A Dedicated Nutritional Care Program (NUTRICARE) to reduce malnutrition in institutionalised dysphagic older people: A quasi-experimental study

Milko Zanini PhD, MSN, MSoc\(^1\) | Annamaria Bagnasco PhD, Assistant Professor\(^1\) | Gianluca Catania PhD, MSN, RN\(^1\) | Giuseppe Aleo PhD, MA\(^1\) | Marina Sartini BSC, PhD, Public Health\(^1\) | Maria Luisa Cristina MSc, MNatSc, Associate Professor\(^1\) | Stefania Ripamonti MSBiol, Clinical Nutrition Expert\(^2\) | Fiammetta Monacelli PhD, MD, Academic Researcher\(^3\) | Patrizio Odetti MD, Professor of Gerontology and Geriatrics\(^3\) | Loredana Sasso MSN, FAAN, Associate Professor of Nursing\(^1\)

\(^1\)Department of Health Sciences, University of Genoa, Genoa, Italy
\(^2\)Private Outpatient Nutritional Service, Brugherio, MB, Italy
\(^3\)Department of Internal Medicine & Medical Specialties, University of Genoa, Genoa, Italy

Correspondence
Milko Zanini, Department of Health Sciences, University of Genoa, Genoa, Italy.
Email: milko.zanini@edu.unige.it

Funding information
MED EAT Srl, Bergamo, Italy. Grant/Award Number: N/A

Aims and objectives: To assess the effects of a texture-modified food program for dysphagia on the nutritional, biochemical and functional profile in a cohort of institutionalised older people in Italy.

Background: Dysphagic institutionalised older people, often also affected by dementia, are frequently exposed to malnutrition. Malnutrition in older people has negative effects on mortality, days of hospitalisation, infection, wound healing and risk of pressure injuries. Therefore, it is very important to prevent malnutrition in this frail population.

Design: A pre–post study without a control group.

Methods: The study included 479 dysphagic institutionalised older people from 20 nursing homes. Anthropometrical, biochemical, nutritional and functional parameters were collected retrospectively, 6 months before the study intervention, at time zero and, prospectively for 6 months after implementing the NUTRICARE food programme, for a total of nine evaluations. The NUTRICARE programme includes meals without nutritional supplementation, and personalised levels of density, viscosity, texture and particle size.

Results: The total mean body mass index of our sample passed from 17.88–19.00; body weight averagely improved by 7.19%, as well as their nutritional and biochemical profiles. There was a progressive improvement of total protein and serum albumin values. Nutritional parameters (serum transferrin and lymphocytes) displayed similar changes. Plasma lymphocytes reached normal levels in 98.23% of the sample. Plasma creatinine levels remained steady throughout the study and within the normal range. No side effects were reported.

Conclusion: The NUTRICARE food programme with adequate proteins, calories, balanced nutritional and bromatological properties, and appropriate texture and palatability significantly improved the nutritional, biochemical and functional profile in a cohort of institutionalised dysphagic older people.

Accepted: 14 February 2017
DOI: 10.1111/jocn.13774

\[ J \text{Clin} \text{Nurs.} \text{ 2017;1–10. wileyonlinelibrary.com/journal/jocn} \]
Relevance to clinical practice: The introduction of a balanced nutritional programme, using high-quality natural ingredients, appropriate texture and palatability can significantly improve health and quality of life in dysphagic older people.

KEYWORDS
dementia, dysphagia, institutionalised older people, malnutrition, modified food texture, nutrition

1 | INTRODUCTION

Dysphagia is a worldwide challenging clinical issue and it is reported to affect approximately 8% of the world population (Cicherò et al., 2013). However, the incidence of dysphagia in institutionalised older people is very difficult to estimate with accuracy, even because they are often affected also by dementia. Therefore, currently no specific data are available; therefore, to date only an approximate estimation can be made. For instance, according to the Dementia Observatory of the Italian National Institute of Health (Osservatorio Demenze, Istituto Superiore di Sanità, 2014) in 2014 over 1 million people were affected by dementia (of which about 600,000 were affected by Alzheimer’s disease). A recent European study by Baijens et al. (2016) reports that dysphagia can affect up to 93% of people at an advanced stage of dementia, but this percentage varies considerably also according to the type of dementia, with a higher prevalence in those with fronto-temporal dementia (26%) and semantic dementia (20%) compared to those with Alzheimer’s disease (7%; Baijens et al., 2016). The prevalence of dysphagia also depends on the setting, for instance in people who live independently, the prevalence of dysphagia is between 30%–40%; this rate rises up to 44% in older people admitted to geriatric acute care; and up to 60% in institutionalised older people (Baijens et al., 2016). Therefore, further studies are required in Italy to obtain an accurate calculation of the incidence of dysphagia in institutionalised older people, most of which are also affected by dementia.

