Original article

Lack of nutritional and functional effects of nutritional supervision by nurses: a quasi-experimental study in geriatric patients

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Abstract

Background: Undernutrition affects recovery from disease and regaining functional abilities; however, it frequently occurs in elderly hospitalized patients.
Objective: To study whether identification of geriatric patients at nutritional risk followed by individualized nursing care could improve their nutritional and activities of daily living (ADL) status.
Design: The design was quasi-experimental. In total, 345 rehabilitation patients (aged 84 ± 7 years, 72% women) were allocated, according to bed availability, to either an intervention or a control ward. Nurses on the intervention ward attended a short class on nutrition and were supervised in nutritional care by trained nurses. In the intervention unit, the nursing staff identified patients at risk of undernutrition through systematic assessment of risk factors, e.g. body mass index (BMI) <24 kg m^{-2}, and treated them according to individual care plans. On the control ward routine nutritional care was offered. Functional status was assessed by the Barthel ADL index.
Results: Mean BMI was 24 ± 5 on both wards. Fifty-five per cent of the patients had BMI <24. On average, patients were weight stable from admission to discharge, irrespective of allocation. No difference was found in ADL status as a result of the intervention. However, patients who gained weight improved more in ADL status than patients who remained stable or lost weight.
Conclusions: In this geriatric setting standard care and care by trained and supervised nurses were equally effective in maintaining weight stability and functionality in rehabilitation patients with a mean BMI of 24. Weight increase was associated with improved functionality.

Keywords: *ADL*; *elderly*; *hospitalized*; *undernutrition*; *weight gain*

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Introduction

Undernutrition affects recovery from disease and infection, and regaining functional abilities and health-related quality of life (1). Several studies show that many elderly hospitalized patients are still not being identified and are not having their nutritional needs met (2–4). Lack of training and understanding about dietary requirements and food provision were given as reasons for inadequate nutritional care in Danish hospitals (3). Rasmussen et al. (4) found that nearly 40% of patients ($n = 590$, median age 71 years) were at nutritional risk and few of the patients were identified, indicating that no systematic assessment was applied.

The main goal in geriatric rehabilitation is to improve functional status, e.g. activities of daily living (ADL) (5, 6). Therefore, it is important to conduct studies that can clarify whether improvement in nutritional status influences functional status, e.g. as measured by ADL. Several studies have examined the effect of nutritional

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supplementation in elderly patients. It has been concluded that (7) evidence is weak about the effects of nutritional supplements on improvement in clinical outcome, functional benefit or reduction in length of hospital stay. A recent meta-analysis pointed out that in short-term care supplementation may lead to fewer complications and reduced mortality (8).

The present study addresses the issue of nutritional assessment and intervention in patients in a geriatric rehabilitation clinic, examining the effects in terms of nutritional and ADL status of a targeted individualized nursing intervention in patients at risk of undernutrition.

Participants and methods

Patients

The study included 345 patients (248 women, 97 men), mean age 83.6 years (SD 7.4), admitted consecutively to a Geriatric Rehabilitation Clinic in Copenhagen over 13 months. Patients hospitalized for less than 8 days ($n = 20$), discharged to other clinics ($n = 37$) or who died ($n = 29$) before discharge were excluded. All patients were admitted to the hospital from their own homes. Seventy-three per cent were discharged to their own homes, 6% to nursing homes and 9% to other departments, 7% died and in 5% discharge destination was unknown. The average hospital stay in the geriatric clinic was 33 days (median 26 days). Patients were admitted to the geriatric clinic after review by a specialist in geriatric medicine in the acute ward, in other wards in the hospital, or in their own homes. The primary reason for admission was the need for evaluation and rehabilitation (51%). The most frequent medical diagnoses (often in combination) were: sequelae after stroke, cardiac insufficiency, hypertension and pneumonia. Half of the patients had cognitive problems.

