MNA and Nutritional Intervention

F. Arnaud-Battandier, S. Lauque, M. Paintin, R. Mansourian, B. Vellas and Y. Guigoz

a Nestlé Clinical Nutrition, Sèvres, France;
b Department of Internal Medicine and Clinical Gerontology, CHU Purpan-Casselardit, Toulouse, France;
c Nestlé Research Centre, Nestec Ltd., Lausanne, Switzerland

Poor nutritional status in the elderly population is now well documented. Malnutrition affects around 20–75% of elderly patients in the hospital [1], 10–60% in nursing homes [2, 3] and 1–9% at home [4]. The causes of malnutrition are often complex and multifactorial. But whatever the cause, the clinical consequences can be serious, leading to complications of disease, poor response to drug treatment, reduced immunocompetence, and increased morbidity and mortality. Economic consequences include the increased costs associated with prolonged hospital stay and additional treatment. It is therefore important to recognize patients who are at risk of malnutrition or who are already undernourished, so that early management and corrective measures can be initiated.

There are various clinical and biochemical tools for diagnosing malnutrition, but they are not always easy to use, or else they require much clinical experience. The Mini Nutritional Assessment (MNA) was designed to detect the risk of malnutrition or malnutrition in patients [5, 6]. It is a validated tool comprising 18 easily measurable items and does not require blood testing. The MNA can be performed by health care professionals in approximately 10–15 min.

Oral supplements are a convenient way of combating malnutrition when a patient is able to take food orally. It is an acceptable option for long-term support if a variety of product categories and flavors can be offered to prevent taste fatigue and assure good compliance.

Using the MNA to evaluate the nutritional status of nursing home patients, a clinical study was performed to determine whether nutritional intervention could modify the MNA score, prevent weight loss, and possibly improve biological markers of nutritional status in patients at risk of malnutrition or already malnourished.
Material and Methods

Eighty-seven patients aged 67 years and over (13 men and 74 women) had an MNA performed during their stay in institutions (Toulouse area, France), and were divided into four groups according to their MNA score [5, 6]:

- MNA score ≥ 24: Well-nourished (Group A)
- MNA score between 17 and 23.5: At risk of malnutrition (Groups B and C)
- MNA score < 17: Malnourished (Group D)

Groups C and D were given oral supplements.

Patients with acute pathology under chemotherapy or with compromised life expectancy were excluded, as were those with impaired intestinal digestion or absorption.

The study design (Fig. 1) was a prospective, open, controlled and randomized clinical trial (groups B and C). It was approved by the local ethics committee, conducted according to the Helsinki II declaration, and written informed consent was obtained from all subjects or their legal guardians.

The study period lasted 60 days. Dietary intakes (3-day diary), anthropometry, MNA, and biological measurements were performed at the start (day 0) and at the end of the study (day 60), while dietary intakes and body weight were also recorded at mid study (day 30). The quantity of oral supplements consumed and the choices made by the patients were recorded daily. The study lasted from December 1995 to May 1997.
Table 1. Mean total energy daily intakes (kcal/day ± SEM) at day 0 and day 60 for the 4 groups of patients

<table>
<thead>
<tr>
<th>Patient groups</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning of study (day 0)</td>
<td>1,689±64</td>
<td>1,584±60</td>
<td>1,558±75</td>
<td>1,489±59</td>
</tr>
<tr>
<td>End of study (day 60)</td>
<td>1,632±72</td>
<td>1,562±66</td>
<td>1,764±117</td>
<td>1,889±100</td>
</tr>
<tr>
<td>Supplement intakes</td>
<td>+393±25</td>
<td>+430±19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Supplement intakes corresponded to the mean daily energy ingested as supplement. 
p values: day 0 p = 0.209; day 60 p = 0.015; supplement intakes p = 0.121.

Four products specifically designed for oral nutritional supplementation were offered to the patients in groups C and D. Each of these products was offered in three flavors. They were sweet or savory, liquid or creamy products enriched with proteins, vitamins, and minerals (Tonexis® HP, Emelis®, Printania®, and Orastel®, Nestlé Clinical Nutrition, Sèvres, France; see appendix). Three supplements were offered daily to each patient, Printania being offered on odd days and Tonexis HP on even days, allowing an additional energy intake of 300–500 kcal/day. All patients were encouraged to eat their normal diet at libitum.

