Nutritional Status and a 3-Year Follow-Up in Elderly Receiving Support at Home

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Key Words
Malnutrition, elderly · Mini Nutritional Assessment, home-living elderly · Public support, home-living elderly · Body mass index, elderly · Mortality risk, malnutrition

Abstract
Background: Elderly receiving public services and care are often frail, suffer from chronic diseases, and sustain a high risk for malnutrition. Objective: To evaluate nutritional status and long-term outcome in elderly living at home. Methods: Of 507 eligible subjects receiving home care in five Swedish municipalities, we examined 353 (age 82 ± 7 years, 64% females). The subjects were interviewed, and the nutritional status was assessed by means of the Mini Nutritional Assessment (0–30 points; the lower the score, the greater the risk). The Mini Nutritional Assessment consists of 18 questions concerning, e.g., anthropometry (body mass index or BMI; kg/m²) and global and dietary issues. The mortality was evaluated in 224 study participants after a 3-year period. In one municipality, 31 of 64 elderly were reexamined after 3 years. Results: 8 and 41% of the elderly were assessed as malnourished or at risk of malnutrition, respectively. BMIs <20 and <23 were found in 12 and 31% of the subjects, respectively. Chewing and swallowing problems and reduced appetite were more often reported by those at risk of being malnourished compared with the well-nourished study participants (p < 0.001). Meals-on-wheels services were given to one third, of whom 66% used one portion for several meals. The 3-year mortality was 50% for those who were malnourished, 40% for those at risk of malnutrition, and 28% for the well-nourished group (p < 0.05). The corresponding mortality was 50% for subjects with a BMI <20, 35% for those with BMIs 20–28, and 27% for those with a BMI >28 (p = 0.05). After 3 years, a weight loss of 4.0 ± 5.8 kg was registered (p < 0.001). Conclusions: About half of the home-living elderly with public support were malnourished or were at risk of malnutrition. The malnourished subjects often had problems during mealtimes and seldom ate full meals. Elderly with a BMI >28 displayed the lowest risk of death within 3 years.

Introduction
The most rapidly growing segment of the population in Sweden and other affluent societies is the group of elderly over 80 years, i.e., the subjects with the largest need for...
health care and social services. In 1992, the municipalities in Sweden were given the entire responsibility for long-term care of the elderly. Since then, the number of available beds in acute somatic health care facilities and in geriatric clinics has been reduced by half, and the length of hospital stay has been also reduced. As a consequence, the municipalities’ abilities to provide adequate health care and services have been challenged.

One prerequisite for good health is adequate nutrition. A Swedish study [1] has shown that, on the whole, the elderly usually eat two to three cooked meals each day with snacks in between. Moreover, the elderly often eat small meals and have changed their food habits much like the general population. Little is known about the nutritional situation, including meal patterns and meal support, for home-living frail elderly [2]. In Sweden, about 8% of the subjects older than 65 years receive services and care from the municipality. In two previous studies [3, 4], we reported on the nutritional status of the elderly in institutional care and of the elderly receiving home nursing care. One third of 872 subjects (>65 years) living in various forms of institutional care were assessed as being malnourished, and half were assessed as at risk of malnutrition [3]. Secondly, 3% of the elderly receiving home nursing care were assessed as malnourished, and 66% were assessed as at risk of malnutrition [4].

The aim of this study was to evaluate the nutritional status, including meal patterns and meal-related problems, in home-living elderly (age >65 years) receiving municipal services. Moreover, we related the nutritional status to long-term mortality and performed a reexamination in a subsample of the participants after 3 years.

Subjects and Methods

Subjects

The investigation took place as a cross-sectional study in five Swedish municipalities, i.e., one rural community, one small city, and three larger cities. In each community one to three home service areas (a total of 10) were selected with a total of 100 subjects from each participating municipality. The eligible study population was the municipalities’ areas (a total of 10) were selected with a total of 100 subjects from each community one to three home service areas (a total of 10) were selected with a total of 100 subjects from each community. In two previous studies [3, 4], we reported on the nutritional status of the elderly in institutional care and of the elderly receiving home nursing care. One third of 872 subjects (>65 years) living in various forms of institutional care were assessed as being malnourished, and half were assessed as at risk of malnutrition [3]. Secondly, 3% of the elderly receiving home nursing care were assessed as malnourished, and 66% were assessed as at risk of malnutrition [4].

