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Usefulness of dietary enrichment on energy and protein intake in elderly patients at risk of malnutrition discharged to home

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Abstract

Introduction: **Malnutrition is a cause for concern among many admitted elderly patients, being common at hospital admission and discharge.**

Objectives: **The objective of this study was to assess if diet enrichment with small servings of energy and protein dense foods, improves energy and nutrient intake in elderly patients at risk of malnutrition discharged to home.**

Methods: **This was a retrospective case series study in elderly patients at risk of malnutrition treated with diet enrichment. There was a data review of dietary and health records of elderly patients discharged to home. Forty-one patients, mean age of 83 ± 5 years, met the inclusion criteria; 13 patients had been lost after 4 weeks of treatment and a total of 24 patients after 12 weeks. Records contained food intake data assessed at baseline, and after 4 and 12 weeks of treatment. Mini Nutritional Assessment, anthropometric measurements, routine biochemical parameters and the Barthel Index were assessed at baseline and after 12 weeks.**

Results: **Compared to baseline, patients significantly improved their energy and protein intake after 4 weeks of treatment, fulfilling the mean nutritional requirements. The improvement in energy and protein intake was still manifest at week 12. After 12 weeks of dietary enrichment, a significant weight gain was observed (4.1%, p = 0.011), as well. No significant changes were detected in functional status.**

Conclusions: **Using small servings of energy and protein dense foods to enrich meals seems a feasible nutritional treatment to increase energy and protein intake and meet nutritional goals among elderly patients discharged to home.**

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UTILIDAD DEL ENRIQUECIMIENTO DE LA DIETA SOBRE LA INGESTA ENERGÉTICA Y PROTÉICA EN PACIENTES ANCIANOS EN RIESGO DE DESNUTRICIÓN DADOS DE ALTA A DOMICILIO

Resumen

Introducción: **La desnutrición es causa de preocupación en muchos pacientes ingresados, siendo frecuente al ingreso y alta hospitalaria.**

Objetivos: **El objetivo de este estudio fue valorar si el enriquecimiento de la dieta con pequeñas raciones de alimentos densos en energía y nutrientes mejora la ingesta energética y de nutrientes en pacientes ancianos con riesgo de desnutrición dados de alta al domicilio.**

Métodos: **Estudio retrospectivo de una serie de casos en paciente ancianos con riesgo de desnutrición tratados con enriquecimiento de la dieta. Se revisaron los datos de la historia clínica y dietética de pacientes ancianos dados de alta a domicilio. Cuarenta-y-un pacientes, con una edad media de 83 ± 5 años, cumplieron los criterios de inclusión; 13 pacientes se perdieron después de 4 semanas de tratamiento y un total de 24 después de 12 semanas. El historial contenía datos de la ingesta de alimentos valorada a nivel basal, y después de 4 y 12 semanas de tratamiento. El Mini Nutritional Assessment, las medidas antropométricas, los parámetros bioquímicos rutinarios y el Índice de Barthel fueron valorados a nivel basal y después de 12 semanas.**

Resultados: **En comparación al inicio, los pacientes mejoraron significativamente su ingesta energética y proteica después de 4 semanas de tratamiento, cumpliendo con los requerimientos nutricionales medios. La mejora en la ingesta de energía y proteínas todavía era manifiesta en la semana 12. Después de 12 semanas de enriquecimiento de la dieta, también se observó un incremento significativo en el peso (4.1%, p = 0.011). No se detectaron cambios significativos en el estado funcional.**

Conclusiones: El uso de pequeñas raciones de alimentos con elevada densidad energética y proteica para enriquecer las comidas parece ser un tratamiento nutricional factible para incrementar la ingesta energética y proteica y cumplir con los objetivos nutricionales en paciente ancianos dados de alta al domicilio.

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Palabras clave: *Actividades cotidianas. Anciano. Dietoterapia. Desnutrición. Estado nutricional.*

Abbreviations

BMI: Body Mass Index.
CI: Confidence Intervals.
MUAMA: Mid-Upper Arm Muscle Area.
MNA: Mini Nutritional Assessment.

Introduction

An important number of elderly patients are admitted to hospitals with a deteriorated nutritional status. In the Spanish population the prevalence of malnutrition in this subgroup of patients ranges from 24.6% to 69.2% of hospital admissions, depending on the diagnostic criteria.[1] Malnutrition at discharge still remains a cause for concern, with prevalence between 6.9% to 27.6% among community-living elderly people[1].

