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Nøgleord:
Malnutrition, Ageing, Taste, Seriusly ill patients, Protein enhanced meals, Food preferences, Personalised food

Can protein and energy enriched soups be a tool in the nourishment of hospitalised patients in Denmark? A quality-development study

Abstract

BACKGROUND Food and taste preferences of patients often change with age or illness. This study aimed to investigate whether protein-enriched soups would be accepted in Danish hospitalized patients as an alternative or supplement to standard protein drinks.

METHOD The study was based on the Plan-Do-Study-Act cycle and included three repetitions (sessions 1–3). Session 1) 18 patients admitted for more than 24 hours at the North Denmark Regional Hospital tasted four different protein-enriched soups (10–20 ml) with or without a topping, and salty chips with dip and rated them on a 0–10 cm VAS scale. Session 2) Citizens with chronic obstructive pulmonary disease participated in a focus group interview to describe food preferences during severe illness at home or during hospital stays. Session 3) Meals were modified according to sessions 1–2 and retested in 11 new patients but using a visual 5-point Likert scale to evaluate.

RESULTS In Session 1, the session failed to collect most of the intended data as 1) patients fell asleep, 2) could not use the VAS scale, 3) experienced taste or smell impairment, 4) could not chew, or could not use a spoon. In Session 2, participants in the focus group interview preferred hot meals, thick consistency, and short eating time while excluding nuts as an ingredient. In Session 3, the retest setting was now able to extract reliable results. Mean scores on the visual 5-point Likert scale for buttermilk, tomato, and potato soups were 4.7, 3.8, and 4.2 out of 5, respectively. Thick and sweet soup was the preferred choice.

CONCLUSION Protein and energy-enriched soups can be well accepted and were rated high in taste experience in Danish hospitalized patients. In the future, protein-enriched soups in small spout cups seem a feasible way to overcome many of the problems these patients face.

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Background

Malnutrition is known as a severe complication in many diseases, e.g. cirrhosis(1), bowel diseases (2), cancer (3), and chronic obstructive pulmonary disease (COPD)(4). When talking the elderly patients, malnutrition is a part of the definition of frailty, which represents a syndrome of great importance (5). This problem is expanding while the proportion of people worldwide above the age of 60 years is growing rapidly and is expected to increase by over 50 % by 2050 (6). Aging results in changes to body composition, leading to decreased body mass and an increased risk of malnutrition, which is characterized by low body mass and weight loss (7). By increasing age, individuals are prone to a decline in senses, including taste, smell, and sight, as well as chewing and swallowing problems, which affect the intake of food and fluids in a negative way. Many types of medications can cause xerostomia, decreased appetite, or nausea, which can have a major impact on the ability to eat a meal and on the intake of protein (7,8). Weight regulation decreases with aging (9,10) and unplanned weight loss leads to sarcopenia and reduced functioning, which can lead to reduced quality of life and increases the risk of depression (7,11). These physical and psychological changes are typical for debilitated patients with chronic diseases (7,11). Upon hospital admission in Denmark, a poor nutritional status is observed in up to 30 % of the patients (12), which increases the risk of prolonged hospitalization (7), readmission shortly after discharge (13), and increased mortality (7,14). Therefore, restoring a proper nutrition status as soon as possible during and after the hospital stay is essential (15). It may be difficult to ensure adequate nutrition while hospitalised, and oral nutritional supplements are often used to increase energy intake. However, many patients find the taste of these "protein drinks" appalling, and an alternative is needed. Currently, there is a lack of knowledge about the food preferences of hospitalized patients in Denmark, and there is a need to identify alternative taste options that are more appealing to the patients. Therefore, the aim of the present study was to investigate whether protein-enriched soups would be accepted in Danish hospitalized patients as an alternative or supplement to standard protein drinks.

Methods

This study was carried out at North Denmark Regional Hospital, Hjørring, Denmark, from March 2021 to September 2022. The study was based on the Plan-Do-Study-Act (PDSA) cycle (16) and consisted of three sessions: 1) a tasting session followed by 2) a focus group interview, and 3) a final tasting session based on experiences from the two first sessions (Figure 1). Each session was processed through the PDSA cycle. To ensure transparency, the study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) (17).

Hvad ved vi?

- Svækkede patienter er stærkt udfordrede i forhold til at spise og drikke sufficient.

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Session 1

Patients were enrolled from departments of geriatric diseases, gastroenterology, and respiratory diseases at the North Denmark Regional Hospital, Hjørring. The healthcare professionals helped with information on the nutrition status of the patient in accordance with the patient inclusion. For participation in the study, the patients were required to meet the following inclusion criteria: age >50 years and hospitalization at one of the departments mentioned above for more than 24 hours. Exclusion criteria were BMI >30, dysphagia, medical conditions that did not allow enteral nutrition, allergy to specific ingredients, and unable to provide informed consent. Oral and written informed consent was obtained from all participants.

