



## Original article

## Protein and energy intake improved by breakfast intervention in hospital



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## ABSTRACT

**Background/aim:** Undernutrition affects about 40% of patients in hospitals. Ordinary food is recommended as the first choice to prevent and correct undernutrition. Meanwhile, sufficient intake, especially regarding protein, is difficult to reach, in patients at nutritional risk. The aim of this study was to improve protein intake at breakfast to at least 20% of total daily requirement or at least 20 g.

**Methods:** A protein rich breakfast including 20 g of protein was served in the departments of heart and lung surgery and vascular surgery for three months. Nutrition intake was registered before and after intervention.

**Results:** Food intake records were collected from 32 and 30 patients respectively, mean age 69 (SD 8) years. At breakfast, protein intake was improved from 14% of individual requirements to 22% ( $p < 0.001$ ) and energy intake was improved from 18% to 25% ( $p = 0.01$ ). Total amount of protein intake for breakfast was increased from 14 g to 20 g ( $p < 0.002$ ). Total daily protein intake increased from 64% to 77% ( $p = 0.05$ ) and total energy intake from 76% to 99% ( $p < 0.01$ ) of requirements.

**Conclusion:** Protein and energy intake for surgical patients at breakfast as well as total daily intake was significantly increased to meet recommended average level for minimum individually measured requirements.

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## 1. Introduction

Undernutrition affects about 40% of patients in hospitals and is associated with an increased morbidity and mortality [1–3]. Patients at nutritional risk have prolonged hospital stay and need more care after discharge compared to patients in good nutritional status [4,5]. From a socioeconomic perspective undernutrition is associated with increased treatments costs and reduced quality of life for the patients [6].

For patients undergoing surgery nutritional risk is associated with enhanced occurrence of postoperative complications and is a

significant predictor of postoperative morbidity and mortality [7,8]. The effects of undernutrition are multi-systemic with consequences for the surgical patients such as poor wound healing, poor respiratory function and impaired immunity [9]. For patients undergoing cardiac surgery, undernutrition is also associated with a prolonged period of immobilization after surgery [7].

Studies report that early oral nutrition after surgery will have a stress reducing effect by minimizing catabolism and is an important part of the fast track surgery concept [7]. Nutritional guidelines recommend ordinary food as the first choice to prevent and correct undernutrition. Studies have shown that reaching nutritional requirements, especially with regard to protein requirements in nutritional risk patients, by ordinary energy dense food is difficult to achieve [3,10–13]. Meanwhile feasibility and positive effects on protein intake has been shown in a study especially dedicated to improve protein intake by hospital food, in a novel menu including protein supplementation [14].

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At Aalborg University Hospital, food is served as a trolley buffet between 8.00 and 17.00 – with a snack at 20.00, leaving an overnight fasting period of 12–15 h. This leaves a negative muscle protein synthesis in the morning, which emphasizes the importance of a protein rich breakfast. Results from an earlier study at Aalborg University Hospital [12] indicated however, that protein as well as energy intake was not sufficient, according to Danish recommendations. These furthermore recommend, that 20–25% of total daily nutrition intake, in accordance with the total daily requirement, should come from the breakfast meal [15].

Recent studies also indicate that it would be more beneficial to net protein synthesis, when total protein intake could be evenly distributed among the three main courses with quantities of 30 g protein per meal [16], instead of either skewed with very high intake at dinnertime, or evenly distributed at all six meals including snacks [17]. Knowing that breakfast, in a traditional Danish manner, sometimes have very low content of protein (e.g. bread with butter and jam (contains 3 g protein)), we agreed on a consensus found it reasonable to reach aim for at least 20 g of protein in a breakfast serving, regarding it a huge improvement from the then current situation. In this hospital, meals were served as three main meals; breakfast, lunch and dinner, and two snack meals daily.

The aim of the study was to evaluate if protein and energy intake in patients at nutritional could be improved by a protein and energy rich breakfast, thus increasing protein intake at breakfast to least 20 g [15].

## 2. Study populations and methods

The study was an intervention study with a baseline and a follow-up measurement of nutrition intake for all patients admitted to the departments of heart and lung surgery (T) and vascular surgery (V) at Aalborg University Hospital.