The causes of malnutrition in older people are complex and multi-factorial, including acute and chronic diseases, loss of appetite and reduced nutritional intake, psychological and psychosocial factors, and hospitalization *per se*[2,3]. Malnutrition has important adverse effects on clinical outcomes; from compromised immune function and impaired wound healing, to loss of functional status that may lead to frailty[4].

Frailty, in turn, may occur as a result of an acute event or be the end stage of many chronic conditions, and it is identified by decreased reserves in multiple organ systems. It may be initiated by disease, lack of activity and inadequate nutritional intake, among others. Its main manifestations are loss of skeletal muscle mass and strength, and an impaired functional status, which results in a diminished ability to care for oneself and an increased risk for institutionalization, morbidity and mortality[5,6]. In hospital admitted patients, general functioning can deteriorate substantially in a relatively short time, therefore, their independence and autonomy may become a matter of concern at discharge.

Different strategies are available to improve the nutritional intake in older adults, from modifying the texture of solid and liquid foods to using oral liquid nutritional supplements in addition to meals. While many studies have used oral nutritional supplements in hospitalized or institutionalized patients, only a few have assessed the effects of increasing the energy and/or nutrient density of recipes[7-9]. Unfortunately, frailty or the risk of malnutrition in aged patients are not a criteria *per se* for oral nutritional supplementation coverage by the healthcare system in Spain, and research on diet enrichment in the community setting in the elderly population is very much needed.

Therefore, the aim of this study was to assess if the use of a treatment through diet enrichment with small servings of energy and protein dense foods, improved energy and nutrient intake in elderly patients at risk of malnutrition discharged to home.

Methods

Study design and subjects

This retrospective case series reports on the use of a diet enrichment treatment with protein and energy dense foods after hospital discharge, in consecutive patients at risk of malnutrition admitted to the Internal Medicine ward from April 2005 until July 2006.

Data was obtained through the review of the dietary and nutritional information gathered by dietitians during the admission and hospital visits of patients, along with the review of written and electronic health records. Subjects included for review were characterized as elderly patients at risk of malnutrition, assessed as a Mini Nutritional Assessment (MNA) score below 23.5 points and discharged to home with a treatment of diet enrichment, as well as the following criteria: over 65 years of age, involuntary weight loss over 5% during the last month or over 10% the last six months and anorexia. Patients eligible for oral nutritional supplementation, enteral nutrition or sent to a nursing home after discharge were excluded from the study.

Dietary treatment

The treatment consisted in individualized dietary counseling once patients were discharged to home, aimed to increase their intake through diet enrichment with small servings of energy and protein dense foods. Patients and family caregivers received oral information and a handout with instructions on how to enrich meals in energy and/or protein according to the recommended quantities. Energy enrichment consisted of small servings with energy rich foods, each serving added approximately 50 kcal to the meal, and examples included: 20 g of raw semolina, 15 g of honey, 5 g of oil or 10 g of walnuts. Likewise, protein enrichment consisted of small servings with protein rich foods, each serving added approximately 5 grams of protein, and examples include: 20 g of powdered milk, 2 small egg whites, 30 g of ham or 2 portions of processed cheese. All servings examples were given in grams and cooking measurements (e.g. tablespoon), patients were instructed on how many servings they had to add daily and the best way to include them into their meals. There was a reinforcement of the treatment via telephone contact with a dietitian 4 weeks after discharge.

Dietary assessment

At baseline, food intake was assessed during hospital stay by direct observation during three working days before discharge, by a dietitian or nursing staff. After discharge, there were data available from a 24-hour recall performed via telephone at week 4, and from a 3-day diet diary recorded before the hospital visit at week 12. Mean total energy, protein,

carbohydrates and fat intakes were calculated using the software Dietsource (version 3.0, Cath Soft, Spain).

Nutritional status and functional assessment

The MNA was used to assess the nutritional status[10]. Subjects were classified as normal nutritional status (>24 points), at risk of malnutrition (17-23.5 points), or malnourished (<17 points). Energy requirements were obtained based on the Harris-Benedict formula plus the stress and activity factors according to each patient. A minimum protein goal was set at 1 g/kg weight/day.

Different anthropometric parameters were obtained during admission and in a scheduled visit 12 weeks after discharge, including: body weight, height, body mass index (BMI), triceps skinfold, mid-upper arm muscle area and calf circumference.