All data were collected using Research Electronic Data Capture tools (REDCap) (18,19).

Four custom-prepared soups and salty chips with dip all with a high level of protein and fat, and energy higher than oral nutritional supplements were developed by a trained chef in the Food Development Laboratory at the North Denmark Regional Hospital. The criteria for food production in hospitals were met (12).

During session 1, the patients were offered cold buttermilk, tomato, potato, and a Jerusalem artichoke soup (all with chrunchy toppings) and salty chips with

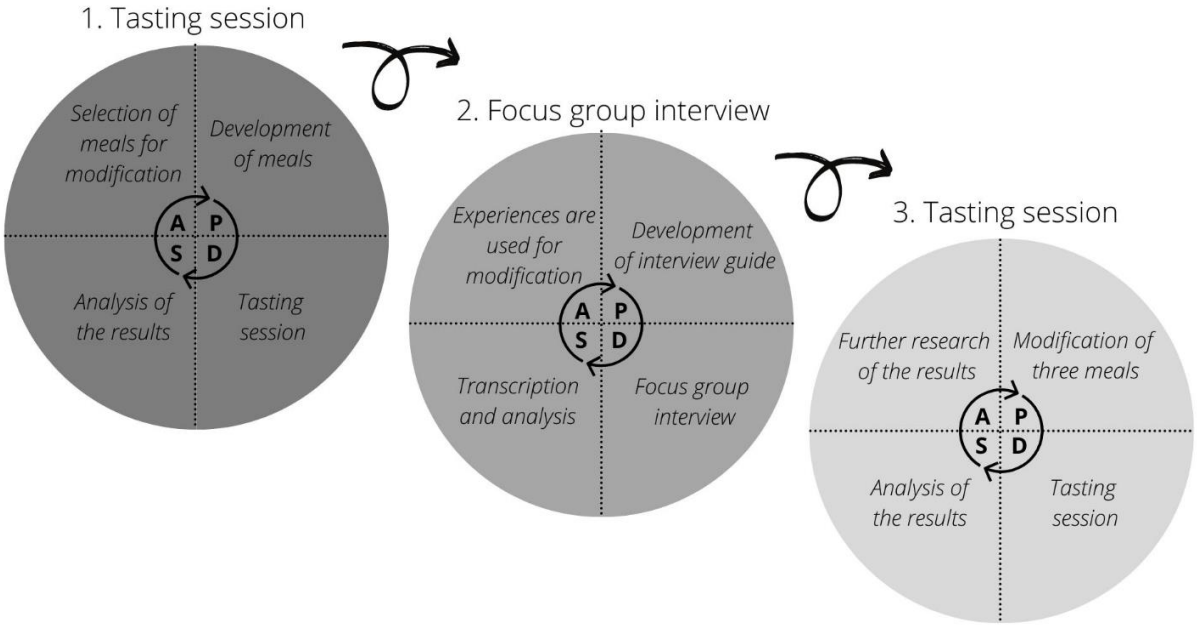

FIGURE 1

The figure shows the method used in the study - The "Plan-Do-Study-Act" cycle. Custom-prepared soups were tested in patients admitted to the Department of Medicine in session 1. In session 2, a focus group interview was conducted on chronic obstructive pulmonary disease. Lastly, the experiences from sessions 1 and 2 were used to modify the soups and retest in patients. Each session consisted of the four elements: plan, do, study, and act.

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dip. Furthermore, the patients were offered a standard oral nutritional supplement drink available at all departments (Nutridrink Protein Chocolate, Nutrica, A/S, Denmark). The patients were offered small samples (10-20 ml) of the custom-prepared meals in a randomized order. Patients were allowed to sip sparkling water between meals to refresh and cleanse their taste buds. The tasting session was performed in the individual patient's hospital room.

Patients completed a questionnaire with six items after each meal and scored them on a 0–10 cm VAS scale, as yes/no or as free text. VAS-rated questions were about taste, appearance, smell, and all-round experience. The questions from session 1 were: 1) What do the soups/chips/nutritional supplement drinks taste like? (free text), 2) Do you like the food? (5-point Likert scale), 3) Would you eat it again? (yes/no), 4) How often would you prefer to eat it again? (several times daily, once daily, once per week, several times per week), 5) Do you like the topping on the soups? (VAS), 6) Would you choose the topping for your soups again? (yes/no) The results were analyzed and used to formulate questions for a structured focus group interview (session 2).