Data analysis was performed using the Number Cruncher Statistical Systems software (NCSS, Kaysville, Utah, USA). The influence of single independent factors and the analysis of the data was performed with classic one-way analysis of variance (ANOVA). Probability (p) values are given with correction by Kruskal-Wallis one-way ANOVA on ranks.

Results

Patients
Of the 87 patients recruited, 78 completed the study (males 11; females 67). Four patients died (all in group D), five were excluded for noncompliance and/or admission to hospital (group C). Age was between 67 and 98 years. There were 19 patients in group A, 22 in group B, 14 in group C, and 23 in group D.

Nutritional Intake
Daily nutritional intakes in groups A and B were very similar at day 0 and day 60 (Table 1). In group C the mean total daily energy intake increased from 1,558 to 1,815 kcal, with a decrease in spontaneous intake, the oral supplementation representing a mean intake of 393 kcal/day. In group D the total energy intake
Fig. 2. Printania® compliance in group C patients from day 0 to day 60: mean daily intake (4 quarters = 1 portion = 200 ml). Dotted line = general mean (3.6 ± 0.7 quarter portions = 180 ± 35 ml; mean ± SD).

Fig. 3. Printania® compliance in group D patients from day 0 to day 60: mean daily intake (4 quarters = 1 portion = 200 ml). Dotted line = general mean (3.6 ± 0.8 quarter portions = 180 ± 38 ml; mean ± SD).
Table 2. Evolution of the MNA scores between day 0 and day 60 for the 4 groups of patients

<table>
<thead>
<tr>
<th>Group</th>
<th>Day</th>
<th>MNA score</th>
<th>mean</th>
<th>SEM</th>
<th>minimum</th>
<th>maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>26.1</td>
<td>0.5</td>
<td>24</td>
<td>28</td>
<td></td>
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<tr>
<td></td>
<td>60</td>
<td>24.4</td>
<td>0.9</td>
<td>7.5</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>19.9</td>
<td>0.4</td>
<td>17</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>20.6</td>
<td>0.8</td>
<td>16</td>
<td>24.5</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>19.3</td>
<td>0.6</td>
<td>17.5</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>19.1</td>
<td>1.0</td>
<td>11.5</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td>13.9</td>
<td>0.4</td>
<td>8.5</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>17.1</td>
<td>0.8</td>
<td>6.5</td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

Increased from 1,489 to 1,877 kcal, but without a decrease in spontaneous intake, the oral supplementation representing a mean intake of 430 kcal/day (Table 1).

Results expressed as kcal/kg body weight/day at day 0 and day 60 showed that in groups A and B there was almost no difference in intake (29 ± 1.5 to 27 ± 1.8 kcal/kg/day, and 31 ± 1.4 to 31 ± 1.7 kcal/kg/day, respectively). On the other hand, patients in group C increased their intake from 29 ± 1.7 to 34 ± 2.0 kcal/kg/day, and in group D from 34 ± 1.3 to 43 ± 1.6 kcal/kg/day.

**Compliance**

Daily energy intakes remained stable during the whole study period in groups C and D, with mean daily supplement intakes of 393 ± 25 kcal/day and 430 ± 19 kcal/day, respectively \((p = 0.12)\).

Analysis of product preference showed a slight decrease in intake of Emelis and Orastel in group D, but not in the other group, by the end of the study (that is, after 50 days; data not shown). These two products were offered daily, whereas Printania and Tonexis were offered on alternate days. For these latter two products, intakes remained constant during the two-month period with no taste fatigue, and total daily energy intakes from supplements remained stable over the study period (for Printania data, see Figs. 2 and 3). These results suggest that it is important to vary the taste and texture of nutritional supplements.

**MNA Scores**

As can be seen in Table 2, the mean MNA score did not change significantly in groups A, B, and C; however, there was a significant increase in the mean score from 13.9 to 17.1 in group D. The final MNA scores of three subjects in group A decreased < 24 and one < 17 (acute infection at day 45). In four patients in group C the final MNA score fell < 17, but these four patients had severe pathological...
Weight Changes
As can be seen in Figure 4, there was almost no change in the median weight during the 60 days of the study in groups A and B; maximum gain and loss ranged from +1 kg to –3 kg in both.

Group C showed an increase in weight with a median of +1.5 kg, a maximum gain of +5 kg, and a maximum loss of –2 kg.