There appears to be a strong association between dysphagia and healthcare outcomes, with regard to malnutrition, pneumonia in stroke patients, and in those affected by cognitive impairment (Sura, Madhavan, Carnaby, & Crary, 2012). In older people, swallowing can be problematic (Nogueira & Reis, 2013) and lead to malnutrition, which is an independent risk factor for higher mortality (Landi et al., 2016) and an intrinsic frailty factor in older people (Mitri, Boulos, & Adib, 2016). Malnutrition remains a clinical priority in 20%–66.5% institutionalised older people (Namasivayam & Steele, 2015; Papparotto, Bidoli, & Palese, 2013). In nursing homes, older dysphagic patients often suffer from cognitive impairment (Björk et al., 2016) and are also more at risk of malnutrition and sarcopenia. The risk of malnutrition increases in relation to the presence of cognitive impairment (OR: 1.844; \( p = .001 \)), dementia (OR: 2.139; \( p = .001 \)), but also in relation to the mere condition of dependency during meals (OR: 2.257; \( p = .001 \); Moreira et al., 2016).

Moreover, dysphagia also increases workload and can be distressing both for the patient’s family members and for the nurses who care for them, and ultimately increase the levels of burnout in nursing home staff (Bagnasco et al., 2015). Therefore, assessing the nutritional status with an integrated approach and appropriate tools is fundamental to effectively prevent malnutrition (Liu et al., 2016).

Institutionalised patients affected by dysphagia are usually fed with blended food or food diluted to the desired density using liquids such as broth or mashed potatoes. To achieve the desired texture, the volume of the food increases during this type of preparation process, and the patient is often unable to eat it all. As well as a waste of food, this entails a significant reduction of nutritional and caloric intake (Massoulard et al., 2011). In addition, dysphagic individuals easily get tired during their meals mainly due to their difficulties swallowing food that does not have an appropriate texture; therefore, they do not eat all of the food they have on their dish. Blended food usually has poor visual and organoleptic characteristics, and often the same food is provided over a long periods of time due to the lack of a valid alternative. An important issue with blended food is that it quickly loses its initial consistency and this can cause swallowing difficulties in dysphagic individuals. Therefore, the swallowing difficulties, in addition to the repeated access to the same kind of food, with always the same taste, and an unappealing aspect, over time reduce their willingness to eat (Keller, 2016).
The reduction of food intake has also been described as the result of the combination between ageing, clinical impairment, poor nutritional properties, and inappropriate texture and unpleasant food appearance (Pritchard, Davidson, Jones, & Bannerman, 2014). In fact, food texture and food appearance significantly modify the way patients approach meals and consequently also food intake (Lee & Song, 2015); especially in dysphagic individuals, modified texture foods should consider enjoyment and compliance, appropriate patient satisfaction and consumption, as essential parts of the swallowing process (Cichero et al., 2013). There is evidence that poor nutritional status leads to unintended weight loss, muscle mass loss, and—particularly in institutionalised dysphagic older people often affected by dementia—to frailty, multimorbidity and swallowing disorders (Nogueira & Reis, 2013; Papparotto et al., 2013; Törnä, Winblad, Cederholm, & Saletti, 2013).

2 | BACKGROUND

Individuals with dysphagia experience distressful swallowing, and this can lead them to interrupt their meals. In these cases, literature suggests to improve energy intake in individuals who are at risk of malnutrition, with highly energetic food (Pritchard et al., 2014). In a recent meta-analysis published by Abdelhamid et al. (2016), statistically significant effects were found but in short-term studies and interventions on small samples including food associated with oral nutrition supplements in patients with dementia. However, few studies focus on the nutritional management of the wide spectrum of dysphagia in older people (Takizawa, Gemmell, Kenworthy, & Speyer, 2016), and mainly deal with poststroke dysphagia and, minimally, patients with dementia using appropriately thickened food and beverages to ensure safe swallowing (Alagakrishnan, Bhanji, & Kurian, 2013; Cohen et al., 2016).