Session 2

Citizens with COPD who were living independently in the municipality of Hjørring (Denmark) were included. Based on the results and experiences from session 1, an interview guide with specific questions aimed at eliciting patients' food preferences, including aspects such as texture, flavor, and appearance, were developed (Table 1).

TABLE 1 - *Interview guide for session 2, which was a focus group interview of patients with chronic obstructive pulmonary disease who were not admitted to the hospital at the time of interview (list of questions)*

Interview guide
- Do you prefer cold or hot meals? - Would you prefer the food to be spicy—or neutral in flavour? - Do you prefer sweet or salty flavours? Or sour flavours such as lemons? - What texture do you find easiest to consume? A thin or thick sauce? - Are several textures preferable—e.g., a soup with buns? - Would you like to have food served that you already know? - What type of food is easy to consume? What is hard to consume or digest? - Do you cook yourself, or do you prefer pre-cooked food? For pre-cooked food, do you heat it up before consuming it?

The participants were interviewed face-to-face. The interview guide and the interview were conducted by a researcher and a dietitian who had no prior relationship with the patients. The interview was transcribed and analyzed based on Malteruds' approach by a researcher (20). The approach is divided into four steps: a) the interview was read, and overall themes were formed; b) coding, where units related to themes were identified and systematization of the themes was undertaken; c) each coded group was condensed; d) a description of each coded group was created (20).

Session 3

Based on sessions 1–2, the three of the custom-prepared meals were modified, the taste was altered, and the toppings were omitted. The patients in session 1 found it difficult to use the VAS scale why this was replaced by a visual 5-point Likert scale, and the questions from session 1 were reduced to three per soup: 1) What do the soups/chips/nutritional supplement drinks taste like? (free text), 2) Do you like the food? (5-point Likert scale), 3) Would you eat it again? (yes/no). The new meals were retested on a new group of selected patients with the same in- and exclusion criteria as in session 1. A similar procedure as described for session 1 was executed. The modified meals were highly enriched with protein and fat (Table 2). In this part of the study, the primary focus was to uncover patients' taste preferences and apply their experiences and feedback to further improve the custom-prepared meals.

Subsequently, the modified meals from session 3 will be further developed and finally implemented in the hospital's procedures for routine food preparation. As this will be a timely process, practical details for the preparation of the high-energy meals will be reported elsewhere.

Figure 2 shows the visual 5-point Likert scale often used in paediatric studies. It was used in session 3, as patients in session 1 could not understand or use the VAS scale of 0–10 cm.

Chemical food analysis

The food products were analyzed for energy contents and nutrients (fat, fatty acid composition, protein, carbohydrates, saccharides, dietary fiber, and salt content) by an external ISO/IEC certified food laboratory (Eurofins Steins Laboratory A/S, Denmark).

TABLE 2 – Data for fat and protein enrichment content in the final meals

Meals	Enriched with	Fat content (g) / 100 g final meal *	Protein enrichment (g) / 100 g final meal* with	Protein content (g) / 100 g final meal *
Tomato soup	Cream (38 %)	28.5	Whey protein powder (43.3)	8.7
Potato soup	Cream (38 %)	26.6	Whey protein powder (43.3)	8.7
Cold buttermilk soup	Cream (38 %) Egg yolks	21.7	Whey protein powder (43.3) and egg yolks (16)	10.3

* Only for the enrichment of fat or protein

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Results

Baseline characteristics

Baseline characteristics for the participants in the tasting sessions (sessions 1 and 3) are presented in Table 3.

Session 1

Full data sets were obtained in 16 out of 18 patients. However, replies—apart from the two that asked "Do you like the food" and "Would you eat it again"—were evaluated as highly unreliable by investigators due to the following factors: 1) Patients had problems staying awake longer than 5–10 minutes at the time in the 30-minute food test, 2) patients did not understand the interview or stay awake to use the VAS scale reliably, 3) patients could not stay focused for answering all six short questions per serving, 4) many were too short of breath or so fatigued, that they could not process topping, 5) most could not taste what they were eating, and 6) more than half could not bring the food to their mouth (had to be spoon fed). Two items were scored with sufficient reliability. The first—"Do you like the soup?"—showed that cold buttermilk soup (mean 9.2 cm), tomato soup (mean 7.8 cm), and potato soup (mean 7.2 cm) were preferred. The second— "Would you eat this again?"—was rated as "yes"

TABLE 3 - Baseline characteristics for the participants in sessions 1 and 3.