Group D showed an increase in weight with a median of +2 kg, a maximum gain of +5 kg, and a maximum loss of –2 kg.

Biological Markers
Mean values of biological markers of nutrition (albumin, prealbumin, hematocrit, hemoglobin) and inflammation (α-glycoprotein, C-reactive protein) were not altered or modified during the time course of the study (data not shown).

Discussion
Using the MNA – a validated tool for nutritional assessment – it was possible to distinguish between individuals in nursing home populations who were at risk of malnutrition, malnourished, or well-nourished. A comparative, controlled, randomized study was performed in elderly patients at risk of malnutrition subdi-
vided in two groups, one receiving a standard diet plus an oral supplement, the other a standard diet only. For ethical reasons, malnourished patients were all supplemented with oral products.

Compliance for the oral products was satisfactory during the 60-day period of the study. It is worth noting that the at-risk supplemented population increased their total energy intake in comparison with the nonsupplemented group and in comparison with their energy intake at entry to the study. This energy increase was accompanied by a slight reduction in their spontaneous food intake. On the other hand, malnourished patients were able to maintain their spontaneous energy intake at the same levels during the whole study, with oral supplementation providing additional energy. Final energy intake was significantly higher in the malnourished group than in the at-risk population.

Previous studies in elderly patients have shown that oral supplementation can be beneficial by increasing energy intake without reducing spontaneous intake [7], and have even demonstrated an improvement rather than a loss of appetite with supplementation [8].

Oral supplementation is the most appropriate way of increasing energy intake whenever possible. Its efficiency is considered equivalent to enteral nutrition given by tube [9]. However, when oral nutrition is not feasible, enteral nutrition is preferable to parenteral nutrition [10], thus maintaining gut function and the gut immune barrier.

Compliance can be maintained for long periods of time with oral supplements provided that patients are offered a wide variety of flavors, textures, tastes, smells, and colors – as we showed in this study, where consumption of oral supplements was maintained during the whole period.

Improvements in both weight and MNA reflected the increase in energy intake. With improved nutritional status, a decrease in morbidity and mortality can be expected [11]. There is a significant relation between a low MNA and increased mortality [12].

A decrease in morbidity has been clearly demonstrated in elderly patients with hip fractures given dietary supplements [13], and in the postoperative period after moderate or major gastrointestinal surgery [8]. Weight gain and improved anthropometric indices have also been reported in demented patients given supplements [14].

**Conclusion**

Nutritional supplements significantly increased nutrient delivery and allowed weight gain in the majority of malnourished patients and in many patients at risk of malnutrition.

Improvement in MNA scores during our study suggested that the MNA can be used as a follow-up tool in nutritional interventions.
Appendix

Names of the products used in this study were modified as follows:

- **Tonexis HP** → **Clinutren HP**
- **Emelis PPPP** → **Clinutren Dessert**
- **Printania PPPP** → **Clinutren Fruit**
- **Orastel PPPP** → **Clinutren Soup**

References


Discussion

**Dr. Morley:** The results were disappointing in the intervention trial, for all of us who believe in nutritional intervention. Could you speculate on why this might be?

**Dr. Arnaud-Battandier:** Why do you say that they are disappointing? In the group who received the supplementation, for example group D (the malnourished patients), we saw an increase in body weight and in the MNA score.

**Dr. Morley:** But you failed to see changes in any of the other variables that you measured, and you did not mention immune function.

**Dr. Arnaud-Battandier:** It is true I did not mention immune function, which was the other arm of the study. I just gave a global result. We now have to examine the values in detail and to try to gain a better understanding of the individual patients.
Dr. Morley: What I’m getting at is whether for a borderline malnourished population – these were not severely malnourished individuals – a longer time period is essential when you do design intervention studies before you start to see some of the other changes occurring.

Dr. Arnaud-Battandier: When you look at published reports, the studies usually last for 3 months. We did a 2-month study. Maybe if we had made it 1 month longer, the results would have been different.

Dr. Guigoz: When we looked at the biological variables, they were not at the level you would expect in malnutrition. We had only two patients with an albumin concentration of 30 g/l, and we had very few patients with a high CRP indicating an inflammatory process. It seems that we are detecting malnutrition, or the risk of malnutrition, before the conventional clinical indices become positive. I think that is an important point. In relation to weight change, it seemed that the other groups were still losing weight – that is, they were on the down side – but with supplementation we stopped the weight loss.