Malnutrition and the difficulties associated with the ability to swallow often constitute one of the complications of cognitive impairment, and therefore a nursing intervention to manage patient nutrition becomes essential (Amujo & Akpor, 2015). Early diagnosis, continued monitoring and an effective treatment of the variables that impact on the patient’s ability to eat can reduce or even eliminate the risk of malnutrition (Roqué, Salvà, & Vellas, 2013).

In addition, there is evidence that pureed diets are considered a risk factor for malnutrition in older persons with dysphagia (De Luis et al., 2009; Massoulard et al., 2011). A recent systematic review by Namasivayam and Steele (2015) reported a potential-associated prevalence between these two clinical conditions ranging from 3%–28% of the residents, although data were highly heterogeneous. However, the authors concluded that addressing malnutrition induced by dysphagia is a concrete and pressing clinical issue. Moreover, in the literature, we found that there is no commonly accepted international taxonomy for food texture and drink consistency; and the standardisation of terminology for modified food diets in dysphagia is often missing or incomplete (Steele et al., 2015).

Energy intake can be increased by offering high energy foods, according to the need of the patients, and decreasing the risk of malnutrition. However, pureed diets surely contribute to affect patient’s quality of life and decrease the social value of mealtime, as well as the potential associated impact on the patient’s nutrition (Crichton, 2015). In a recent study by Lim, Mulkerrin, Mulkerrin, and O’Keefe (2016), patients on a diet of thickened fluids declared that they would prefer to give up 5 of 10 years of their life rather than adhere to this kind of diet. Healthcare staff caring for institutionised patients should be appropriately trained to monitor the risk of malnutrition and avoid its onset (Lindroos et al., 2014). Interventions to prevent malnutrition should include aspects related to the ability to eat autonomously, food variety and palatability, the concentration of nutrients, as well as socialisation, permitting enough time to eat, and improving healthcare staff’s competency in this field (Keller, Beck, & Namasiyayam, 2015).

2.1 | Aims and objectives

To assess changes in daily food intake following the introduction of a texture-modified food programme for dysphagia, and how this impacts on the nutritional, biochemical and functional profile in a cohort of institutionalised older people. To address these aims, we formulated the following research question: “Would a nutritional intervention including personalised texture foods, in the right quantity, variety and with excellent palatability and acceptability characteristics reduce malnutrition in a group of institutionalised dysphagic older people?”

3 | METHODS

3.1 | Design

The present investigation is a pre-post study without a control group with time series. In this kind of design, the pretest acts as a control group; therefore, it enables to compare the levels of malnutrition in the same people over and to have a better control over variables (i.e., anthropometric parameters, plasmatic and biochemical nutritional parameters, and the clinical assessments of the patients).

A weakness of this design is the possibility of human error, because subjects can include also outliers, and therefore we have fewer subjects to collect data on. The sample was calculated to obtain a 95% level of confidence based on a population of about 2,000 people and added another 20% considering the probability of dropout from our study, for a total of about 460 subjects. The sample was selected for convenience by including all the institutionalised dysphagic older people who met our inclusion criteria and lived in the nursing homes that participated in the present study. The nursing homes were selected through convenience sampling by personally contacting via email and then by phone the medical directors of

Few studies take into account the period of transition from a normal diet to a soft texture diet, which is never the result of patient’s choice. Therefore, as this diet transition is imposed on the person, it is often very distressing. Moreover, mealtime is reduced to a mere intake of food and energy, losing its socialising nature, whereas a person-centred approach would favour a more acceptable transition without sacrificing the social value of mealtime (Ullrich & Crichton, 2015). In a recent study by Lim, Mulkerrin, Mulkerrin, and O’Keefe (2016), patients on a diet of thickened fluids declared that they would prefer to give up 5 of 10 years of their life rather than adhere to this kind of diet. Healthcare staff caring for institutionised patients should be appropriately trained to monitor the risk of malnutrition and avoid its onset (Lindroos et al., 2014). Interventions to prevent malnutrition should include aspects related to the ability to eat autonomously, food variety and palatability, the concentration of nutrients, as well as socialisation, permitting enough time to eat, and improving healthcare staff’s competency in this field (Keller, Beck, & Namasiyayam, 2015).
the nursing homes and asking them if in principle they were willing to participate in this study. The nursing homes included in the present study were all private centres accredited by the National Public Health Service. Therefore, they are all private health facilities that provide services in the community under the public health scheme. The nursing homes had an average of a hundred beds each and provide social and healthcare services for chronically ill patients with medium-to-high levels of dependency. The staff working in these nursing homes includes nurses, nursing assistants and physiotherapists. Therefore, there are no nutrition experts, dieticians or speech therapists to monitor variables related to dysphagia. All healthcare staff is required to provide at least 750 minutes (12.5 hr) of care per week to each patient. The person in charge of each nursing home is a physician, either a geriatrician or an internist. Cases of dysphagia are typically dealt by the nursing home food services that usually blend the food with a mixer in the morning of the day it will be served or just before the preparation of the patient’s food trolley. The issue with blended food is that it loses its consistency over time and therefore dysphagic individuals have difficulty swallowing it.