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Mini Nutritional Assessment in Swedish Elderly

Health Status and Assessment of Mood. The interview form also contained questions about health and whether the subjects were regularly seeing a physician. Pharmaceutical prescriptions were registered together with supplementary vitamin and mineral intake. Based on this information, the subjects were classified in 13 diagnostic groups. Each subject was asked to assess his or her mood in accordance with a scale graded from 1 to 4, ranging from feeling very depressed to being very satisfied.

Methods

The participants were interviewed and examined by the community personnel that usually provided the care. A total of 96 staff persons were involved in the examination. Before starting, all personnel received 6 h of education about how to use the instruments in the study (see below).

Nutritional Assessment. The nutritional status was assessed according to the Mini Nutritional Assessment (MNA), an instrument adapted for elderly populations [5]. The MNA consists of 18 point-weighted questions (0–30 points), e.g., anthropometric measurements. The subjects were weighed (sitting or standing), and the standing height was measured. The body mass index (BMI, kg/m²) was calculated. Midarm circumference and calf circumference were measured using a soft tape measure on the nondominant side. A recent weight change was recalled by the participants. Moreover, intake of medication, acute diseases (including psychological stress), mobility, neuropsychological problems, and pressure sores/skin ulcers were registered in accordance with the MNA formula as well as the answers to six questions to assess dietary intake, e.g., how many full meals were eaten (see below), food choice, fluid intake per day, and how much help was required during the meals. Finally, the subjects made a self-assessment of their nutritional status and of their self-perceived health status. A total score <17 indicates malnutrition, one of 17–23.5 indicates risk of malnutrition, and a total score ≥24 indicates that the person is well nourished.

To create a reference for meal size, we used the norms of The Nordic Nutritional Recommendations 1996 [6] and of the WHO 1989 [7]. In order to reach an acceptable level of vitamin and mineral intake [6], we chose a minimum average energy intake/day of 7.5 MJ (1,800 kcal) for both men and women. A template was used describing the makeup of the three main meals (breakfast, lunch, and dinner). To assess the portion size, the personnel were given pictures of plates with four different portion sizes, including four pictures of acceptable breakfasts. The template, in combination with the two largest-portion pictures, constituted the reference for a ‘full’ meal. The fluid intake was calculated from the number of glasses (200 ml) that the subjects drank per day.

Moreover, the subjects were interviewed using a separate form about how the daily food help was supported and whether they divided the delivered meals-on-wheels. They were also asked whether they experienced any problems during meals. The appetite was assessed according to a scale graded from 1 to 4: no appetite, reduced appetite, acceptable appetite, and good appetite.

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Activities of Daily Living (ADL). The subjects' capabilities to perform daily activities were assessed according to the ADL index of Katz et al. [8]. Six activities are included in the assessment: bathing, dressing, toileting, mobility, continence, and eating. Independence in all activities is denoted as A, whereas dependence in all six activities is denoted as G [9].

Three-Year Follow-Up. Three years after inclusion, a mortality follow-up was performed by consulting Swedish population records. Data from one of the participating municipalities were not available. Therefore, of 353 subjects, it was possible to evaluate 224 (age 83 ± 6.8 years, 68% female) for 3-year mortality. In one of the urban municipalities, the participants were reexamined using the initial protocol. Of 64 subjects, we were able to reexamine 31 (age 87 ± 6 years, 77% female, and 88% living single) out of 37 survivors. Twenty-one persons still lived in their homes, and 10 had moved to institutional care were interviewed and examined by the research dietitian in collaboration with the personnel taking care of the elderly.

Statistics and Ethics. Data are presented as mean values ± SD or median (25th–75th percentile), as indicated. In the evaluation of differences between MNA categories, Anova or the Kruskal-Wallis test was used, in accordance with the distribution of the tested variable. For statistical analyses of the Katz ADL index, the letters A–G were given the numbers 0–6. In the 3-year follow-up analyses, Student’s paired t tests or Wilcoxon’s matched-pairs tests were used, in accordance with the distribution of the variables. Survival analyses, including Kaplan-Meier curves and log-rank tests, and logistic regression analyses were performed in order to evaluate the relationship between nutritional status and long-term outcome. The statistical analyses were done using the Stata software package (Statacorp, Tulsa, Okla., USA).

