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# SUITABILITY OF THE SHORT-FORM MINI NUTRITIONAL ASSESSMENT IN FREE-LIVING ELDERLY PEOPLE IN THE NORTHWEST OF SPAIN

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**Abstract:** *Objective:* To evaluate the Mini Nutritional Assessment (MNA) test and the short-form MNA (MNA-SF) as screening tools for malnutrition risk and malnutrition in the free-living elderly of northwestern Spain. *Design:* transversal study. *Setting:* free-living elderly people of northwestern Spain. *Subjects:* 728 participants (36.4% men and 63.6% women), the average of age for both genders was 80.7±7.4. *Results:* according to MNA screening 12.5% subjects were classified as undernutrition (MNA<17) and 57.5% were at risk for undernutrition (17≤ MNA ≤23.5). Significant correlations were found between MNA-SF and the full version (r=0.916; p<0.000). The sensibility and specificity of the MNA-SF for the full MNA version were 81.4% and 92.7%, respectively. The regression analyses showed that weight loss had more influence on the MNA score, followed by the *Body Mass Index (BMI), acute illness or psychological stress, mobility, self-perceived health status and neuropsychological problems. Conclusions:* These data showed a high prevalence of undernutrition risk among the free-living elderly people in northwestern Spain using the MNA test in two steps. The high sensitivity and specificity of MNA-SF might be sufficient for medical practice to identify patients at undernutrition risk or undernutrition. Generally, the full MNA confirmed the diagnosis for persons identified at risk by the MNA-SF, and planning was needed for nutritional interventions.

**Keywords:** Mini Nutritional Assessment (MNA), nutritional status, elderly people, free-living.

## Introduction

The early detection of malnutrition and the risk of undernutrition (1) is an important challenge for improving the care of elderly people. The development of malnutrition is a continuum, starting with inadequate food intakes followed by signs of changes in biochemical indices and body composition (2). Malnutrition in elderly people is associated with impaired general physical condition and activity (3) and increased mortality rate (4). It is estimated that the proportion of aged individuals in the European Union will reach around 30% by 2050, almost twice the current level (5). In most European countries, the prevalence of malnutrition among the elderly living at home is between 5-20%, percentages that increase among the institutionalized elderly and hospitalized (6).

It is important to evaluate the nutritional status of the elderly population and the evaluation of the factors that affect nutritional status (physiological, deficiencies or defects nutritional…) to help reduce prevalence of malnutrition and improve the quality of life of the elderly, thus reducing the need for hospitalization or institutionalization, while increasing their longevity (7, 8).

In the last decades many researchers tried to find a tool for identifying older people with poor nutrition status or those at high risk of nutritional problems. While no consensus has been reached, many different methods have been used (9). The Mini Nutritional Assessment (MNA) has been specifically developed to evaluate the risk of malnutrition in frail elderly people and to identify those who could benefit from early intervention (10-12). The MNA contains geriatric-specific assessment questions related to nutritional and health conditions, independence, quality of life, cognition, mobility and subjective health (13). This questionnaire has been recommended by the European Society of Clinical Nutrition and Metabolism (ESPEN) for the nutrition screening of elderly people (14). An extensive review of the literature has been done by different authors (13, 15, 16) and these articles provide large data sets from different settings (free-living, home care, institutionalized, hospitalized).

In a work published in 2001 (17) conclude that if the MNA-SF score is greater than 12, the patient generally has an acceptable nutritional status, and if the score is less than 12, the full MNA should be completed for nutritional intervention. It takes less than 4 minutes to administer the MNA-SF and between 10 and 15 minutes for the full MNA (16). In 2009 the newly revised MNA-SF (18) was published, introducing an additional classification of risk of malnutrition that the original MNA-SF lacked.

The aim of the present study was to determine the suitability of the MNA-SF test, revised by Kaiser and colleagues (18) vs. the full MNA, for the evaluation of the nutritional status in free-living elderly population of northwestern Spain.