Study design

The design was quasi-experimental using a pre–post-test design with non-equivalent groups (9). The power calculation was based on (i) the hypothesis that weight gain would lead to improvement in ADL function and (ii) difference in changes between the intervention and control groups. Since a previous study (10, p. 295) had found the same improvement on the Barthel index by geriatric rehabilitation at all basic levels of ADL function (without nutritional intervention), there was reason to believe that this heterogeneous patient population would benefit further from nutritional intervention. Assuming a level of significance of 0.05 and a relative treatment effect of 30% improvement for the predefined outcome variable modified Barthel index (11) and an arbitrary standard deviation of 1.2 (log-scale), this gave a power of 0.9 to detect a treatment effect with 160 patients in each group (12).

The head nurse allocated incoming patients according to bed availability to one of two similar units, each comprising 22 beds. The nurse had no information about the patient's nutritional status. The intervention and control units did not differ with respect to the nurses' age, extent of experience or experience in geriatric nursing, or in the distribution of registered nurses and nursing auxiliaries. To avoid the possible spillover effect from intervention to control unit, the nurses in the control unit were told not to change anything in their procedures and daily practice with regard to nutritional care. There was no interchange of nurses between the two wards. Besides nurses, the interdisciplinary staff comprised physicians, physiotherapists, occupational therapists and social workers. The interdisciplinary staff did not differ between the two units regarding age, gender and experience. They did not take part in the nutritional care unless asked to do so by the occupational therapists who trained patients with functional eating problems or by the physicians who prescribed commercial nutritional supplements at discharge. The authors did not have access to dietitiants in this study.

Context

The units were located next to each other with a corridor between the units. The standard nutritional procedures at the start of the study were similar in the two units and comprised five to six, non-preplated meals (three main meals and two or three snack meals) that were prepared in the hospital kitchen and served by the nurses in a dining room. The energy, protein, carbohydrate and fat content of both the main meals and the snack meals was calculated by the kitchen staff. The dinner, served at 18.00 h, consisted of a main dish and a dessert. For breakfast and lunch the patients could choose between different types of food, e.g. bread with cheese, porridge, yoghurt, a small warm dish or sandwich spread. The snack meals consisted of, for example, home-made supplements (drinks and puddings) based on milk and eggs, commercial protein and energy drinks and puddings, cookies, ice-cream and cocoa with whipped cream. The meals were served at approximately 08.00, 10.00 and 12.00 h, and at 15.00, 18.00 and 21.00 h. At-risk patients had a diet consisting of 9000 kJ with fat-energy of 50% and protein-energy of 18%. All other patients had a diet with fat-energy of 40% and protein-energy of 18% (13). The dining room was comfortable and aired before meals. The nurses were responsible for the patients' nutritional care and for assessment of ADL status.

Nursing interventions

Table 1 shows the nursing actions in the two units. Before the study period, nurses in the intervention unit attended a 90 min lecture given individually or in small groups by an experienced nurse (IP), on the symptoms, consequences, risk factors, prevention and treatment of undernutrition. Furthermore, the nurses were trained in assessing nutritional status, including diet registration, examining oral and dental status, and enquiring about nutrition-related problems. Photographs were used to recognize oral and dental problems as well as the portion sizes of hot meals. As two of the authors (IP, HVP) participated in the clinical work the nurses were supervised on a daily basis throughout the study.

On admission the patients were interviewed and assessed (Table 1). The information was registered together with living situation and drugs, including those with the potential to cause nausea. During the first 3 days of admission a dietary registration was performed. All meals were noted in a preprinted registration form and the nurses registered the intake of each served meal, i.e. 0–25%, 26–50%, 51–75% or 76–100% of a standard meal (14). On the fourth day an average intake was calculated. The result was used to design individual nursing plans within the first 3 days of admission. The plan could, for example, include education of the patient about nutritional needs (Table 1).

Standard nutritional care

Patients in the control unit received the same clinical routine procedures for nutritional care as described in the context section for the intervention unit. The patients were assessed using procedures identical to those in the intervention unit, and had similar meal types. For these patients supplements and extra food were available (Table 1). The nurses in the control unit did not have any additional nutrition-related training.

