Is It Possible To Increase Weight and Maintain the Protein Status of Debilitated Elderly Residents of Nursing Homes?

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Background. The care of elderly persons in chronic care nursing wards is generally complicated by nutritional problems such as weight loss and worsening protein status. An inability or refusal of the patient to consume enough food often necessitates the use of expensive commercial formulas for nutritional support. The purpose of this study was to determine whether the use of an in-house (high-protein, milk-based) low-cost formula with added minerals and vitamins for total nutritional support would be effective in maintaining weight and protein status of patients in the long term.

Methods. Participants were recruited from five nursing care units of a single geriatric facility. All residents who required formula feeding were followed prospectively. The formula was provided either as a pudding or a milkshake for oral feeding or as a liquid for tube feeding and served as the sole source of nutrition. Data were collected regarding the participants’ weight (monthly), serum albumin level (periodically), and the manner of formula administration (oral, nasogastric, or gastrostomy tube).

Results. One hundred forty-three participants who received this formula were followed for a maximum period of 6 years. Mean weight increased by 5 kg during the first year and remained stable thereafter. Those participants who died within 6 months had no increase in weight. The long-term mean serum albumin level of all participants was an acceptable 4 g/dL.

Conclusion. The long-term use of an inexpensive in-house formula for total nutritional support increased weight and maintained serum albumin levels in most of the chronically ill elderly nursing care patients who participated in the study.

The inability to maintain the weight and protein status of elderly nursing home patients is common, and the compromised nutritional state that results may be life-threatening. Varying but consistent reports exist of a high incidence of protein-calorie malnutrition in residents of long-term care facilities (1,2). The prevalence of malnutrition in nursing homes is common and may be present in a significant proportion of the patient population (3). Weight loss frequently occurs and may be reversible, with the single most common reported cause being depression. Other important potentially treatable causes include psychotropic drug reduction and medications that cause anorexia (4,5). The relation between undernutrition and an increased risk for death in older patients has been well described (6). A recent meta-analysis has shown that protein and energy supplementation in the elderly who are at risk for death as a result of malnutrition was associated with a lower mortality rate (7).

The maintenance of nutritional status in the elderly persons is often difficult. In those with degenerative dementia, “uncontrolled weight loss is almost inevitable in the later stages, despite quality of care” (8). Elderly tube-fed nursing home patients with pressure sores were noted to be malnourished despite receiving a diet high in calories and protein (9). Others have reported that despite the provision of apparently adequate calories and proteins by means of enteral feeding, many elderly patients lose weight when feeding is continued longer than 3 months (10,11). The authors of a recent report noted that the incidence of protein-calorie malnutrition in tube-fed patients was significantly greater than that of freely eating elderly residents of a nursing home (12).

Despite the high incidence of protein-calorie malnutrition in older persons, it is frequently not recognized. Even when detected, often it is not treated. Until recently, the prevailing attitude in the literature has been one of acceptance and futility. It has been suggested that the weight loss that is frequently seen in patients with Alzheimer’s disease may be due either to a metabolic aberration inherent in the disease or to management issues relating to their feeding (13). In fact, Blaum and associates suggest that “it is not known whether it is possible to improve nutritional status in some or all undernourished nursing home residents . . .” especially in those with end-stage dementia (14).

Other investigators observed that only 50% of patients with dementia and inadequate oral intake are likely to survive more than 6 months after percutaneous endoscopic gastrostomy placement (15). The most significant factor that predicted poor survival in patients at 6 months was a serum albumin concentration less than 2.8 g/dL.

Therefore, the use of expensive commercial formulas to provide nutritional support to chronically ill elderly patients, especially those with degenerative dementia, is often only partially effective. We developed an in-house high-protein, milk-based, low-cost formula for economic reasons. Our initial observations using this formula for total nutritional support suggested a positive effect on the nutritional status of our patients (16). Thus, we conducted a prospective study to determine the efficacy of this formula.

Methods

Formula

Because of the high cost of the available commercial formulas, we developed an in-house high-protein, milk-based, low-cost formula with vitamin and mineral supplementation to meet the

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feeding method, because of the need for sterile formulas). Their formula was changed to commercial supplements until they were transferred to other institutions, or until the end of the study, until they recommenced eating regular stomy tube. Patients were followed until their death, until the end of the study. Neurologic dysphagia, or increased metabolic or nutritional demands. Causes included severe appetite loss or refusal to eat, neurologic dysphagia, or increased metabolic or nutritional demands. The indication for the commencement of total formula feeding was an inability to achieve adequate nutritional intake using regular foods or partial supplemental feeding. Causes included severe appetite loss or refusal to eat, neurologic dysphagia, or increased metabolic or nutritional demands. The formula was administered orally as a milkshake or pudding or as a liquid for enteral feeding. The total cost of the formula in 1999, including materials and preparation, was $1.37 per liter, compared with $3.27 per liter for Ensure-Plus, a similar commercial formula (Abbott Laboratories, Abbott Park, IL).