## Subject and methods

### *The Population Studied*

We designed a cross-sectional study involving 728 persons on a voluntary basis, over 65, living in their homes, located in Ourense, northwestern Spain. The volunteers were recruited by social workers of the participating municipalities that previously were trained to perform this work. All participants gave their informed consent in writing. Subjects with severe cognitive impairment or a severe psychiatric diagnosis were excluded; all

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participants were able to communicate verbally.

***Data Collection***

Each participant underwent an interview in which we collected data on demographic variables (age, sex, place of residence), and anthropometric parameters required to complete the MNA were measured in triplicate (weight, calf circumference, mid upper-arm circumference and knee height) following the recommendations of the author of the MNA (19). Height was estimated using the mean knee height from the Chumlea et al stature equations for Caucasian patients (20). BMI ($Kg/m^2$) was calculated from weight (kilograms) divided by height (meters) squared.

The nutritional status of the population was assessed using the MNA (19) in two stages, in the first one only six questions in the short version of the MNA were evaluated (17) making reference to *appetite, weight, mobility, psychological stress or acute disease, neuropsychological problems* and BMI.

The nutritional condition of the population was classified into three categories: adequate nutritional status (12-14 points), at nutritional risk (8 to 11 points) and malnourished (from 0-7 points) (18). In the second stage 18 full MNA questions grouped into four subgroups were evaluated: anthropometric, global, dietetics and subjective assessments. Based on the score the population was classified into three categories: malnourished (<17), at nutritional risk (17≤score<24), and adequate nutritional status (≥ 24).

***Statistical Analysis***

Results of this study were statistically analyzed with SPSS 17.0. Means, standard deviations and frequencies were used as descriptive statistics. The Kolmogorov-Smirnov test was used to check the normal distribution of variables. The ANOVA test was performed to compare means for age, weight, height and BMI between the men and women, and the Mann-Whitney U test was used to compare different scores in the short and full MNA test between both genders. Spearman's correlation analysis was performed to determine the significance of the relationship of the short form and the full version of the MNA test. The sensitivity, specificity and predictive values were calculated to assess the association between the MNA-SF and the MNA full regarding the classification of undernutrition and undernutrition risk. Stepwise linear multiple regression analyses were used to study the strength of the questions in the MNA on the MNA total score. The statical significance level was set at 0.05.

## Results

Of the 728 participants with a mean age of 80.7±7.4, 63.6% were women and 36.4% men (Table 1). The average weight of this population was 70.1±14.0 Kg, which was significantly higher in men than in women. On the contrary the height of men was significantly lower than theirs, with a mean of 1.61±0.12 m.

The average BMI in this population (27.4±7.6 $Kg/m^2$) corresponds to normal weight (21). However, after analyzing by gender significant differences between the two values were found: the mean BMI in men (30.6±8.3) is in the range of obesity, and in women (25.1±6.1) in the range of overweight. Weight problems (overweight, but especially obesity) were shown in 81.2% of the elderly, while this percentage was reduced to 45.4% in the elderly women group, in which higher prevalence of overweight as opposed to obesity was found (Table 1).

The mean score of the MNA-SF was 10.6±2.6 and the full MNA was 21.4±3.9 (Table 1), the values found in men (11.4±2.4 and 23.2±3.6) were significantly higher than those of women (10.2±2.6 and 20.4±3.7). The Spearman correlation between full MNA and MNA-SF was significantly higher (r=0.916, p <0.000).According to the MNA-SF, 431 of the 728 participants (Table 2) had an inadequate nutritional status (90 malnourished and 341 at nutritional risk); 297 were in normal nutritional status and of these, according to the full MNA, 95 were at risk. The rest were confirmed as individuals with an adequate nutrition.The sensitivity of MNA-SF against the full MNA regarding individuals with an inadequate nutritional status (malnourished or at risk) was 81.4% (415/510) and specificity in relation to those with an adequate state is 92.7% (202/218). The positive predictive value is 96.3% and the negative predictive value is 68%. No participants classified as malnourished on the full MNA were diagnosed in good nutritional status for the MNA-SF and vice versa.In 158 cases of the 728 (21.7%) participants were classified incorrectly in one of the three categories studied, and of these 119 (75.3%) were classified by the MNA-SF in a higher category to which it corresponds according to the full MNA and 39 (24.7%) were classified in a lower category to that diagnosed by the full MNA.