Dr. Oster: I was glad to see Dr. Arnaud-Battandier’s results, because I know how difficult it is to get supplements into the patient. In our hands, in hospital we get about 200 additional kcal into the patient, with the result that the normal weight loss which occurs in geriatric patients can be stopped. They do not gain weight, but they do not lose weight either. We did an additional study where we supplemented patients for 6 months after discharge from hospital, and in the whole group there was no effect, but when we took compliance into account (users of the supplement vs. non-users), we saw a slight increase in ADL after 6 months of supplementation – not too convincing, but at least not a decrease.

Dr. Vellas: We need to remember that the main aim of the study was to find out whether it is possible to increase energy intake by oral supplementation. We found that in people with a low MNA score or in people at risk of malnutrition it was indeed possible to increase energy intake significantly. We shouldn’t forget, however, that we had a very good dietician in Sylvie Lauque.

Dr. Rubenstein: I would like to bring that point home. I thought Dr. Arnaud-Battandier’s study was very positive. Using this kind of study as a pilot, you can go on to get a big grant for a multiyear interventional study. Basically you showed that it is possible to increase intake, and you’ve also translated that into weight gain, and people apparently enjoyed getting the supplement. With 21 individuals in one group and 17 in the other in a 2-month follow-up period you cannot expect any other significant outcome benefit in that time. The sample size was just not designed for that.

Dr. Arnaud-Battandier: Exactly. The sample size was small because we did the immunological studies at the same time, and it was impossible to do more patients.

Dr. Morley: Did they get the supplement with the food, before the food, or in between?

Ms. Lauque: The soup was given during the meal, instead of the nursing home soup. The cream was given at the end of the meal, as a supplement to the nursing home dessert. The fruit drink was given instead of water or the regular drink. This was the usual schedule, but sometimes it varied according to the patients. Some patients preferred to have two soups and no cream, for example.

Dr. Guesry: I suggest that you should measure the time spent by the team – the nurse, the dietician and all the health workers in the different groups. We did a study 2 years ago in the biggest center for tetraplegics in France. Only by increasing the time that the nursing team spent with each patient was it possible to increase the energy consumption, well-being and physical performance. So I wonder if here there is not a certain bias between the groups in your study; obviously, when you provide a supplement, you have to spend some time with the patient. You don’t just throw it on the table and leave.

Dr. Camilla: Your results seem to support the short form of the evaluation, because you only showed us results for weight and body mass index. I would like to know whether you can give us any information on protein intake as opposed to energy?
Dr. Arnaud-Battandier: I don’t have the results of the protein intake measurements with me. We looked at it, and there is an increase in protein intake for group C and group D.

Dr. Guigoz: The results parallel the energy intake, because the protein energy in the supplement remained constant throughout the study. The protein intake was significantly increased in the supplemented groups.

Dr. Morley: What percentage of the food is protein in the supplements, do you know?

Dr. Guigoz: It varied from one product to another, but it was around 25%.

Dr. Miller: I want to return to a comment that Dr. Vellas made with regard to Dr. Rubenstein’s scale, differentiating healthy individuals, in whom a short form might work well, from the more frail, where a more complete scale would be appropriate. I wonder whether the short form might also be useful in bringing our general practitioners – in the broad sense of that term – into our total scheme. I would want our geriatric fellows to use the whole scale and learn how to apply it to nutritional interventions and so forth. But I personally would be delighted if our general medicine residents, general internists and family practitioners would use the short form as a screen and then bring us or dieticians in to do the more complete scale and start designing the interventions. I am really excited about that possibility.

Dr. Vellas: That is one way to work. But I am concerned that a nutritional screening initiative in a nursing home or in elderly people in hospital will show nearly 100% of the population at risk. If the short form works like that, it is not useful for frail elderly people.

Dr. Morley: The nutritional screening initiative is meant to be self-scored and to encourage people to go to a doctor or ideally to a dietician to ask questions. It was developed originally to try to increase supplement use and it was coupled with a series of advertisements on TV in the United States on how every older person should be taking supplements. It was set up to be overinclusive and I agree that the advantage of what we are bearing here, even the short form for the MNA, is that it is not overinclusive.