All subjects underwent venous blood sampling on admission and during the follow-up visit to obtain routine biochemical and hematological parameters.

The Barthel Index was used as a measure of functionality[11]. This is a tool that assesses the activities of daily living of individuals on a scale ranging from 0 to 100 points. Low scores indicate high dependency and high scores show a more or less intact ability to care for oneself.

Statistical analysis

Continuous variables were analyzed as means, and categorical variables were transformed to frequencies for each category. All data are presented as means and 95% confidence intervals (CI) on parenthesis, unless indicated otherwise. For continuous variables, a Wilcoxon signed-rank test for paired data was performed to assess changes within baseline and after 4 and 12 weeks of treatment. Categorical variables were analyzed using a Mantel-Haenszel Chi-Square test. For all statistics, significance was accepted at the 5% probability level. Data analysis was performed with the use of the statistical analysis software SPSS (version 18, IBM Corporation, USA). Study approval was granted by the Ethics Committee of Clinical Research of the Hospital Clinic Universitari de Barcelona.

Results

Patient characteristics

Forty-one patients in our sample met the inclusion criteria. At week 4, three patients refused the follow-up, four had a worsening in their condition and changed treatment, and six died. Data from 28 patients were available at this time point. At week 12, only 17 patients could attend the follow-up visit; six refused further following, two had a worsening in their condition and changed treatment, and three died. Baseline characteristics for the initial sample are shown in table I.

The cause of hospital admission was heart failure in 13 (32%) patients, infection in 12 (29%), respiratory failure in eight (19%), gastrointestinal diseases in six (15%) and other conditions in two (5%) subjects. Patients had one or more of the following comorbidites: heart disease in 24 (59%) patients, diabetes in 11 (27%), respiratory disease in 11 (27%), kidney failure in 10 (24%), and liver disease in four (10%) patients.

During admission, all patients reported having anorexia, 40 (98%) moderate and one (2%) severe. Twenty-one (51%) patients needed a soft diet, 18 (44%) a standard diet, and two (5%) a pureed diet. Baseline MNA showed that 12 (29%) patients were malnourished and 29 (71%) were at risk of malnutrition.

Dietary assessment

As shown in table I, mean energy and protein intake at baseline did not reach energy requirements and the

Table I
Baseline characteristics of patients

Baseline characteristics (n = 41)	
Age (years)	83 ± 5
Women/men	27/12
Weight (kg)	59.1 ± 13.4
BMI (kg/m^2)	23.6 ± 3.9
Triceps skinfold (mm)	12.5 ± 4.4
MUAMA (cm)	21.3 ± 2.3
Calf circumference (cm)	31.9 ± 4.1
Total proteins (g/L)	61 ± 7
Total cholesterol (mg/dL)	142 ± 37
Hemoglobin (g/L)	110 ± 22
Energy requirements (kcal)	1594 ± 297
Protein goal (g)	59 ± 13
Energy intake (kcal)	1343 ± 176
Protein intake (g)	55 ± 12
Carbohydrate intake (g)	156 ± 42
Fat intake (g)	60 ± 29
Barthel Index	67 ± 18

Values are means and standard deviation. BMI: Body Mass Index. MUAMA: Mid-Upper Arm Muscle Area.

Table II
Treatment received and mean baseline percentages of intake for energy and protein in relation to requierements

Treatment received	*Number of patients*	*Percentage of energy intake*	*Percentage of protein intake*
Energy enrichment	21 (51%)	81%	100%
Protein enrichment	3 (7%)	100%	85%
Both enrichments	17 (42%)	82%	78%

minimum protein goal set. The criteria for diet enrichment were based on the percentage of intake for energy and protein with regard to the objectives set for each patient (Table II). The amount of dietary energy enrichment recommended was 200 kcal in 14 (34%) patients, 250 kcal in 19 (46%) patients and 300 kcal in five (12%) patients. Dietary protein enrichment was of 10 g in 16 (39%) patients, 15 g in three (7%) patients and 20 g in one (2%) patient.

Compared to baseline, patients significantly improved their energy and protein intake after 4 weeks of treatment, fulfilling the mean nutritional requirements (Table III). At week 4, 19 (68%) patients reached 100% of the energy requirements and 16 (57%) patients at least 1 g/kg weight of protein. The improvement in energy and protein intake was still manifest after 12 weeks of treatment, where seven (41%) patients reached 100% of the energy requirements and 13 (76%) patients the protein goal.

