of multiple medications in institutionalized elderly people has been described previously (23); an average of 10 drugs was reported in a national study (24). Various drugs, such as anticholinergics and psychopharmaceuticals, have been shown to bring about side-effects and thereby cause dry mouth or alter taste and smell perceptions (25, 26). According to a study by Pickering, loss of appetite and anorexia linked to drug consumption were frequent and contributed to malnutrition (27).

Acceptance and preference

Significant differences in acceptance and preference were more often found between OH and SH-M than between OH and SH-G subjects, which could be explained by the fact that those in SH-M were older and had poorer health status than the two other groups. Maybe more differences between products could have been found if only individuals with dysphagia had participated in the SH groups. It should also be pointed out that the tested products having the highest qualities regarding consistency and sensory aspects were selected by the test panel.

People in SH-M perceived the MPs as significantly easier to masticate and swallow compared

with those in OH, which could be related to the high frequency of chewing and swallowing problems and impaired dental status in SH-M. The texture-modified products were probably perceived as easy to masticate and swallow in comparison with solid MPs. Avoidance of such products is common in SH (28). The findings are in line with those in a study by Hildebrandt et al. (29). Furthermore, in spite of symptoms related to dysphagia, a diet with modified consistency was not always provided in SH-M. These factors may explain why SH-M subjects appreciated the texture-modified MPs most. The amount of oil and type of starch in the MPs did not seem to affect the swallowing and chewing ability of the tested population.

No significant differences were found in the ability to swallow the CPs comparing OH with SH-M and SH-G, even though swallowing difficulties and related problems were more prevalent in SH than in OH subjects. The amount of egg yolk and starch was identical in the three products. The lower amount of oil and a coarser milling degree of the carrot in CP 10 seemed to reduce neither the chewing nor the swallowing ability. The design of the CPs was probably quite optimized from the swallowing point of view.

In conclusion, the prevalence of impaired chewing and/or swallowing, as well as the number of prescribed drugs, was higher in SH than in OH subjects. SH-M differed most from OH in the prevalence of impaired chewing and/or swallowing function, which probably explains the differences in preferences. SH-M found the MPs easier to masticate and swallow compared with OH. The texture-modified products were probably perceived as easy to masticate and swallow in compared with solid MPs. Avoidance of such products was common in SH. All texture-modified MPs and CPs were, however, masticated and swallowed with ease.

Elderly people living in SH are exposed to conditions often associated with disease-related malnutrition and dysphagia. Identifying swallowing problems is essential for appropriate management of the patient, usually including a texture-modified diet. An energy- and nutrient-dense, appetizing and tasty texture-modified diet is necessary for safe and efficient nutrition and could improve quality of life. With a growing elderly population with health problems including dysphagia, nutritious foods with modified consistency and high sensory quality need to be developed urgently.

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