



## NUTRITIONAL INTERVENTION DURING HOSPITALIZATION IN MALNOURISHED PATIENTS

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**Abstract:** *Background:* Malnutrition affects up to 60% of older people at hospital. *Objective:* To diagnose the nutritional status of patients admitted to a geriatric care unit and to assess the effects of specific nutritional followup to improve the nutritional status of hospitalised patients compared with standard care in the same care unit. *Design and intervention:* Patients were 75 years and older were able to eat normally and the malnourished status was evaluated by either a MNA short-form score < 11 points or albumin (alb) level < 35g/L or transthyretin (TTR) < 0.2 g/L. The study comprised two groups: the interventional group (IG) received specific nutritional intervention for a maximum of 20 days and the control group (CG) received no specific encouragement other than that usually provided in the care unit when malnutrition was detected. At admission, day 0, the MNA, anthropometric data, autonomy levels (ADL, IADL), cognitive and depressive status, blood parameters (Alb, TTR and C-reactive protein, CRP) and 3-day food intake were measured. At day 10, ADL and 3-day food intake were measured. Finally at day 20, blood parameters and 3-day food intake were measured. *Subjects:* The nutritional status of all patients admitted to the geriatric care unit was systematically assessed and fifty hospitalised elderly people (87.2 ± 5.9 years old) were recruited in the geriatric unit to participate in the study with specific nutritional follow-up (IG n = 22; CG n = 28). *Statistical analysis:* All data are presented as mean ± standard deviation (SD) for all patients for the interventional and control groups. Student t-test was used to determine the effect of nutritional intervention on blood samples and food intake. *Results:* 478 people were hospitalised in the acute geriatric care unit, age was 85.6 ± 6.4 years and the length of stay 20.1 ± 10.9 days. Among these, 61.5% were malnourished and 73 accepted to participate in the study. Complete results were obtained for analysis for 50 patients. On admission, the average blood parameters, in particular alb and TTR were low and CRP was high, which showed an inflammatory status. After 10d of intervention, changes in levels of alb, TTR and CRP were highly significant in the IG (p=0.005 for alb; p=0.0003 for TTR; p=0.0004 for CRP). In the CG, changes in TTR and CRP were also significant (p=0.001 for TTR and p=0.003 for CRP). An increase in TTR values occurred in only 67.8% of patients in the CG against 86.4% in the IG. An increase in calorie intake was noted for 72.7% of the IG against only 46.4% of the CG. *Conclusion:* Intervention given to patients during the first 10 days of the hospital stay can re-initiate food intake, and thus improve blood parameters. However the nutritional intervention does not lead to better outcomes compared to usual care.

**Key words:** Elderly, malnutrition, food intake, transthyretin, nutritional intervention.

### Introduction

In most countries, the proportion of people aged over 60 years is growing faster than any other age group. The World Health Organization and the United Nations announced that there are currently 650 million people aged 60 years and older. By 2050, this number is forecast to reach 2 billion (1). Maintaining good health in the older people has become a public health issue. For the older people, the main risk is protein-energy malnutrition (PEM) or undernutrition. PEM is the result of inadequate

nutrient intake. It is a pathological state caused by the persistent mismatch between metabolic needs and the bioavailability of energy, protein and micronutrients. It is a dynamic process that begins when protein-energy inputs become insufficient to cover the body's needs. According to studies, this condition can affect 19 to 60% of institutionalized persons, 50% in hospital and 3 to 10% at home (2, 3). On all fronts, the consequences of PEM are dreadful, with a cascade of complications leading to an increase in morbidity and mortality (4). PEM increases the duration of hospital stays, reduces the supply of minerals and vitamins, increases immune deficiency, infections, the risk of falling and the number of fractures; it is the spiral of malnutrition (5). PEM can have a dual mechanism. On the one hand, it may be exogenous and linked to a lack of intake, or on the other hand it may be

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endogenous and linked to an increase in protein-energy needs in situations of hypercatabolism such as those encountered in patients with ulcers, cancers or infections (6).

There are several reasons for a decrease in food intake in the elderly. On average, a 70-year-old person consumes 30% fewer calories than a young person (7, 8). Unlike young adults, the elderly are not able to replenish nutritional stores after an inflammatory syndrome, which can cause persistent malnutrition.