**Table 1**
Descriptive characteristics of the elderly people of northwestern Spain (728 participants)

| Variable | Total | Men | Women |
|---|---|---|---|
| No. participants (%) | 728 (100%) | 265 (36.4%) | 463 (63.6%) |
| Age (years) (mean±sd) | 80.7±7.4 | 80.4±7.3[a] | 80.8±7.5[b] |
| Weight (Kg) (mean±sd) | 70.1±14.0 | 75.6±13.1[a] | 66.2±13.3[b] |
| Height (m) (mean±sd) | 1.61±0.12 | 1.58±0.15[a] | 1.63±0.10[b] |
| BMI (Kg/m2) (mean±sd) | 27.4±7.6 | 30.6±8.3[a] | 25.1±6.1[b] |
| Prevalence of undernutrition (%) | 16.5 | 5.9 | 24.4 |
| Normal weight (%) | 23.4 | 12.9 | 30.2 |
| Prevalence of overweight (%) | 30.7 | 34.3 | 28.3 |
| Prevalence of obesity (%) | 30.7 | 46.9 | 17.2 |
| MNA-SF (mean±sd) | 10.6±2.6 | 11.4±2.4[a] | 10.2±2.6[b] |
| Full MNA (mean±sd) | 21.4±3.9 | 23.2±3.6[a] | 20.4±3.7[b] |
| 1. Anthropometrics | 6.4±1.6 | 6.8±1.4[a] | 6.1±1.7[b] |
| 2. Global assessment | 5.9±1.9 | 6.4±1.8[a] | 5.7±1.8[b] |
| 3. Dietary assessment | 6.1±1.2 | 6.9±1.0[a] | 5.7±1.1[b] |
| 4. Subjective assessment | 2.9±0.9 | 3.0±0.8[a] | 2.8±0.9[b] |
| Nutritional status (MNA) | | | |
| Undernutrition (%) | 12.5% | 6.8% | 15.7% |
| Undernutrition risk (%) | 57.5% | 42.2% | 66.3% |
| Adequate nutritional status (%) | 30.0% | 51.0% | 18.0% |

Different superscripts in the same row indicate that values are significantly different (p<0.000)

The multiple regression analysis for items in the full MNA gave an $R^2$ value of 0.988 and in the study of the variance a statistical significance of p <0.001 was obtained, which showed a linear association of some items with the full MNA total score. The regression coefficients of all items of the MNA had a significance of p<0.000 (Table 3) except for the number of meals per day in the group of women. The items that contributed most to the final score of the questionnaire were *weight loss*, followed by *BMI* and *acute illness or psychological stress. Mobility, self-perceived health status and neuropsychological problems* were less contributing, followed by *appetite loss* and *ability to eat.* Six of these questions are included in the MNA-SF (*weight loss*, BMI, *acute illness or psychological stress, mobility, neuropschological problems* and *appetite loss*). These regression analyses showed some slight differences among them concerning the statistical contribution of items to the model. The *acute illness or psychological stress, mobility, neuropsychological problems, appetite loss, ability to eat, protein intake, calf circumference* and *mid upper-arm circumference* had more influence on the MNA score for women than for men (Table 3).