Nutritional status and functional assessment

Of the 17 individuals that completed the follow-up, 14 (82%) patients were categorized as risk of malnutrition and 3 (18%) as malnourished, at baseline. After 12 weeks of dietary enrichment, the nutritional status classification significantly changed with eight (47%) patients categorized as normal nutritional status, eight (47%) as risk of malnutrition and one (6%) as malnourished ($p = 0.021$). There was a 4.1% weight gain 12 weeks after discharge. We did not find any differences for other anthropometric measurements though, as shown in table IV. Even though plasma proteins and total cholesterol were inside normal ranges at baseline, they increased together with hemoglobin after treatment. Barthel Index scores showed a slight improvement, without reaching statistical significance.

Table III
Mean values for energy and nutrient intake after 4 and 12 weeks of treatment

Mean values for energy and nutrient intake after 4 weeks of treatment (n = 28)				
	Requirements	*Discharge*	*4 weeks*	*p*
Energy (kcal)	1650 (1528-1772)	1342 (1265-1419)	1720 (1596-1844)	<0.001
Protein (g)	61 (56-67)	56 (51-61)	67 (61-73)	0.002
Carbohydrate (g)	–	158 (142-174)	178 (161-196)	ns
Fat (g)	–	58 (46-70)	86 (68-105)	0.011
Mean values for energy and nutrient intake after 12 weeks of treatment (n = 17)				
	Requirements	*Discharge*	*12 weeks*	*p*
Energy (kcal)	1730 (1575-1884)	1342 (1252-1433)	1695 (1515-1876)	<0.001
Protein (g)	62 (55-69)	59 (53-65)	66 (55-77)	ns
Carbohydrate (g)	–	160 (138-182)	202 (177-227)	0.006
Fat (g)	–	55 (41-69)	68 (56-80)	ns

Values are means and 95% CI.

Table IV
Mean values for anthropometric, biochemical and functional data (n = 17)

	Discharge	*12 weeks*	*p*
Weight (kg)	62.4 (55.3-69.5)	65.1 (57.6-72.5)	0.011
BMI (kg/m^2)	24.8 (22.6-26.9)	25.9 (23.6-28.1)	0.014
Triceps skinfold (mm)	13.1 (10.7-15.4)	13.5 (10.8-16.1)	ns
MUAMA (cm)	21.2 (19.9-22.6)	21.5 (20-22.9)	ns
Calf circumference (cm)	31.7 (29.7-33.7)	31.7 (29.4-34)	ns
Total proteins (g/L)	62 (58-65)	69 (65-74)	0.001
Total cholesterol (mg/dL)	143 (129-157)	163 (143-182)	0.041
Hemoglobin (g/L)	103 (92-114)	114 (103-124)	0.048
Barthel Index	76 (70-83)	82 (72-91)	ns

Values are means and 95% CI. BMI: Body Mass Index. MUAMA: Mid-Upper Arm Muscle Area.

Discussion

The aim of this study was to evaluate if the use of a treatment through diet enrichment with small servings of energy and protein dense foods, could improve the energy and protein intake of elderly patients at risk of or with manifest malnutrition that were discharged home. Our results show how the treatment of this group of patients through the addition of small servings of energy and nutrient-dense foods to the usual diet resulted in increases of both energy and protein intakes. No significant changes were detected in functional status.

Malnutrition is a cause for concern among many admitted elderly patients, being common at hospital admission and discharge. Being malnourished at hospital discharge has been associated with a higher use of home health services, higher readmissions and mortality after hospitalization[12-15]. Diet enrichment is a dietary tool often used by dietitians in our hospital in the treatment of malnutrition, but its effectiveness had never been evaluated before. In contrast with oral nutritional supplementation, this modality of dietary treatment is a less well-researched area especially among community-living elderly people. Treatment assessment 4 weeks after patients were discharged showed how energy and protein intake significantly improved, compared to baseline. Besides, patients met the mean nutritional goals set for energy and protein. For those patients that arrived at the 12 weeks follow-up the improvement in energy and protein intake was maintained. We haven't been able to find studies in the literature aiming to evaluate the effect of diet enrichment with small servings of energy and protein dense foods in a home-based setting, as is the case with our study. Dietary enrichment on community living elderly people was evaluated in a study where participants received a home-delivered lunch meal[16]. Subjects were randomized in two groups in a crossover within-subjects design, receiving a regular menu or an enhanced version of the same menu that provided twice the energy through enrichment with conventional foods. Similar to our results, the enriched meal resulted in a significant increase in mean energy and protein intakes, as well as in other nutrients.