3.2 Ethical approval

The study was approved by the Liguria Regional Ethics Committee (P.R. 12/13 of the 11th March 2014), and a formal written consent was obtained from the patients and their official caregivers for the cases of dementia.

3.3 Participants

3.3.1 Inclusion criteria

Patients over the age of 65 years, with low comorbidity levels (Cumulative Illness Rating Scale—CIRS < 6), a previous diagnosis of dysphagia established by a physician or reported in the clinical record.

3.3.2 Exclusion criteria

High levels of comorbidity (CIRS > 6), clinical instability, terminally ill patients, chronic or cancer diseases, severe dysphagia (DOSS ≥2) or percutaneous endoscopic gastrostomy feeding, and the presence of orogastric tubes.

Based on the design of our study, our data sets also included information from the patients’ previous medical records. The indicators used in the present study include information routinely collected by nursing homes (Table 1)

3.4 Data collection

Biochemical parameters such as albumin and transferrin are described in literature as malnutrition indicators in older people (Chen et al., 2016). In addition, we also measured lipids and creatinine due to the increased intake of protein related to the different amounts of macronutrients provided during our intervention.

This helped us to keep track of any changes in the patients’ metabolism.

General conditions, such as weight and body mass index (BMI) are useful indicators for the measurement of the patients’ metabolism (Cederholm et al., 2015). Therefore, these data were routinely collected by the nursing home physicians and nurses and recorded in the patients’ clinical records on a monthly basis. All the data on the patients’ nutritional status during the 6 months before the beginning of our intervention were drawn from the patients’ charts. Instead, after the beginning of our intervention they were collected directly by our research team. All the blood tests were prescribed and managed by the physician in charge of each nursing home.

For the patients’ nutritional assessment, we chose the Mini-Nutritional Assessment—Short Form because it is the one most commonly used in nursing homes, it provides a comprehensive description of nutritional status, and identifies malnourished subjects in a better way than the mere use of BMI (Mastronuzzi, Paci, Portincasa, Montanaro, & Grattagliano, 2015). The Italian version of the Mini-Nutritional Assessment—Short Form (MNA-SF) was translated and validated by the Nestlé Nutrition Institute. The MNA-SF was drawn from the validation paper by Kaiser et al. (2009), which showed a sensitivity of 90.2% and a specificity of 76.2%, at the upper cut point with an area under the curve of 0.93 and a sensitivity of 88.3% and a specificity of 87.1%, with an area under the curve of 0.95 (Kaiser et al., 2009).

The physicians of the nursing home had previously diagnosed with dysphagia the patients enrolled in our study. After measuring the level of dysphagia with the Dysphagia Outcome and Severity Scale (DOSS; O’Neil, Purdy, Falk, & Gallo, 1999), the right texture for each patient was prepared according to their response to different food consistencies.