The elderly are more likely to develop malnutrition, and reduced food intake can be triggered by various factors including impaired taste and smell (5, 9, 10), less varied food choices (sensory specific satiety) (11), and a deterioration in dental status with age (12-15). However, this is never the only cause of PEM (5). Various diseases and medications can affect food intake. Some drugs alter the perception of taste or cause a decrease in the production of saliva. Others can impair intestinal transit and cause nausea, diarrhea or constipation (16). High levels of medication can reduce food intake in elderly patients (17). Besides, a study has shown that disease, medications, weight loss, low albumin and TTR concentrations during hospitalization are risk factors of readmission (18).

Several nutritional treatments, when carried out early enough, seem to have a positive effect on energy and nutrient intake in frail elderly people (19, 20). They can produce gains in or maintain weight, and are sometimes associated with increased physical activity (20-22). Oral nutritional supplements (ONS) have usually been the first-line treatment for malnutrition (23, 24). Studies with enriched food have also had positive outcomes in the energy intake of elderly hospitalized patients (25, 26). Most supplements contain protein and/or high energy ingredients and are given in the form of a cream or milk drink during or between meals (19, 27). The effects of this type of intervention on body composition, muscle function and quality of life have been investigated (20, 28, 29). Another observational study showed that a state of malnutrition was significantly associated with dysphagia and slow food intake. Visual disturbances associated with depression can also lead to malnutrition as they often induce food refusal (14).

The purpose of this study was to compare the effect of specific nutritional intervention on nutritional status in malnourished patients hospitalized in an acute care geriatric unit with usual care.

## Methods

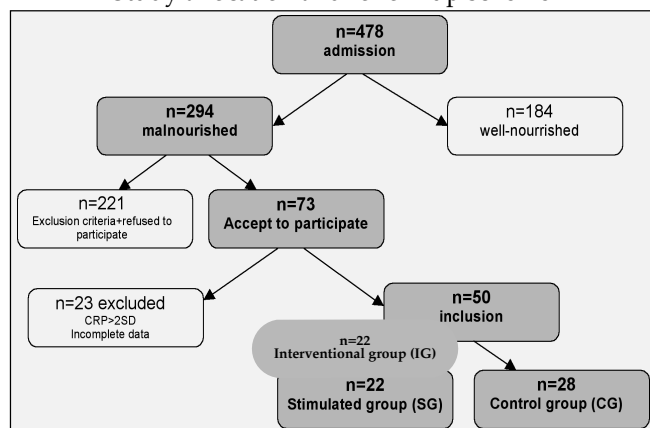
### Subjects (Figure 1 and 2)

Before being recruited for the interventional study, the patients were screened for various nutritional parameters. Strict inclusion criteria were used. To be included patients

had to be over 75, have an MNA short score < 11 or albuminemia < 35 g/L or transthyretin (TTR) < 0.2g/L. They had to have no swallowing problems and not require parental feeding. Patients were excluded if they suffered from acute heart or renal failure, or any rapidly evolving disease. This study was approved by the Burgundy Ethics Committee.

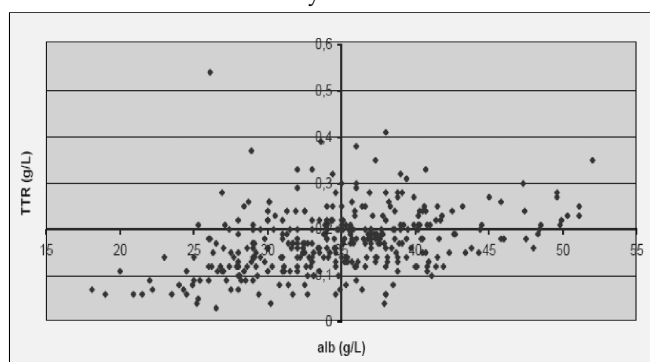
**Figure 1**

Study allocation and follow-up scheme



**Figure 2**

Distribution of patients (n=478) as their albumin and transthyretin rates



### Study design

The study was a 3-week randomized controlled trial. Daily dietary intake was the principal criterion to calculate sample size. We considered standard errors for daily dietary intake at day 10 at 300 kcal. For a situation with a 5% alpha risk, the number of subjects to be included was 18 subjects in each group for a power of 90%.