Table 1. Interventions and standard treatment in the two units

Intervention unit	Control unit
BMI and ADL status on admission, weight once a week and weight and ADL status on discharge	BMI and ADL status on admission, weight once a week and weight and ADL status on discharge
Six meals a day (including three snack meals)	Six meals a day (including three snack meals)
Home-like eating environment	Home-like eating environment
Nursing care in small groups	Nursing care in small groups
Training and supervision of nurses	
Definition of risk patients: BMI <24 or weight loss $\geq 5\%$	
Examination of oral status and asking for nutrition-related risk factors	
Diet for at-risk patients: fat-energy of 50% (9 MJ)	
Diet for all other patients: fat-energy of 40% (7, 8, 12 MJ)	
Assessment of diet registration for 3 days	
Individualized nursing plans for at-risk patients and undernourished patients	
Involving patients by education in nutritional needs when being ill: by asking about appetite, wishes and needs, and by giving recipes and prescription on nutritional supply	

BMI: body mass index; ADL: activities of daily living.

Assessment of nutrition and activities of daily living

Body mass index (BMI) was calculated within 2 days of admission. Patients were weighed in the morning once weekly and on discharge. The weight was measured to the nearest 0.1 kg on a mechanical chair weight (Libra; HC Nielsen Hospital Equipment, Denmark). The height was measured to the nearest centimetre by a tape measure using the Frankfort plane (15) or, owing to the patient's condition, by whole arm span or by length of supine position on a flat bed (16). Patients with BMI <24 kg m^{-2} and/or weight loss $\geq 5\%$ within the previous month were defined as being at risk of undernutrition (17).

Independence in basic activities of daily living (BADL) was assessed using the modified Barthel index (11). The Barthel index was developed to assess improvement in elderly rehabilitation patients, and includes eating, walking, chair/bed transfer, continence, dressing and bathing, and ranges from 0 to 100 points; the higher the score the more independent the person is (18). The index has been validated and found to be reliable in elderly rehabilitation patients (19). This study used the modified version by Shah et al. (11) and tested the internal consistency by Cronbach's alpha, which was 0.93. The nurses were familiar with the modified Barthel index (10) and it was assessed within 3 days of admission and on discharge.

Statistical analysis

Wilcoxon's two-sample and Fisher's exact tests were used for comparison between the groups at baseline. The effect of gender was tested using the Mantel–Haenzel or the Breslow–Day test. The Wilcoxon two-sample test was also used to examine the difference in change between groups. Three-way analysis of variance (ANOVA) was used to test the interaction between gender and treatment unit. Three-way was used to analyse the effect of intervention: difference in weight, BMI and Barthel index changes. The explanatory variables were treatment (intervention or control), BMI classification (BMI <24 and BMI ≥ 24) and weight change. Weight changes were categorized as 1: weight loss (≤ -0.5 kg); 2: no weight change (-0.5 to $+0.5$ kg); and 3: weight gain ($\geq +0.5$ kg). SAS (SAS Software 8.2; SAS Institute, Cary, NC, USA) and SPSS 11.5 (Statistical Package for the Social Sciences; Chicago, IL, USA) were used for the statistical analyses. Statistical significance was set at $p < 0.05$.

Ethics

The patients were informed orally and in writing that they were taking part in the study and the Ethics Committee in Copenhagen accepted the study. The Danish Data Protection Agency gave consent for the data registration.

Results

In total of 345 patents were included, 155 in the intervention unit and 190 in the control unit. As shown in Table 2, fewer women in the intervention unit needed help with cooking than those in the control unit (63.2% vs 47.3%, $p < 0.01$), otherwise there were no differences between the patients in the two units. Fifty-five per cent of all patients had a BMI of <24 on admission. The average BMI was around 24. The Barthel index showed, according to Mahoney et al. (20), that patients needed some help with BADL (intervention unit: 65.6 points; control unit: 64.3 points). Forty-eight per cent in the intervention unit and 47% in the control unit used seven or more drugs, and 27% and 28%, respectively, used potentially nausea-inducing drugs. The average length of hospital stay was 5 days longer in the intervention unit (not significant).

No significant difference in change in weight, BMI and Barthel index from admission to discharge was found between the intervention and the control unit. Patients in the intervention unit had a weight change of 0 kg (SD 2.9) and patients in the control unit had a weight change of -0.1 kg (SD 2.8) ($p = 0.89$).