For each patient, anthropometrical, biochemical, nutritional and functional parameters (Table 1) were collected retrospectively, 6 months before the start of the study, at time zero and,

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The nutritional, biochemical and functional parameters assessed for each patient during the observational study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropometric parameters (weight, height, BMI)</td>
<td></td>
</tr>
<tr>
<td>Plasmatic biochemical nutritional parameters (total protein, albumin, transferrin, lymphocytes, creatinine, total and HDL cholesterol, triglycerides)</td>
<td></td>
</tr>
<tr>
<td>Patients’ clinical assessment:</td>
<td></td>
</tr>
<tr>
<td>Mini Nutritional Assessment—Short Form (Kaiser et al., 2009)</td>
<td></td>
</tr>
<tr>
<td>Instrumental Activities of Daily Living (Katz, 1983)</td>
<td></td>
</tr>
<tr>
<td>Barthel index (Granger, Albrecht, &amp; Hamilton, 1979; Mahoney &amp; Barthel, 1965)</td>
<td></td>
</tr>
<tr>
<td>Clinical dementia rating (Morris, 1993)</td>
<td></td>
</tr>
<tr>
<td>Edinburgh Feeding Scale for Dementia Italian Version (Bagnasco et al., 2015)</td>
<td></td>
</tr>
<tr>
<td>Cumulative Illness Rating Scale CIRS (Parmelee, Thuras, Katz, &amp; Lawton, 1995)</td>
<td></td>
</tr>
<tr>
<td>Dysphagia Outcome and Severity Scale (DOSS; O’Neil et al., 1999)</td>
<td></td>
</tr>
</tbody>
</table>
prospectively, every 8 weeks for 6 months after starting the dedicated food programme, for a total of at least nine times.

The levels of compliance and satisfaction were assessed through specific forms filled out by the staff. These forms were used to collect information on the amount of food each patient ate and their level of satisfaction. The amount of food each patient ate from each dish was measured in quarters of the food eaten (e.g., if the patient had eaten a quarter, two quarters, three quarters, or all of the food served on each dish). These assessments were performed for every dish served during mealtimes, and every day throughout the period of this study.

In addition to direct observation, satisfaction was measured using the EdFED scale, for which the observations of adverse behaviours to being fed were conducted on a daily basis, and their frequency was evaluated on a monthly basis. We used the Italian version of the EdFED Scale, whose psychometric properties were tested by Bagnasco et al. (2015) and confirmed its validity for the assessment of feeding difficulties in older people.

### 3.5 Intervention

We provided a dedicated food programme, called "NUTRICARE", consisting of food in single serving portions, which can either be eaten as they are or used to prepare richer and more varied meals.

We used various levels of texture of high quality food, obtained through a specific process to meet the consistency, density, and viscosity required by each dysphagic person. With “high-quality food”, we mean food that meets the characteristics of a person in terms of quantity, consistency, taste, variety and palatability, enabling to minimise weight loss (Landi et al., 2016). We informed nursing home physicians that our NUTRICARE programme did not include nutritional supplements, in the event these were already being provided.

Each meal included a first course, a second course and a side dish, with garnish, but with a modified texture, providing an average intake of 1,850 calories associated with breakfast and 1 daily snack provided by the nursing homes. The daily amount of energy and protein met Italian recommendations for older people, established by the Italian Society for Human Nutrition (Table 2: SINU, 2014). These recommendations are based on the international Dietary Reference Values (EFSA, 2010) that take into account age, weight and height in the geriatric population. In our specific case, we considered the average requirement (AR) of nutrients in older people. The NUTRICARE programme involved a 1-day training session for local staff before starting the programme.

### 3.6 Data analysis

All the data are expressed in means ± standard error of the mean. For comparisons among groups, one-way ANOVA was used to evaluate variance differences, Dunnett’s multiple comparison test was used as a post-test, and the test for trend across ordered groups.

<table>
<thead>
<tr>
<th></th>
<th>Kcal 1,850</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein, g</td>
<td>65.51</td>
</tr>
<tr>
<td>% Protein Kcal/daily Kcal</td>
<td>13.08</td>
</tr>
<tr>
<td>Lipid, g</td>
<td>63.55</td>
</tr>
<tr>
<td>% Lipid Kcal/daily Kcal</td>
<td>30.91</td>
</tr>
<tr>
<td>Carbohydrates, g</td>
<td>259.04</td>
</tr>
<tr>
<td>%Carb. Kcal/daily Kcal</td>
<td>56.01</td>
</tr>
</tbody>
</table>

Student’s t-test was used to compare two groups. The statistical analysis was performed using STATA/SE14tm software (StataCorp LP, College Station, TX, USA) and GraphPad Prism version 5.0. A p-value < .05 was considered statistically significant.