The 50/73 malnourished patients were included and were randomly assigned to either the interventional group (IG), in which patients were encouraged regularly by nutritionist and at every meal to initiate food intake and to increase the calories ingested only by food or the control group (CG), in which patients received no specific nutritional intervention other than that usually



implemented in the unit when malnutrition was detected by use of supplements (Figure 1).

Patients in the international group were allowed to modify their meals to increase the proportion of protein-rich foods, such as cheese and yogurt, available in the units (oral nutritional supplements were not given except when it was prescribed by doctor).

### Nutritional survey

The usual measurements, namely the nutritional status by MNA (30), weight, BMI (with the Chumlea equation (31)), anthropometric data (calf and brachial circumferences, biceps and triceps skinfolds), ADL (32) and IADL (33) were made on day 1 and at the end of study period. Mini Mental State Examination (MMSE, 34) and GDS (35) were evaluated only on day 1. Daily energy intake was calculated for each patient using a three-day diet record at day 1, 10 and between 17 and 20 days, by deducting the weighted rests of the weighted proposed food. For the last values, premature exits of the patients do not allow to have enough data for a meaningful interpretation (only 9 persons in the IG and 8 persons in the CG). Intake during breakfast was not measured, but as it is very much appreciated by elderly people, it was consumed almost entirely every morning. Dieticians estimated that the breakfast in the short stay units contributed approximately 250 kcal. Blood samples, plasma albumin, transthyretin and CRP, were determined by routine methods and were obtained on the morning of inclusion and on day 20 or automatically at the end of the hospital stay (if the length of stay < 20 days).

### Statistical analysis

All of the data are presented as mean  $\pm$  standard deviation (SD) for all of the patients and by group. Within-group comparisons were made with the Wilcoxon rank-sum test or with a paired Student t-test and between-group comparisons were made with a paired Student t-test, as appropriate. Statistical analyses were conducted using NCSS 2000 software (Statistical System for Windows, published by Number Cruncher Statistical System, Kaysville, Utah, USA).

## Results

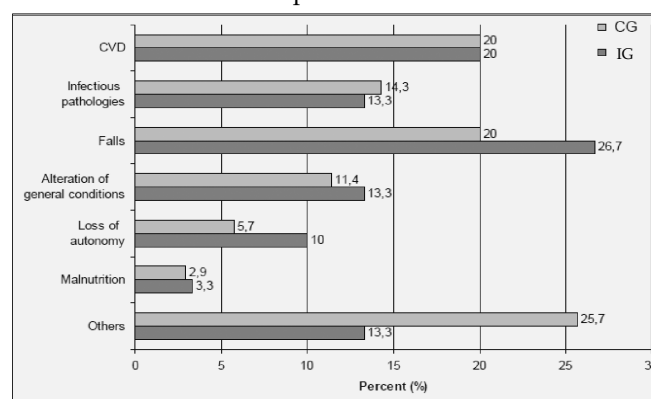
### Baseline nutritional status

Four hundred and seventy-eight patients ( $85.6 \pm 6.4$  years old; mean  $\pm$  SD; range: 62-102) were hospitalised in acute care units of Champmaillot hospital, Dijon, France during the 6 months of recruitment (length of hospital stay:  $20.1 \pm 10.9$  days; range: 1-64). During the study

period, 294 of the admitted patients (61.5%) were malnourished (Figures 1 and 2). Seventy-three patients (24.8% of malnourished people detected at admission) were included in the two study groups and complete analysis results were obtained for 50 at day 10 (n = 22 interventional group, IG; n = 28 control group, CG). There were no significant differences between the two groups for reasons for hospitalization at baseline (Figure 3). Before intervention, the patients presented criteria for malnutrition with low MNA scores. Blood levels for albumin and TTR were far below the normal values (mean values respectively less than 30 g/L and 0.2 g/L in the two groups). Insufficient calorie intake was observed in the two groups. High blood levels of CRP reflecting inflammatory processes were found in the two groups (table 1). We did not note significant differences between groups for anthropometric data, MMSE, GDS or activities level (not shown).

There were no significant differences between the two groups for reasons for hospitalization at baseline (Figure 3). During the study period, 294 of the admitted patients (61.5%) were malnourished.

**Figure 3**  
Reasons of hospitalization at baseline



Before intervention, the patients presented criteria for malnutrition with low MNA scores. Blood levels for albumin and TTR were far below the normal values (mean values respectively less than 30 g/L and 0.2 g/L in the two groups). Insufficient calorie intake was observed in the two groups. High blood levels of CRP reflecting inflammatory processes were found in the two groups. However, we noted normal anthropometric data for patients (body mass index, calf and brachial muscle circumference...).