A 250 mL unit of formula provided approximately 340 calories and 14 g protein, 41 g carbohydrate, 14 g fat, and 2.9 g fiber (2.6 g of which was insoluble fiber). The formula comprised the sole source of nutrition, and patients received from 3 to 6 units daily, depending on their nutritional needs (thus providing between 1020 and 2040 calories, and 42 to 84 g protein per day). The formula was administered orally as a milkshake or pudding or as a liquid for enteral feeding. The total cost of the formula in 1999, including materials and preparation, was $1.37 per liter, compared with $3.27 per liter for Ensure-Plus, a similar commercial formula (Abbott Laboratories, Abbott Park, IL).

### Participants

The study population included elderly patients from 5 nursing care units of a single geriatric facility. We prospectively followed all patients who required long-term formula feeding. Treating physicians made the decision to commence total formula feeding based on clinical factors. The indication for the commencement of total formula feeding was an inability to achieve adequate nutritional intake using regular foods or partial supplemental feeding. Causes included severe appetite loss or refusal to eat, neurologic dysphagia, or increased metabolic or nutritional demands. Data were collected regarding the participants’ weight (monthly), serum albumin level (periodically), and the manner of formula administration (oral, nasogastric, or gastrostomy tube). Patients were followed until their death, until the end of the study, until they recommenced eating regular food, until they were transferred to other institutions, or until their formula was changed to commercial supplements (because of the need for sterile formulas).

### Statistical Analyses

We computed means and tables using SPSS for Windows software (Chicago, IL). We analyzed weights using the MLWIN 1.1 program and a repeated-measures method that deals with missing data (17,18).

### RESULTS

We included 143 patients in the study. Their ages ranged from 60 to 103 years, with a median age of 83 years. Table 1 includes a description of the baseline characteristics of the patient population. We noted an average weight loss of 1.4 kg in the 6-month period before the study began. The maximum period of follow-up was 6 years, with most patients (n = 112, or 78% of the patient population) followed for a period of up to 1 year. Table 2 lists characteristics of participant follow-up.

An analysis of all available monthly weights during a period of 1 year for all participants showed an increase in weight of 5 kg (from 52 to 57 kg). In assessing all available weights every 3 months for 2 years, we noted an initial increase in weight in the first year of follow-up, with weight stabilizing thereafter (Figure 1). Because the use of “all available weights” may lead to a comparison of different participants at each period, we repeated the assessment and included only patients with weight measurements at each time period (113 patients) (Figure 2), with results that were nearly identical to those in the initial analysis.

We assessed changes in weight over time for all available weights using multilevel models. We performed the repeated-measures method with missing data to obtain a linear model of weight with time, in which there were two different curves, one for the first 23 months and another for the period 24 to 60 months. The model assumed different inclines for each person (random effect), and we looked at the mean weight of all participants. In the first 23 months, the mean change in weight for each month was 0.319 kg (p = .001). The mean change for 24 to 60 months was only 0.174 kg (p = .02). The difference between the inclines of these two periods was significant (p = .002). When we added to the linear model the square of the time, the difference was not significant, and thus we include here the linear model.

#### Table 1. Baseline Characteristics of the Patient Population

<table>
<thead>
<tr>
<th>Patients (n)</th>
<th>Median age (y)</th>
<th>Age range (y)</th>
<th>Distribution according to age, n (%)</th>
<th>Female sex, n (%)</th>
<th>Baseline diagnoses, n (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>143</td>
<td>83</td>
<td>60–103</td>
<td>60–79 y: 38 (26.6), 80–89 y: 80 (55.9), 90+: 25 (17.5)</td>
<td>87 (61)</td>
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<tr>
<td></td>
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<td>60–79 y: 38 (26.6), 80–89 y: 80 (55.9), 90+: 25 (17.5)</td>
<td>87 (61)</td>
<td>Dementia: 94 (66), Stroke: 61 (43), Heart disease: 53 (37), Diabetes Mellitus: 29 (20), Fractures: 31 (22)</td>
</tr>
</tbody>
</table>

#### Table 2. Characteristics of Patient Follow-up

<table>
<thead>
<tr>
<th>Patients (n)</th>
<th>Months of follow-up, n (%)</th>
<th>Reasons for ending follow-up, n (%)</th>
<th>Feeding method, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>143</td>
<td>0–6: 79 (55.2), 7–12: 33 (23.1), 13–24: 16 (11.2), 25–36: 6 (4.2), 37–60: 9 (6.3)</td>
<td>Death: 92 (64.3), Improvement: 10 (7.0), Other formula: 13 (9.1), Transfer: 4 (2.8), End of study: 24 (16.8)</td>
<td>Tube only: 123 (86.0), Oral and tube: 14 (9.8), Oral only: 6 (4.2)</td>
</tr>
</tbody>
</table>

*Note: *Patients may have more than one diagnosis.