### 4 RESULTS

The sample included 479 institutionalised older people from 20 nursing homes in Northern Italy. The older subjects were aged 79.72 ± 12.31 (ranging from 36–104 years), whereas 88.28% were aged ≥65. Of these, 67 (16.71%) were males, and 334 (83.29%) were females.

Of the enrolled sample (n = 479), 56 patients (12%) dropped out from the study: 28 (50%) died; 22 (39%) for meal refusal; three for clinical instability (5%); and three returned back to their homes (5%). Twenty-two patients refused to participate in this study. In the end, our intervention sample included a total of 401 patients (66 men and 335 women).

Through the NUTRICARE intervention, a total of 86,622 meals were served, of these the participants included in this study fully consumed 72,227 (83.4%) meals, 10,715 (12.3%) were partially consumed and 3,620 (4.1%) were not eaten. Therefore, the level of compliance to meal consumption was high. The participants’ level of satisfaction was confirmed by the positive results obtained through the EdFED-I Scale, which measures the participants’ refusal to eat meals. At T0 (before starting the intervention), the mean EdFED-I score was 7.98 (SD 3.65), whereas at the end of the intervention (T6) this score went down to a mean of 6.65 (SD 3.13), with a statistically significant difference (p < .001) between the two scores.

Globally, their level of comorbidity, according to the CIRS index, was severe 3.68 ± 1.61. Ninety-seven percent suffered from cognitive impairment (CDR ≥ 1). We enrolled patients with low-to-moderate dysphagia levels (2), according to the DOSS, and were distributed in the intervention group as follows: level 6: 0.25%; level 5: 46.13%; level 4: 50.87%; and level 3: 2.74%.

According to the clinical records, upon admission to the nursing homes, patients had an average BMI of 20.96 ± 4.07 (men = 21.19; women = 20.91), and during their stay, this value steadily decreased in both sexes. At the beginning of the intervention, the average BMI score was 17.88 ± 3.48 (men = 18.03; women = 17.66). Following
our intervention, this trend was inverted in our sample achieving a mean BMI of 19.00 ± 3.32 (19.23 in men and 18.96 in women).

Patients’ body weight also improved after a steady and dramatic decline following admission to the nursing homes. We recorded a mean decrease of 15.37% ± 9.40%, whereas the re-gain resulting from the introduction of the new diet was 7.19% ± 8.81%. We observed the same body weight and BMI trend also in the group aged over 85.

The ANOVA test of the BMIs showed a highly significant difference among the observed values (\( F = 22.98; p < .001 \); observed values vs. time 0) and a significant trend over the previous 6 months of our intervention study (test for linear trend: \( z = -8.12, p < .001 \); Figure 1).

We observed a significant improvement of the nutritional and biochemical profiles of our sample. There was a progressive and significant improvement of total protein and serum albumin values, respectively. The ANOVA test for serum proteins was \( F = 301.12; p < .001 \); the ANOVA test for serum albumin was \( F = 74.04; p < .001 \), and our intervention produced a significantly positive trend (serum protein: \( z = 34.73, p < .001 \); serum albumin: \( z = 19.28, p < .001 \); Figures 2 and 3).

Nutritional parameters (serum transferrin and number of lymphocytes) displayed similar changes although with a higher variability. The ANOVA test for serum transferrin was \( F = 115.75; p < .001 \) and the ANOVA test for blood lymphocytes was \( F = 215.39; p < .001 \) but the trend following our intervention was always positive and significant (serum transferrin: \( z = 15.27, p < .001 \) and blood lymphocytes: \( z = 19.63, p < .001 \); Figures 4 and 5).

Plasma lymphocytes reached normal levels in 98.23% of the patients.

Lipid parameters showed a sharp decrease in total cholesterol and a significant increase in HDL cholesterol; however, plasma triglycerides showed significant changes (ANOVA test: \( F = 4.49; p < .001 \); Dunnett’s post-test \( ns \); trend test \( z = -3.06, p < .01 \); Figure 6). The ANOVA test for total cholesterol was \( F = 71.85; p < .001 \) and the ANOVA test for HDL cholesterol was \( F = 95.52; p < .001 \). The numbers in italic refer to the patient samples upon each assessment.

**FIGURE 1**  Trend analysis for BMI parameter before and after the intervention study. Dunnett’s multiple comparison test versus time 0 (\(* p < .05, ** p < .01, *** p < .001\)). The numbers in italic refer to the patient samples upon each assessment.