Several studies have been conducted in the hospital setting and with institutionalized elderly people. Although oral nutritional supplementation seems to be the treatment of choice during hospital stay, the possibility of increasing energy and protein intake through the enrichment of hospital meals has been evaluated. These studies have shown how this kind of intervention allows elderly patients to increase their energy intake, with mixed results for protein intake, without hindering normal food intake[17-19]. In order to achieve this goal, the portion size of meals have to be kept small with an increased energy and nutrient density[20]. Similar problems may be faced by institutionalized elderly people in nursing homes, where between 20.8% to 33% of residents are malnourished in Spain[1]. A recent multicenter study carried out in Spanish nursing homes concluded that there was a need to improve residents' energy intake, proposing as an alternative to increasing food portions, the enrichment of certain food types[21]. This approach has been investigated in other countries, such as the study of Ödlund Olin et al[8]. where elderly residents in a nursing home received energy-dense meals or standard meals for a 15-week period. Residents in the energy-dense meals group significantly increased their energy intake compared to the standard meal group. Another study investigated the effect of a 12-week intervention with energy and protein-enriched diet plus the use of snacks, on the nutritional status of residents at risk of malnutrition. At the end of the intervention, protein intake was significantly higher in the experimental group, although energy intake was similar in both the experimental and control groups[22].

In our study, a significant number of patients with complete follow-up improved their MNA score. Besides, body weight and BMI significantly improved after 12 weeks of treatment, although these patients already had a good BMI at baseline. Other studies have also found improvements on weight and BMI through diet enrichment, although the greatest effect is usually found in those patients with a low BMI at baseline[8]. Even though variations within limits of normality have little clinical relevance, the increases in biochemical parameters observed in our study could be a result of dietary enrichment as well.

Older adults can be admitted to a hospital with a good functional status and lose some of that function upon discharge. In our study, functional status assessed as activities of daily living with the Barthel Index showed little progress. This lack of significant improvement after 12 weeks of treatment could have been caused, in part, by the fact that those patients in better condition arrived at the follow-up visit, while those with lower scores in the Barthel Index were the ones that died or were lost due to a worsening in their condition. Other studies have not been able to find any progress on functional status with this kind of nutritional intervention either[8,22].

There are a number of methodological limitations inherent to a retrospective case series study, including the lack of a control group and the possibility of selection bias. Without a control group it is not possible to distinguish if the changes observed were due to the treatment or inherent to an improvement in the clinical status of patients after discharge. In any case, our data suggest that this kind of intervention might be a valid alternative to increase energy and protein intake. In addition to these, the review of health records showed a lack of data due to a loss of patients at the 12-week follow-up visits, which limited sample size. The subjects included in this study suffered from a variety of chronic diseases and co-morbidities, which caused a loss of an important number of patients due to a worsening in their condition or death before the follow-up visit. Besides, the use of the Barthel Index as the only

measure of functional status without the use of other tools such as the measure of strength (e.g. grip strength) or mobility (e.g. gait speed), constitutes another limitation.

Other diet-based interventions such as increasing the number of meals have not warranted an improvement in energy intake among elderly people[23]. Given the small appetite of this kind of patients, diet enrichment seems a feasible nutritional treatment to increase energy and protein intake and meet nutritional goals among elderly patients discharged to home. Besides, in a time of economic constraints and with predicted further cuts in healthcare systems around many European countries, menu enrichment with conventional foods could be a viable, easy and effective intervention in those elderly patients that may not be eligible for oral nutritional supplementation coverage by some national healthcare systems.

Therefore, using small servings of energy and protein dense foods to enrich meals might prove a useful and inexpensive treatment for those elderly patients at risk of or with manifest malnutrition discharge home. We believe that our results justify carrying out prospective studies in elderly patients at risk of malnutrition. It would be valuable to compare the effects of diet enrichment with energy dense foods versus conventional oral nutritional supplementation on nutrient intake and nutritional status. Moreover, achieving improvements in functional status through nutritional therapies will require multi-factorial interventions and specific evaluations that address physical factors.

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