The study conformed to the Declaration of Helsinki. In subjects who had cognitive dysfunction, consent was sought from relatives. The regional research ethics committee at Karolinska Institutet, Stockholm, approved the study.

Results

The mean age in the study populations varied among the five municipalities from 80.4 ± 7 to 83.6 ± 6 years (p < 0.05), whereas gender, civil status, MNA score, and BMI were not significantly different. The data from the five municipalities are pooled.

Nutritional Status at the Time of Inclusion

MNA and BMI results are shown in table 1. Eight and 41% of the study participants were classified as being either malnourished or at risk of malnutrition, respectively, and 12 and 31% had a BMI <20 or <23, respectively. The age correlated weakly with weight and BMI, i.e., r = −0.26 (p < 0.001) and r = −0.18 (p < 0.001), respectively. The age did not differ between the three MNA categories.

Six percent of the study participants reported a weight loss >3 kg during the last 3 months, and 12% had lost 1–3 kg. Nearly every 5th person was not able to recall weight changes due to memory impediment. The elderly’s own assessment of their nutritional status corresponded to the MNA classification. Two thirds of those who did not think they had a nutritional problem had a MNA score ≥24. Likewise, 2 of 3 subjects who were assessed as being at risk of malnutrition also thought of themselves as being moderately malnourished. From the self-assessed appetite in the interview form, 2% reported no appetite, 18% a reduced appetite, 37% an acceptable appetite, and 43% reported a good appetite. The subjects who scored low in MNA often reported a decreased appetite and the subjects who scored high in MNA often had a good appetite (p < 0.001).

Meal Pattern and Meal Support

Using the template and the portion pictures mentioned above, 57 subjects (16%) were assessed as eating one full meal a day, 162 subjects (46%) two full meals, and 134 subjects (38%) three full meals a day. Half drank less than 1 liter/day. One tenth of the study participants reported that they regularly took vitamin and mineral supplements. The interview showed that the subjects with a MNA score <17 seldom had a sufficient lunch meal as compared with those with a MNA score ≥17: 17 and

Table 1. Outcome of MNA and BMI in the whole population

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<tr>
<th>MNA (0–30 points)</th>
<th>Mean ± SD</th>
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<tr>
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<td>23.2 ± 3.6</td>
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<table>
<thead>
<tr>
<th>Weight, kg</th>
<th>Mean ± SD</th>
</tr>
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<tbody>
<tr>
<td>Women</td>
<td>62.9 ± 13.1</td>
</tr>
<tr>
<td>Men</td>
<td>73.4 ± 12.6</td>
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</table>

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<tr>
<th>Height, cm</th>
<th>Mean ± SD</th>
</tr>
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<tbody>
<tr>
<td>Women</td>
<td>158 ± 6.7</td>
</tr>
<tr>
<td>Men</td>
<td>169.9 ± 6.9</td>
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<thead>
<tr>
<th>BMI, kg/m²</th>
<th>Mean ± SD</th>
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<tr>
<td>&lt;20, n (%)</td>
<td>44 (12)</td>
</tr>
<tr>
<td>20–23, n (%)</td>
<td>69 (20)</td>
</tr>
<tr>
<td>23–28, n (%)</td>
<td>156 (44)</td>
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<tr>
<td>&gt;28, n (%)</td>
<td>86 (24)</td>
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63%, respectively (p < 0.001). 3 of 4 subjects with a MNA score < 17, 2 of 3 subjects with a MNA score 17–23.5, and one third of those with a MNA score ≥ 24 always needed help with shopping (p < 0.001). Almost half (46%) prepared their own meals, and more than one third always needed help with cooking. Two thirds of the subjects with a MNA score < 17 always needed help to prepare their meals, whereas one third in the group with a MNA score ≥ 24 (p < 0.01) needed the corresponding support. Problems during meals with chewing, swallowing, appetite, teeth, dry mouth, and eyesight were more commonly reported in the group with low MNA scores compared with the well-nourished group (MNA score ≥ 24; p < 0.05). The community provided meals-on-wheels to 1 in 3 subjects. The portion received was always used for more than one meal by 40%, whereas 26% sometimes divided the meal. Eighty-nine percent of the subjects with a MNA score < 17 always divided their meal compared with 28% of those with a MNA score ≥ 24 (p < 0.01).