### Effect of intervention on nutritional parameters (Table 1)

After the intervention period, no differences were found between IG and CG for several parameters including MNA and anthropometric data. Significant



differences were noted for the evolution of blood criteria. Only the IG showed a significant increase in albumin levels ( $p < 0.005$ ). In both groups, TTR increased during the stay and the average values reached the 0.2 g/L threshold (respectively  $p < 0.0003$ , IG and  $p < 0.001$ , CG). A decrease in CRP level was observed in the two groups and was significant ( $p < 0.0004$ , IG and  $p < 0.003$ , CG). At the end of the follow-up, the difference between the groups for CRP levels was almost significant ( $p=0.06$ ) while initially they were identical, which shows the positive effect of intervention in the reduction of inflammation.

The increase in energy intake was only significant in the IG ( $p=0.02$ ) after 10 days. In IG patients, 72.7% (16 of 22) showed an increase in their energy intake compared with only 46% in the CG (13 of 28). After 10 or 20 days, no significant difference was observed between groups. ( $p=0.17$ , not shown). During the follow-up, only 50% of patients in each group at the beginning, almost 35% in each group after 10 days had oral nutritional supplements (ONS) but without significant difference. After 20 days 2/9 subjects (22%) of the IG compared with 3/8 subjects (38%) of the CG continued to consume ONS in spite of their bad nutritional state. At baseline, protein intake was lower in the IG than in the CG ( $p=0.03$ ). After 10 days, this difference became no significant. The increase in protein intake was not significant in either group. An increase in protein intake was noted for 47% of patients in the IG vs. 52% in the CG ( $p=NS$ ). At baseline

and after 10 days lipid intake was similar in the two groups. At baseline, carbohydrate intake was also similar in the two groups ( $p = 0.11$ ). The increase in carbohydrate intake from baseline was only significant for the IG ( $p = 0.001$ ). This difference between groups was almost significant ( $P=0.08$ ).

## Discussion

The aim of this project was to screen for and manage malnutrition and to estimate the effect of intervention on re-nutrition in old patients in a hospital environment.

This study allowed us to confirm that many hospitalized patients suffer from malnutrition (61.5%) and that malnutrition only represented 3% of the reasons of hospitalization. These data confirm those of many authors (15, 20, 35, 37) for the malnutrition rate of elderly hospitalized patients and our data are higher than those cited during the studied period (malnourished = 61.5%).

In malnourished patients, we have shown that with appropriate intervention, blood levels of all of the evaluated parameters positively changed but without significant difference between groups. In the CG, only two of three parameters increased significantly and to a lesser degree than in the IG. We noted that intervention might lead to a greater decrease in CRP levels than that achieved with usual care (CG). With this decrease in the inflammatory level, people could be more likely to eat because severe inflammation reduces appetite. The body

**Table 1**  
Baseline and change measures (at day 10 and 20) of interventional and control group. Data are shown with means  $\pm$  SD