**FIGURE 2**  Serum albumin levels over 12 months of observation. Dunnett’s multiple comparison test versus time 0 (\(* * * p < .01, \quad *** p < .001\)). The numbers in italic refer to the patient samples upon each assessment.

**FIGURE 3**  Serum protein levels over 12 months of observation. Dunnett’s multiple comparison test versus time 0 (\(* * * p < .001\)). The numbers in italic refer to the patient samples upon each assessment.

**FIGURE 4**  Serum transferrin levels over 12 months of observation. Dunnett’s multiple comparison test versus time 0 (\(* * * * p < .001\)). The numbers in italic refer to the patient samples upon each assessment.
measurements. A decreasing trend was observed before the start of our study, and our intervention interrupted this negative trend (trend test ns).

The activities assessed with these scales showed the potential steadiness of the patients’ conditions. No side effects were reported throughout the period of observation.

### 5 DISCUSSION

Modified food texture needs adequate properties of thickness, cohesiveness and slipperiness to ensure bolus flow and physiological behaviours associated with swallowing. This enabled patients previously diagnosed with dysphagia to easily swallow the NUTRICARE-modified texture food, ensuring full meal consumption and satisfaction in over 83% of cases. Serum proteins after admission to the nursing homes dropped below 4 g/dl. Probably, the administration of medical nutritional supplements led to a slow growth, but our intervention enabled to normalise this parameter. Likewise, serum albumin improved gradually but steadily during our study, achieving a mean value higher than the initial one. A study on nutritional assessment showed that NUTRICARE intervention resulted in a mean difference in MNA-SF scoring over 12 months observation.

**FIGURE 5** Blood lymphocyte levels over 12 months of observation. Dunnett’s multiple comparison test versus time 0 (**p < .01, ***p < .001). The numbers in italic refer to the patient samples upon each assessment

**FIGURE 6** Plasma lipid levels over 12 months of observation. Dunnett’s multiple comparison test versus time 0 (****p < .001). The numbers in italic refer to the patient samples upon each assessment

p < .001. The post-test for linear trend was significant for both parameters (total cholesterol: \( z = -22.61, p < .001 \); HDL cholesterol: \( z = -19.96, p < .001 \)).

The Mini-Nutritional Assessment—Short Form (MNA-SF) showed a significant ANOVA test (\( F = 46.61; p < .001 \)) and a significant growth trend (\( z = 18.44, p < .001 \); Figure 7).

Data on functional status showed a mean Instrumental Activities of Daily Living score that remained low throughout the study (0.65 ± 2.31; Table 3). Also the Barthel index was low during the measurements. A decreasing trend was observed before the start of observation. Dunnett’s multiple comparison test versus time 0 (****p < .001). The numbers in italic refer to the patient samples upon each assessment

**FIGURE 7** MNA-SF scoring over 12 months observation.

The activities assessed with these scales showed the potential steadiness of the patients’ conditions. No side effects were reported throughout the period of observation.
In our study, the steady level of triglycerides and the increase of HDL cholesterol showed that nutritional status and metabolism were improving. Finally, the extremely low MNA score, upon admission to the nursing home, increased by two points after the new diet was introduced and the trend was highly significant. All these results were observed in the presence of a steady serum creatinine level (i.e., no change in kidney function). The recovery of the nutritional status in this cohort of older dysphagic patients was achieved in 6 months without any other nutritional supplementation. In fact, at the end of our study, all the participating nursing homes decided to continue the nutritional programme introduced by our intervention.

The nutritional clinical improvements achieved by the present study were very positive compared to previous studies that reported inconclusive attempts to implement texture-modified food for dysphagia nutrients properties with micronutrient and sensory quality enhancement (Hall & Wendin, 2008; Keller, Chambers, Niezgoda, & Duizer, 2012). Pureed food either of in-house or commercial production has not met the expectations for sensory quality and nutritional properties so far (Keller, Locher, & Steele, 2014; Steele et al., 2015).

### CONCLUSION

The NUTRICARE protocol includes foods with a personalised texture that enables to reduce the volume of the food without modifying its nutritional characteristics and flavour. Unlike food that is simply blended with a mixer, the NUTRICARE programme for each patient offers a selection of different foods but with the same texture. In this way, dysphagic individuals during each meal do not need to continuously adapt to foods with different textures when they swallow (Melgaard, Eg Nefer, Rasmussen, Liisberg, & Grønlund, 2014). In addition, NUTRICARE foods maintain the same texture over time. All this reduces swallowing difficulties in dysphagic individuals, enabling them to easily eat all their food, ensuring both full meal consumption and satisfaction.