MNA in Relation to Health Status, Mood, and ADL

Elderly with multiple disorders or malignant disease had median MNA scores < 22, whereas subjects with high blood pressure, diabetes mellitus, or with no reported diseases had median MNA scores exceeding 24.5 (NS). The BMI varied in a similar fashion from 23 to 27 in the various diagnosis groups (p = 0.16). When the elderly assessed their state of mind, 3% always felt very depressed, and 25% felt sometimes depressed, whereas 44 and 23% often or always, respectively, felt satisfied. Those classified as at least at risk of malnutrition were often depressed, and the well-nourished study participants usually stated their mood as being satisfactory (p < 0.001). The degree of dependence in the various MNA categories is shown in figure 1. For example, the median Katz index was C (A–F) in those with a MNA score of < 17 as compared with A (A–C) in the subjects with a MNA score ranging from 17 to 23.5 (p < 0.001).

Mortality Follow-Up

Figure 2 shows the 3-year mortality in the various MNA groups for the 224 subjects we were able to register. Mortality was 50% for those found to be malnourished, 40% for those at risk of malnutrition, and 28% for the well-nourished study participants (p < 0.05). The corresponding mortality rates were 50% for those with a BMI < 20, 35% for those with a BMI of 20–23 as well as for those with one of 23–28, and 27% for subjects with a BMI ≥ 28 (p < 0.05; fig. 3). The odds ratio for the mortality outcome within 3 years was tested using logistic regression analyses with MNA (3 categories), age (4 categories), and male sex as independent covariates. Table 2 shows that low MNA scores independently predicted mortality.

Nutritional Follow-Up

The median MNA score had decreased from 22 (range 20.5–26) to 19.5 (range 17–23.5; p < 0.001) in the 31 subjects that we were able to reexamine after 3 years. Initially, 13% were classified as being malnourished, while 26% were classified correspondingly at follow-up (p < 0.05). The mean weight loss was 4.0 ± 5.8 kg. Additionally, the Katz ADL index indicated a higher degree of dependence after 3 years (data not shown), and changes in MNA score and in Katz ADL index correlated (r = 0.57; p < 0.001).
Fig. 2. Three-year survival in home-living elderly with community support as grouped by MNA (p < 0.05).

Fig. 3. Three-year survival in home-living elderly with community support as grouped by BMI (p < 0.05).

**Discussion**

This study showed that almost half of a group of Swedish elderly receiving home help services were at risk of malnutrition. Eight percent were classified as being malnourished which is in line with findings reported in previous studies investigating similar populations [4, 10–12]. A major finding of our study was that the MNA had a prognostic value in home-living elderly subjects, as the 3-year mortality increased with low MNA scores. This observation lends support to a previous report on Danish nursing home residents [13]. Moreover, we have recently found a relation between 3-year mortality and MNA classification in a study of geriatric patients [14]. To our knowledge, this is the first time a similar relationship is reported in home-living elderly. In parallel, a low BMI
and, for each step in the four age categories, towards increased age. Mortality that is linked to each step towards worse nutritional status is ending. Under such conditions, it may not be possible to fully restore the nutritional status. Nevertheless, good nutritional intake as well as to anthropometric and biochemical indices of nutritional status in various elderly populations. Sources of uncertainty in our study are the large number of observers and the fact that the observers were directly involved in the care of the study subjects which may have biased the assessments. We tried to deal with this by training the staff in order to minimize the interobserver differences, and possibly the bias went in both directions, as some may have under- and others overestimated the extent of nutritional problems.

When we related MNA score and BMI to the health status, we found no significant differences between the groups. It is reasonable to assume that home-living elderly are healthier than elderly in hospital or in institutional care, e.g., a nursing home. Frailty rather than disease probably accounts for the fact that as many as half of the population were scored as at risk of malnutrition. The MNA in 330 healthy elderly (age 77 ± 6 years) in New Mexico, USA, averaged 27 ± 2 points [20] compared with the average score of 23.2 ± 4 in the current frail and older population. We also evaluated the possible relationships between nutrition and perceived mood and independence in daily activities. About half of the subjects with low MNA values reported a depressed mood. In accordance with findings in Swedish elderly (>75 years) in general [21], about one fifth among the subjects with high MNA scores sometimes felt depressed. The relationship between malnutrition and depression is complex.