		International Group (n=22)	P	Control Group (n=28)	P	P (between groups)
<i>Results at 20 days</i>						
Age (years)	Baseline	85,8 $\pm$ 5,8		88,3 $\pm$ 5,8		NS
Sex (M/F)	Baseline	8 / 14		6 / 22		NS
MNA score	Baseline	18,4 $\pm$ 3,5		18,4 $\pm$ 3,1		NS
Weight (Kg)	Baseline	66,9 $\pm$ 16,8		62,9 $\pm$ 14,2		NS
	Change	-0,3 $\pm$ 16,0	NS	0,3 $\pm$ 14,2	NS	NS
BMI (Kg / m <sup>2</sup> )	Baseline	27,7 $\pm$ 5,7		28,7 $\pm$ 6,6		NS
	Change	0,0 $\pm$ 5,2	NS	0,3 $\pm$ 7,2	NS	NS
Albumin (g/L)	Baseline	29,2 $\pm$ 4,3		28,8 $\pm$ 3,4		NS
	Change	2,2 $\pm$ 4,7	0,005	0,9 $\pm$ 4,4	NS	0,1
Transthyretin (mg/L)	Baseline	150,0 $\pm$ 5,0		160,0 $\pm$ 6,0		NS
	Change	5,0 $\pm$ 6,0	0,0003	4,0 $\pm$ 7,0	0,001	NS
CRP (mg/L)	Baseline	55,1 $\pm$ 49,2		53,5 $\pm$ 44,9		NS
	Change	-39,6 $\pm$ 16,2	0,0004	-27,1 $\pm$ 31,5	0,003	0,06
<i>Results at 10 days</i>						
Total energy intake (kcal/d)	Baseline	1209,2 $\pm$ 340,4		1233,4 $\pm$ 292,0		NS
	Change	129,7 $\pm$ 356,8	0,02	-34,0 $\pm$ 363,6	NS	0,09
Protein intake (g/d)	Baseline	43,0 $\pm$ 16,1		50,7 $\pm$ 12,1		0,03
	Change	2,5 $\pm$ 20,7	NS	-0,1 $\pm$ 18,3	NS	NS
Lipid intake (g/d)	Baseline	41,2 $\pm$ 17,0		47,1 $\pm$ 15,9		NS
	Change	1,4 $\pm$ 18,3	NS	-2,9 $\pm$ 14,1	NS	NS
Carbohydrate intake (g/d)	Baseline	104,0 $\pm$ 36,6		115,9 $\pm$ 30,5		0,11
	Change	26,8 $\pm$ 39,9	0,001	-1,9 $\pm$ 43,9	NS	0,08

Note: P = Probability; MNA = Mini Nutritional Assessment; BMI = Body Mass Index; CRP = C Reactive Protein



is devoted to the fight against inflammation (usually due to bacteria or heart disease) to the detriment of food intake, so that caloric intake over the day is reduced.

Calorie intake was low for hospitalized patients during study and did not cover baseline energy expenditure. These data were confirmed by Bos et al (39). Calorie intake increased significantly only for the IG during the follow-up. This highlights the effect of intervention on elderly hospitalized patients. However, calorie intake was low in each group, at day 1 and 10, and less of 25kcal/kg-bw/d. We regret the insufficient dietary data at the end of the follow-up, but the length of stay was too short to enable data collection (17.8±3.7 days; range 10-28).

Hospital food alone was insufficient to cover needs because the meals provided about 1800 kcal if they were eaten in their entirety. Meals should be increased to at least 2000 kcal and energetically dense in order to allow patients to cover their needs or to enable them to eat it. In addition, oral nutritional supplement (ONS) should be distributed to all patients when they arrive at hospital, and the consumption of these supplements should be checked.

In a study conducted by Tieland et al (40), the authors concluded that protein intake was particularly low for frail elderly people and with an intake below the current protein requirement (0.7 g/kg-bw/day). In our groups, patients had low protein intakes during the study (0.7±0.4 g/kg-bw/day for the IG vs. 0.8±0.4 g/kg-bw/day for the CG at day 0 and day 10) and their intakes should be higher than 1 g/kg-bw/day depending on their pathologies. Intervention in this study therefore failed to increase these values.

We can notice that patients in both groups suffered from falls, a deterioration in general health and loss of autonomy, all of which cause problems at meal times and thus limit calorie intakes during meals.

We have shown that half of the patients included had ONS at the beginning of the follow-up, but they were rarely consumed entirely. Most of the time less than 50% of the ONS were consumed because there were put on the table and not given directly to patients. A study by Kennedy et al (41) reported that ONS were rarely consumed and frequently wasted. We also found in this study that after 10 days, only 35% of patients in each group consumed ONS whereas consumption should have remained stable or increased given the daily calorie intake. Several studies (39, 42-43) showed that short-term dietary supplementation might have a positive effect on interleukin growth factor 1, fat free mass and weight or weight gain. Our study showed a significantly greater decrease in CRP values in the IG than in the CG but without significant difference between groups.

To conclude, our clinical investigation demonstrated that intervention should be carried out during hospital stays but to be effective in elderly malnourished patients, it must be intensive, requiring the presence of staff to

encourage patients, to distribute and to assure the consumption of ONS. Intervention appears to play an important social role for the elderly.

Finally, malnutrition, with only 3%, is not yet a real motive for hospitalization with a care to be improved during the hospital stay, particularly useful of ONS.

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*Conflict of interest:* None of the authors had a conflict of interest in relation to this manuscript.

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