### Discussion

The study population included elderly patients from 5 nursing care units of a single geriatric facility. We prospectively followed all patients who required long-term formula feeding. Treating physicians made the decision to commence total formula feeding based on clinical factors. The indication for the commencement of total formula feeding was an inability to achieve adequate nutritional intake using regular foods or partial supplemental feeding. Causes included severe appetite loss or refusal to eat, neurologic dysphagia, or increased metabolic or nutritional demands. Data were collected regarding the participants’ weight (monthly), serum albumin level (periodically), and the manner of formula administration (oral, nasogastric, or gastrostomy tube). Patients were followed until their death, until the end of the study, until they recommenced eating regular food, until they were transferred to other institutions, or until their formula was changed to commercial supplements (because of the need for sterile formulas).
When we analyzed the effect of age on these findings, we found that participants aged 60 to 84 years displayed an initial slight decrease in mean weight followed by a subsequent increase of 4 kg during the period of 1 year (Figure 3). An even greater increase in mean weight during the year occurred in participants older than 85 years, without a similar initial decrease in weight (Figure 4).

Figure 5 shows the mean serum albumin level measured in the initial 3 months of formula feeding and thereafter at 9 to 12 months. We found that stable, acceptable mean serum albumin levels greater than 4 g/dL were maintained throughout the study.

**DISCUSSION**

The results of this study suggest that by using an in-house formula for total nutritional support we maintained both the weight and the protein status of elderly, chronically ill patients cared for in nursing units. This finding is encouraging, because previous studies have suggested that a deterioration in the nutritional status of such patients, especially in those with degenerative dementia, is almost inevitable.

We found that not only did the weight and protein status of the participants stabilize but they had a significant initial weight gain in the first 2 years of feeding. The weight was maintained and even increased slightly for an extended period (5 years). Weight subsequently decreased after 18 months of follow-up only in patients older than 85 years.

Weight loss is one of the most important indicators of malnutrition. Both low body weight and weight loss are highly predictive of morbidity and death in elderly persons. Poor nutritional status, partly reflected by weight loss, is a contributing factor in the development of pressure sores (19–21), and it has also been related to impaired immunity (22). Nutritionally compromised patients in nursing homes have a greater risk for development of fevers and infections (23) and have a higher mortality rate (6,24). Thus, weight maintenance plays a major role in decreasing morbidity and mortality risks in frail elderly persons (7).

Participants who died within 6 months had no increase in weight. This possibly represents a group of patients in poor general physical condition in whom weight loss and increased mortality rates would be expected. However, their nutritional status remained stable during the study, which may reflect a positive outcome.

The timing of the commencement of formula feeding is important, and supplemental formula feeding should be initiated whenever the patient is not able to achieve an adequate nutritional intake. In our study, total formula feeding was begun early, as evidenced by the relatively mild decrease in weight in the period before the study. This is especially important when the patient is expected to require long-term feeding or has a significant increase in nutritional needs. Adequate professional dietetic care, as well as physician and nursing awareness of the possible consequences of malnutrition in these patients, will determine the timely initiation of nutritional support.

The use of our formula was associated with an acceptable long-term mean serum albumin level of more than 4 g/dL. This is in contrast to the observation that despite a seemingly adequate level of protein and energy intake, approximately one third of geriatric patients who receive enteral feeding with a formula providing high energy and protein nutrition were noted to have persistently low serum albumin levels (25). Serum albumin is a valid indicator of protein status in elderly persons. As noted earlier, the only factor that predicted poor survival in tube-fed geriatric patients at 6 months was a serum albumin concentration less than 2.8 g/dL (15). We have noted that the development of pressure sores is frequently preceded by a decrease in serum albumin level with the use of commercial formulas, and this requires further investigation.

Very few patients required a low-lactose formula, which was
surprising given the relatively high degree of lactose intolerance that is reported for this population in the literature, which explains the current emphasis on lactose-free commercial formulas. We found that by using a formula containing lactose and fiber, we were able to relieve the severe constipation that generally accompanies tube feeding in geriatric patients.

The apparent nutritional advantages of this in-house formula over commercial formulas need to be evaluated further. The preparation of the formula involves the use of readily available constituents of high nutritional value. The availability of the formula as a pudding or milkshake makes it palatable to the patients and may thus encourage them to continue eating orally and delay the need for tube feeding. Oral feeding is considered superior to tube feeding, especially in patients with advanced dementia (26). The use of orexigenic agents may be beneficial in stimulating the appetite of some patients with anorexia and weight loss (27). We did not use these agents during the study and we recognize that their use may have delayed or prevented the need for total formula feeding.

Of the 143 participants, approximately 12% survived longer than 3 years. Considering that most of our patients had end-stage dementia and stroke, this degree of survival is possibly better than expected (10,28). We believe the participants had improved quality of life, and this observation should be investigated in further studies, as should such outcome measures as recovery after surgery and the healing of pressure sores.

In conclusion, the inability to maintain the weight and protein status of frail elderly nursing home patients is common and leads to an increase in morbidity and death. Until now, the attitude in the medical community has been one of acceptance and futility. Our study has shown that it is possible to increase weight and maintain the protein status of debilitated elderly patients in nursing homes by using a simple, inexpensive in-house formula for total nutritional support.

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