Depression leads to reduced appetite, but, on the other hand, malnutrition may induce depression and apathy [22, 23]. Predictably, a low ADL functioning, according to the Katz ADL index, corresponded to low MNA scores. Loss of lean body mass and reduced muscle strength lead to increased dependence. Much evidence supports this assumption [24]. On the other hand, the MNA consists of issues, many of which focus on ADL functions. Consequently, a correlation between MNA and Katz ADL index is to be expected.

Moreover, we wanted to study the meal pattern in home-living frail elderly. Two thirds of the examined subjects ate two or less ‘full’ meals a day. Of the one third of the population that received meals-on-wheels, 2 of 3 study subjects reported that the portion always or sometimes was enough for more than one meal. 9 of 10 subjects with MNA scores <17 divided the meal. Low MNA scores were related to reduced appetite, as well as to difficulties in chewing and swallowing, problems using fork and knife, bad teeth, and poor eyesight. Together these findings indicate that the food intake was insufficient in many of the elderly living at home. Recently, we reported that energy and nutrient intakes in elderly living in sheltered housing only reached 60–80% of the recommended levels [25]. Similar figures for home-living elderly with community support or receiving meals-on-wheels have been reported from England, the USA, and Canada [26–29]. Finally, we noticed a mean weight loss of 4 kg in the 31 survivors that were reexamined in one of the participating communities. Much of this decline in nutritional status in late life is related to the ageing processes per se and is, therefore, probably partly irreversible. However, much evidence indicates that nutritional therapy may restore body mass, improve functional status, and even postpone mortality in very old subjects [24, 30–32].

In many elderly, the complex of malnutrition, reduced ADL, and impaired cognitive functions indicates that life is ending. Under such conditions, it may not be possible to fully restore the nutritional status. Nevertheless, good

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<th>OR</th>
<th>95% CI</th>
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<tr>
<td>MNA</td>
<td>1.89</td>
<td>1.18–3.01</td>
</tr>
<tr>
<td>Age</td>
<td>1.33</td>
<td>1.01–1.74</td>
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<tr>
<td>Male gender</td>
<td>1.60</td>
<td>0.86–2.99</td>
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The ORs for MNA and age correspond to the increased risk for mortality that is linked to each step towards worse nutritional status, and, for each step in the four age categories, towards increased age. (<20 kg/m²) was also related to an increased mortality. Interestingly, subjects with a BMI >28 had the best 3-year survival. This finding is supported by results of several reports [15, 16], e.g., we have recently shown that geriatric patients with a BMI >25 had higher 1-year survival rates than patients with a BMI <25 [17]. In middle-aged populations a BMI range of 20–25 is recommended. This BMI range does not appear to be relevant to the very old, especially not the upper reference limit. Accordingly, a higher optimal BMI range for elderly has been suggested [18].

There are a variety of techniques for assessing nutritional status which may partly explain why the reported occurrence of malnutrition in home-living elderly populations varies. In this study, we chose to use the MNA, a technique that considers both sociopsychological and medical factors relevant to older adults. Recently, we [14] and others [19] have reported that MNA relates well to nutritional intake as well as to anthropometric and biochemical indices of nutritional status in various elderly populations. Sources of uncertainty in our study are the large number of observers and the fact that the observers were directly involved in the care of the study subjects which may have biased the assessments. We tried to deal with this by training the staff in order to minimize the interobserver differences, and possibly the bias went in both directions, as some may have under- and others overestimated the extent of nutritional problems.

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### Table 2. Odds ratios (OR) and 95% confidence intervals (CI) for death within 3 years using three MNA groups (MNA scores <17, 17–23.5, and ≥24), four age categories (<78, 78–84, 85–88, and >88 years), and gender as covariants in a multivariate logistic regression analysis

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nutritional routines are of crucial importance to performance and perceived quality of life in the frail elderly subject. This study pinpoints the problems of malnutrition and its recognition. We may conclude that malnutrition, usually unrecognized in the elderly with home help services, is related to impaired physical and mental functioning as well as to reduced survival. Studies are needed to evaluate whether nutritional therapy can influence survival and function in this population.

References


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