Each of the departments enclosed 27 (T) and 10 (V) beds. Average patient stay was 7 days (T) and 5 days (V).

### 2.1. The organization of the breakfast before the intervention

Breakfast was served from a trolley buffet by nurses or service personnel. Patients who were able to walk to the trolley ordered their own food from the nurse or service staff who served the food, while patients who were not mobile had the food served by the nurses. Patients could choose from a smaller variety of food for breakfast, but mainly a morning meal consisting of an open sandwich with cheese and jam, yogurt, coffee, tea and water, orange juice or milk. Other options were cereals, oatmeal, or rye bread porridge. The variety of the food was the same every day. The importance of the morning meal was not in focus compared to the other meals, neither in the departments nor in the central kitchen. Meal composition and serving was rather coincidental.

### 2.2. Food intake registration system

Nutrition intake data for the baseline and follow-up measurements were registered for three consecutive days in each patient on a registration schedule, which was already used to monitor food intake in patients at nutritional risk in the departments.

All food servings and drinks were registered as pieces or approximate quartile portion sizes. Drinks were registered in approximate deciliters. Registrations were done by the patient or nursing staff, depending on patient's abilities. Registration of the served portion was done when served, and of the eaten, when the meal was finished. During the night shift the nursing staff calculated the intakes by use of a computer program. The program had food portions and drinks premeasured for protein (grams) and

energy (calories (kcal) and Joules (MJ)). Total daily nutritional intake was registered on the schedule at patient bedside and in the electronic patient record. For the study, intakes from breakfast and total intakes were furthermore registered in the study database.

### 2.3. Requirements

All patients were screened by NRS-2002, as a standard procedure for all patients upon admittance to hospital [10,11].

All patients at nutritional risk by NRS-2002 [18], had their requirements for energy- and protein intake calculated in the computer program based on the scale of Harris–Benedict equation [10,11,19]. Protein requirements were calculated in the program as 1.1 g/kg/d, as recommended by the National Danish Board of Health.

### 2.4. Inclusion criteria's

Patients hospitalized >48 h and found to be at nutritional risk by NRS-2002 screening were included. The duration of admittance was necessary in order for the patients to have experience with the breakfast intervention.

Adult patients (>18 years old), who could eat orally and did not rely on enteral and/or parenteral nutrition were included.

### 2.5. Exclusion criteria's

Patients with diagnosed cognitive dysfunction, progressive and terminal illness as well as patients with language barriers were excluded from the study.

Registration schedules with missing data were excluded. Missing data were defined as if breakfast, or more than one food-serving (meal, drink, in between meal), was not, or was unclearly registered on the schedules.

### 2.6. Intervention

The aim was that each new recipe should contain 5 g of protein per portion, giving the possibility to serve a breakfast meal including 20 g of protein. The calculation of energy and protein content in the breakfast served at baseline showed that many of the products used, did not reach the goal for protein intake.

Semi-structured qualitative interviews with ten randomly selected patients, were used for collection of concept knowledge, to qualify the development of the breakfast intervention. Patients were asked about their preferences and habits regarding breakfast, and about how the existing breakfast in the hospital lived up to these preferences. At the end of the interview a mood board tool was used with pictures of different foodstuff for breakfast. A mood board is a tool to visual brainstorming often used by graphic designers to communicate creative and new ideas [20]. The patients selected the pictures of foodstuff they would like the most to eat for breakfast, if they should select food for future breakfast in the hospital.

New recipes and servings were developed from the qualitative data results. The development took place in the diet department of the hospital central kitchen. We opted to integrate protein in two different ways, natural protein based on foodstuff with high protein density, as egg, and skyr (a traditional Icelandic sour milk, high in protein and low in fat), and protein powder supplementation (Whey protein isolate, Toft WPI – Toft care Denmark). The type of protein powder was chosen based on the amino acid composition. New recipes and servings were tested in the kitchen. The servings were evaluated internally by tasting among 10 members of the kitchen staff, and were afterwards adjusted for

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