	Session 1		**Session 3**	
	N = 16	Missing *n (%)*	N = 11	Missing *n* (%)
Male sex: *n (%)*	9 (56)	2 (11)	5 (46)	
Age*: years (IQR)*	77 (69.0;87.8)	2 (11)	86 (81.5;88.5)	
Weight: *kg (IQR)*	65 (52.0;75.0)	3 (17)	51 (56.0;69.0)	
BMI: *kg/m² (IQR)*	21.31 (19.1;23.9)	4 (22)	21.64 (19.91;26.83)	
Reason for admission: *n (%)*		2 (11)		
Cardiac diseases	2 (13)		0 (0)	
Pulmonary diseases	10 (63)		6 (55)	
Gastrointestinal diseases	7 (44)		0 (0)	
Neurological diseases	4 (25)		1 (9)	
Infection	6 (38)		1 (9)	
Other	1 (6)		5 (46)	
Symptoms: *n (%)*		4 (22)		1 (9)
Poor appetite	10 (71)		9 (90)	
Xerostomia	4 (29)		4 (40)	
Nausea	4 (29)		2 (20)	
Involuntary weight loss	9 (64)		5 (50)	
Loss of appetite	4 (29)		2 (20)	
Fatigue	7 (50)		6 (60)	
Loss of weight: *n (%)*		8 (44)		1 (9)
No weight loss	2 (20)		4 (40)	
<5 kg	5 (50)		4 (40)	
5-10 kg	0 (0)		1 (10)	
>10 kg	3 (30)		1 (10)	
Cognitively affected: *n (%)*	2 (18)	7 (39)	4 (36)	

IQR: inter quartile range; BMI: Body Mass Index

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by 94 % for the cold buttermilk soup, 75 % for the tomato soup, and 59 % for the potato soup. During session 1, the standard protein drinks were removed from the tasting session due to weak and unfeasible patients, and the taste was not good. Furthermore, the chips with dip and the Jerusalem artichoke soup were removed before the subsequent tasting session due to chewing problems and the patients' taste preferences.

Session 2

Results of the focus group interview had the following themes: Meals should look appealing, hot meals were preferred ("Cold food does not taste as good as hot food"), thick consistency was preferred ("A thick soup is better than a thin soup", "A soup with a thick consistency is easier to swallow"), and time-consuming meals were not acceptable. Toppings for the meals were acceptable only if they did not require much chewing. "Nuts are banned" was a consistent statement.

Session 3

In session 3, full data sets were obtained in 11 patients. The retesting of the modified protein-enriched soups was feasible for the patients to participate in, and they could report back reliably. All could use the visual 5-point Likert scale and answer the three simple questions. Patients scored the soups as 4.7, 3.8, and 4.2 out of 5 possible for the cold buttermilk, tomato, and potato soup, respectively. Most patients (91 %) would like to ingest cold buttermilk soup again, followed by tomato soup (82 %) and potato soup (64 %).

Chemical food analysis

The results from the food analysis are shown in Table 4. All three custom-prepared meals had a higher total

TABLE 4 - The energy analysis of the custom-prepared soups and the standard protein drink used in the study. All soups had a higher protein and fat content than the standard protein drink.

Meals	**Tomato Soup** (g) / 100 g final meal	**Potato Soup** (g) / 100 g final meal	**Cold butter-milk soup** (g) / 100 g final meal	**Nutridrink (Nutrica)** (g) / 100 g final meal
Energy	798 kJ /192 kcal	903 kJ /217 kcal	808 kJ /193 kcal	630 kJ /150 kcal
at	13	16	11	5.2
- saturated fatty acids	7.9	10	6.8	0.6
- monounsaturated fatty acids	2.9	3.5	2.7	3.1
- polyunsaturated fatty acids	0.4	0.5	0.5	1.5
Carbohydrate	8.4	4.7	10	16.7
- sugars	6.2	2.3	8.6	7.1
Dietary fibre	0.5	1.2	1.2	0
Protein	10	13	13	9.0
Salt	1.7	1.3	0.21	0.15

Comparison of energy content, fat, fatty acid compositions, carbohydrate, sugars, dietary fibre, protein, and salt per 100 g of tomato soup, potato soup, cold buttermilk soup and Nutridrink Protein Chocolate (Nutrica). The nutritional contents were analysed by Eurofins Stein Laboratory A/S and compared to the nutritional content in the protein drink (Nutridrink Protein Chocolate from Nutrica A/S). All units except for energy content are in grams (g).

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energy, fat, and protein content than the standard oral nutritional supplement drink.

The three soups developed in the study had a higher energy content compared with the oral nutritional supplement drink available as a standard at the hospital. If the servings of soups were of the same size as the protein drink, patients would increase their energy intake by 26–43 % and protein intake by 11–44 %.