Table 2. Baseline variables: comparison between intervention and control units

	Intervention ($n = 155$)	Control ($n = 190$)	p-Value
Gender			0.81
Women	110 (71.4%)	138 (72.6%)	
Men	44 (28.6%)	52 (27.4%)	
Average age (years)	83.2 ± 7.7	83.9 ± 7.1	0.40
Women	84.1 ± 6.9	84.8 ± 5.9	0.60
Men	81.1 ± 9.2	81.6 ± 9.4	0.99
Living alone	129 (83.8%)	154 (81.1%)	0.47
Women	96 (87.3%)	121 (87.7%)	1.00
Men	33 (75%)	33 (63.5%)	0.27
Help with cooking: home care/others/no one	18/27.8/54.1%	33.6/19.1/47.3%	0.01
Women	14.7/22.1/63.2%	33.6/19.1/47.3%	<0.01
Men	26.3/42.1/31.6%	21.9/21.9/56.3%	0.10
Average weight (kg)	63.1 ± 16.4	62.0 ± 17.2	0.59
Women	60.4 ± 15.3	57.1 ± 13.9	0.08
Men	69.7 ± 17.3	74.9 ± 18.4	0.11
BMI (kg m^{-2})	24.3 ± 5.9	24.0 ± 4.9	0.57
Women	24.4 ± 6.1	23.3 ± 4.5	0.44
Men	24.1 ± 5.4	25.6 ± 5.3	0.15
Barthel index	65.6 ± 24.2	64.3 ± 24.3	0.64
Women	67.4 ± 23.8	66.6 ± 23.4	0.76
Men	61.0 ± 24.7	58.2 ± 25.6	0.64
Length of hospital stay	37.2 ± 29.8	32.2 ± 24.9	0.13
Diet (e.g. diabetes)	15 (9.8%)	25 (13.2%)	0.32
Drugs			0.83
0–3	28 (18.2%)	25 (13.2%)	
4–6	51 (33.1%)	73 (38.4%)	
7–10	52 (33.8%)	68 (35.8%)	
>10	23 (14.9%)	24 (12.6%)	
Nausea-inducing drugs	42 (27.2%)	54 (28.4%)	0.85

All data on admission, with the exception of length of hospital stay.
Data are presented as mean ± SD or n (%). Significance was measured with Fisher's exact test (two-tailed) or Wilcoxon two-sample test.
BMI: body mass index.

Patients with BMI <24 ($n=180$) on average had a weight gain of 0.5 kg, whereas patients with BMI ≥ 24 ($n=165$) had a weight loss of 0.7 kg ($p<0.001$). This finding was similar in both units. When isolating those with BMI <24 (i.e. at risk of undernutrition), there were no significant differences in weight course between the intervention and control patients.

A statistically significant improvement of 15.1 points (intervention) and 15.6 points (control) ($p<0.01$) by Barthel index from admission to discharge was seen in both groups, but no difference in improvement between groups was found.

Weight gain was significantly associated with an increase of 5.6 points on the Barthel index ($p=0.02$). The Barthel index increased more in men than in women (19 vs 14 points) ($p=0.03$). Whether patients were admitted to the intervention or the control unit was not a significant explanatory variable.

Discussion

This study showed that individual and systematic nursing intervention, as well as standardized nutritional care, was associated with maintained nutritional and functional status in a group of geriatric patients. Thus, nutritional training of nurses showed no benefits. However, there was a positive association between improved nutritional status and enhanced ADL functions.

The patients matched the description of geriatric patients in the Nordic countries (21) and their age and functional status were comparative to other geriatric patients (22, 23). However, their nutritional status was better than in most controlled nutritional intervention studies in corresponding patients (24). The patients had an average BMI of 24.1 on admission. This relatively good nutritional status and the fact that patients included were selected mainly for rehabilitation purposes may mean that an effect of intervention is less likely than in patients with acute somatic disorders. In most intervention studies in elderly hospitalized patients where effects of supplementation have been reported the patients had a lower BMI, e.g. <20, from the start (24). Thus, the potential for improvement in elderly patients' nutritional status may be influenced by the status on admission. The two units were geographically placed close together. The nurses in the control unit knew what was happening; despite the fact that they were supposed not to change their practices, they may have focused unintentionally on nutritional care, leading to changed practice. The focus on nutritional care in general may also have increased the focus on identifying patents at risk of undernutrition in the control unit. Thus, the intervention may of itself have standardized the level of nutritional care in both units. Compared with observational studies where many patients lose weight (25, 26), the control patients in this study were weight stable, which indicates that the quality of the standardized nutritional care might have been above average.