Our findings corroborate an in vivo experimental model indicating how a tasteful trigger/stimulus can elicit swallowing initiation in persons with dysphagia, through the synergic activation of both the higher brain and peripheral nervous system (Humbert & Joel, 2012). This may be important for the development of new concept diets, based on texture-modified tasteful stimuli that initiate swallowing as an integral part of the swallowing process in dysphagia to reduce malnutrition.

Nursing staff reported good patient compliance with the NUTRICARE programme, ease in catering food, and no need to extend feeding time for those affected by dysphagia.

The NUTRICARE intervention reduced swallowing difficulties in dysphagic individuals, and many even started eating on their own and this contributed to improve the socialising aspect of mealtimes. Therefore, the patients' nutritional gain has important benefits in terms of reducing malnutrition. Moreover, avoidance of supplementation and extended feeding time for persons with dysphagia could translate into important cost savings for nursing homes.
The convenience sample was determined by the voluntary participation of the nursing homes in our study, which provided general care to the people enrolled during the period of observation. The participants were individuals with physical, psychic and sensorial impairments, whose healthcare conditions could have been a confounding variable for the general outcome of this study. The CIRS analysis did not show any significant worsening, but further investigations with clinical trials would enable to verify with more reliability the outcome of the intervention.

8 | RELEVANCE TO CLINICAL PRACTICE

Health professionals should be aware that good nutrition is not an optional extra but a fundamental human right and a precondition for good health and quality of life, especially when caring for frail patient populations such as dysphagic older people.

The NUTRICARE programme with an adequate protein, caloric, macronutrient and micronutrients content, balanced bromatological properties, and appropriate texture and palatability properties was successful in reducing malnutrition, achieving the required balanced caloric and nutritional intake in patients with dysphagia.

A dedicated modified texture food programme like NUTRICARE offers an effective and innovative solution to tackle malnutrition in dysphagic older people and improve their health and quality of life.

ACKNOWLEDGEMENTS

We thank the executive managers of MedEat for supporting this study. We also thank the managers and all the staff of the following nursing homes: Centro “Don Orione, Bergamo; Provincia Religiosa di San Marziano di Don Orione—Piccolo Cottolengo, Milano; CRA la Casa di Alberi di Vigato—Gruppo Proges; Casa protetta di Fontanellato—Gruppo Proges; Istituto Bassano Cremonesini—ONLUS; Residenza San Camillo Villa Visconta—Fondazione Opera San Camillo; Residenza IPPocrate—Gruppo Senior Service-Korian; Residenza Anna e Guido Fossati—Gruppo Senior Service-Korian; Residenza Le Torri—Gruppo Senior Service-Korian; Residenza Villa Antea—Gruppo Senior Service-Korian; Residenza la Certosa di Pavia—Gruppo Senior Service-Korian; Residenza Sacra Famiglia—Gruppo Senior Service-Korian; Residenza I Roveri—Gruppo Senior Service-Korian; Fondazione Mons. Arrigo Mazzari—ONLUS; Fondazione Sacra Famiglia, Verbania; Fondazione Sacra Famiglia di Cesano Bosconoi; Casa di Riposo e Casa Protetta Giuseppe Gasparini; RSA Sestri Ponente—Società Cooperativa Lanza del Vasto, Genova.

FUNDING

This study was partly funded by MED EAT Srl, Bergamo, Italy.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

CONTRIBUTIONS

Study design: MZ, AB, PO, LS; data collection: MZ, GC, SR; data analysis: MZ, AB, GC, GA, MS, SR, FM, PO, LS; manuscript preparation: MZ, AB, GC, GA, MS, DLC, SR, FM, PO, LS.

REFERENCES


学霸图书馆

(www.xuebalib.com) 是一个“整合众多图书馆数据库资源，提供一站式文献检索和下载服务”的24小时在线不限IP图书馆。

图书馆致力于便利、促进学习与科研，提供最强文献下载服务。

图书馆导航：

图书馆首页  文献云下载  图书馆入口  外文数据库大全  疑难文献辅助工具