Hvad tilføjer denne artikel til vores viden?

- Viden omkring smagspræferencer hos syge indlagte patienter i Danmark.
- Energi-indtaget hos indlagte patienter kan øges betydeligt ved at indføre nye alternativer til de proteindrikke som der gives til svækkede patienter på hospitalerne.
- Studiet viser blandt andet at svækkede patienter gerne spiser proteinberigede supper.

Discussion

This is, to our knowledge, the first study to develop and evaluate the acceptance of protein and energy-enriched soups in hospitalized patients in Denmark. The present study document that acute and frail patients prefer a homogenous soup with no toppings and that a sweet taste like in cold buttermilk soup was preferred.

It is known that people who are frail or aging may experience changes in taste, smell, and texture perception, which can affect their food preferences and intake (21–25). The present study documents that acute patients prefer a well-known taste and that a sweet taste is preferred confirming existing studies.

Results from the focus group interview showed that soup was preferred. The participants expressed that meals should be small, manageable, and not time-consuming to prepare and eat, consistent with another study by Terp et al., which investigated nutrition in older people in Denmark (26). This was also confirmed in session 1, where the patients did not like toppings that required chewing either because they were too fatigued to chew or had too little breath to spare. This fits well with previous studies finding that a reduction in chewing efficiency was associated with increased age (27), which could explain the low score on meal toppings. The consistency and texture of meals are essential to enhance safety and ease of consumption. The participants in session 2 all preferred soup when they were hospitalized or ill at home. The patients rated the sweet cold buttermilk soup high, and this confirms more studies documenting that older people often prefer sweet tastes in general (23,28,29) It is well documented that the prevalence of dysphagia and chewing problems is high among the institutionalized elderly, which may explain why they prefer food with a homogeneous and viscous consistency at the same time that limited energy is required to eat the food.

Strengths and limitations

The study had several strengths whereas the most important one was the development of the soups by a trained chef who could ensure good flavor despite enrichment with fat and protein. The study group is interdisciplinary and consists of a gastroenterologist, a trained chef, a dietitian, a chemist, an occupational therapist experienced in dysphagia and a project manager experienced in clinical studies. The nutrient composition is scientifically analyzed for the content of macronutrients (carbohydrates, proteins, and fats),

micronutrients (vitamins and minerals), fiber, and other bioactive compounds. It was also beneficial to include hospitalized patients in the study and taste rating sessions, although some disadvantages, limitations, and possible causes of bias originate from the patients' poor physical and mental state, as described above. Lastly, the change to a visual 5-point Likert scale for scoring the meals was easy to understand for all the patients in the study.

Although, this study is not without limitations. Firstly, the number of patients included in the study is low and their poor physical and mental state were a challenge through the tasting sessions. Secondly, the questionnaires used in the tasting sessions were developed by the research group and were therefore not standardised, which would have been preferable. There are to our knowledge no standardized questions for collecting data about food preferences in hospitalized patients. The study's continual adaptation and changes can be perceived as a limitation in terms of maintaining a high-quality study design.

Conclusion

We found a way to enhance the energy content of meals for hospitalized patients in Denmark while keeping an optimized appearance and taste that were in accordance with the preferences of most patients. If patients would keep a similar volume intake for the soups developed during the study as for the standard protein nutrition drinks, their energy intake would increase by 26% to 43 % with an increase in protein intake of 11% to 44 %. Although it is challenging to include hospitalized patients in tasting sessions and ratings, it is beneficial for developing new and energy-enriched foods in a hospital setting. Due to the challenges faced by these hospitalized patients, we were unable to compare the custom-prepared meals with the standard protein drinks, as originally intended.

Hvordan kan det bruges i danske akutmodtagelser/perspektivering?

- Mad til svækkede patienter skal gerne kræve minimal energi at indtage og serveres i små, overskuelige portioner.

Ethics approval and consent to participate

The study was conducted according to the guidelines of the Declaration of Helsinki. Oral and written informed consent was obtained from all participants. The regional ethical committee of Northern Denmark waived the need for approval.

Consent for publication

Not applicable

Availability of data and materials

The data presented in this study are available on request from the corresponding author.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

This study was conducted by a diverse group of researchers (DM, TB, LH, AJ) and healthcare providers (MO, ALK). AJ was responsible for the preparation of all

meals. All the authors were involved in the tasting sessions, and DM and MO performed the focus group interview. Healthcare professionals and researchers within the project collected all data. LH prepared the draft paper. All authors contributed to the editing process and read and approved the final manuscript.

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