Randomization of patients to the two units was impossible, for the reasons explained in the methods section. Instead, a quasi-experimental design was used. The strength of this design in comparison with a true experiment, i.e. a randomized trial, depends on the similarities between the experimental and control groups (9). To comply with this, the most widely used quasi-experimental design: the pre–post-test design with non-equivalent groups (27), was used. The pre-test was conducted at baseline to detect whether there were signs of selection bias due to the distribution of patients to the intervention and the control unit. The difference reported occurred at random. The nurses' age, years of experience and experience in geriatric nursing, and the proportion of registered nurses and auxiliary nurses were also tested, without finding any significant differences. Thus, the pre-test showed that the two units were comparable in relation to the chosen variables.

In the power estimation, an estimated standard deviation in the improvement of Barthel index was used in the absence of real values. The real standard deviation in this study turned out to be 24 (Table 2), indicating a large variation within the sample, and thus a larger sample would have been needed to obtain the assumed power of the intervention. Thus, a post hoc calculation was done based on the observed standard derivation. For an unchanged measure of effect (30% risk reduction) with a power of 0.90, the study should have included 325 patients in each group.

The cut-off for being at risk of malnutrition, i.e. BMI <24, was chosen as suggested by Beck and Ovesen (17). In the present study, the aim was to prevent undernutrition, therefore lower BMI cut-off limits were not used. According to the Swedish National Board for Health and Welfare, BMI should be 24–29 in elderly people and BMI <22 indicates underweight in elderly people (16). As described above, 55% of the population with BMI <24 on admission had a weight gain of 0.5 kg, whereas patients with BMI ≥ 24 had a weight loss of 0.7 kg. This may partly be ascribed to the effect of "regression towards the mean", but may also indicate that a BMI of 24 is appropriate as a cut-off for at-risk patients. In a randomized controlled trial, where the effect of supplements was examined in a group of elderly discharged patients, BMI ≤ 24 was also used as the inclusion criterion (28). In that study no significant difference in weight was found between the intervention and the control group, but the intervention group showed a significant increase in handgrip strength (28).

A weight loss of 5% within the last month was, however, not effective as an indicator of nutritional risk, because the patients in general could not give reliable information. Instead, the diet registration, evaluation of 3 days' nutritional intake and assessment of nutrition-elated variables, including oral status, were used to identify patients at risk of undernutrition.

The study excluded only patients who died or were referred to other wards. However, as discussed above, this may mean that less well patients with better chances for benefit from intervention were excluded. Previous studies where food supplements have shown an effect have excluded patients with poor compliance or who declined to participate. Larsson et al. (29) excluded 56 patients (11%), Potter et al. (30) excluded 107 (18%) non-participating patients and Volkert et al. (31) excluded 40 out of 72 patients, reflecting a great risk of selection bias in those studies compared with the present study.

The improvement in ADL status in both units indicates that, according to Mahoney et al., the patients generally improved from "being in need of some help" to "being able to manage most ADL tasks" (20). No significant difference in improvement due to the intervention was found. However, there was a significant association between weight gain and improvement in ADL status. This was a limited increase of 5.6 points on the Barthel index. For the individual patient this may sound irrelevant; however, it means, for example, an increase in the ability to walk up stairs or visit the toilet, which may contribute to the possibility of living independently and thus have an impact on the patient's quality of life. This observation stresses the need for integrating good nutritional care in geriatric rehabilitation, despite the fact that this study could not demonstrate any difference between patients in the two units.

In conclusion, this study could not show any effects of tailored nursing focusing on nutritional care that were not already obtained by good routine nursing care in this group of geriatric patients. Contributory factors may be that the patients were in a good nutritional state at the start and that the nurses in the control unit focused on nutrition as much as nurses in the intervention unit. The association between weight gain and improvement in ADL status indicates that good nutritional care should be an integrated tool in geriatric rehabilitation.

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