**Table 2**
Distribution of nutritional status in elderly people-participants among MNA-SF and full MNA

| MNA-SF | Full MNA | | |
|---|---|---|---|
| UNDERNUTRITION | UNDERNUTRITION | 67 | UNDERNUTRITION |
| 90 | RISK | 23 | 67+24+0=91 |
| | ADEQUATE | 0 | |
| RISK | UNDERNUTRITION | 24 | RISK |
| 341 | RISK | 301 | 23+301+95=419 |
| | NORMAL | 16 | |
| ADEQUATE | UNDERNUTRITION | 0 | ADEQUATE |
| 297 | RISK | 95 | 0+16+202=218 |
| | ADEQUATE | 202 | |
| **TOTAL 728** | | **728** | **728** |

According to the MNA score (Table 1) 70% of the population does not have an adequate nutritional status, either by being in a situation of malnutrition (12.5%) or at risk of malnutrition (57.5%), and this situation is worse in the case of women as only 18% are in a good nutritional status compared with 51% of men. When analyzing the average values for the 4 subgroups of full MNA (anthropometric, global, dietary and subjective), significant differences were found between malnourished patients at risk and those with a good nutritional status (Table 4).

## Discussion

Data showed a high prevalence of malnutrition and risk of malnutrition among this population living in their homes in northwestern Spain. Only 30% have an adequate nutritional status. However, it is noteworthy that the average BMI in this population is in the range of normal weight which, according to some authors (21), assumes that in the elderly this anthropometric parameter is not a real rate since, according to MNA, these participants are malnourished or at a high risk of malnutrition. Bearing in mind that the BMI relates height and weight, its changes should be influenced by the variation of either. Thus, size decreases with age, but weight does not have the same value at this stage in life compared to adulthood since aging is accompanied by a reduction in muscle mass, loss of protein stores, and body fat redistribution (21), as a result, a senior can have an adequate BMI and not have a good nutritional status.

**Table 3**
Multiple regression analyses for components of full MNA

| Variable | Total | | Men | | Wome | |
|---|---|---|---|---|---|---|
| | Stand ß value | p | Stand ß value | p | Stand value | p |
| Weight loss | 0.276 | <0.000 | 0.287 | <0.000 | 0.326 | <0.000 |
| BMI | 0.255 | <0.000 | 0.287 | <0.000 | 0.155 | <0.000 |
| Acute illness or psychological stress | 0.234 | <0.000 | 0.251 | <0.000 | 0.231 | <0.000 |
| Mobility | 0.181 | <0.000 | 0.191 | <0.000 | 0.186 | <0.000 |
| Self-perceived health status | 0.177 | <0.000 | 0.187 | <0.000 | 0.188 | <0.000 |
| Neuropschological problems | 0.176 | <0.000 | 0.184 | <0.000 | 0.145 | <0.000 |
| Appetite loss | 0.138 | <0.000 | 0.148 | <0.000 | 0.141 | <0.000 |
| Ability to eat | 0.130 | <0.000 | 0.148 | <0.000 | 0.137 | <0.000 |
| Independence | 0.125 | <0.000 | 0.130 | <0.000 | 0.135 | <0.000 |
| Self-perceived nutritional status | 0.113 | <0.000 | 0.112 | <0.000 | 0.090 | <0.000 |
| Prescription drugs | 0.113 | <0.000 | 0.122 | <0.000 | 0.130 | <0.000 |
| Fluid consumption | 0.098 | <0.000 | 0.097 | <0.000 | 0.104 | <0.000 |
| Protein intake | -0.093 | <0.000 | 0.067 | <0.000 | 0.046 | <0.000 |
| Fruits or vegetables intake | 0.090 | <0.000 | 0.094 | <0.000 | 0.108 | <0.000 |
| Calf circumference | 0.081 | <0.000 | 0.102 | <0.000 | 0.079 | <0.000 |
| Pressure sores or skin ulcers | 0.067 | <0.000 | 0.073 | <0.000 | 0.088 | <0.000 |
| Number of meals eaten daily | 0.035 | <0.000 | <0.000 | 1.000 | 0.068 | <0.000 |
| Mid upper-arm circumference | 0.034 | <0.000 | 0.034 | <0.000 | 0.029 | <0.000 |

The high prevalence of malnutrition and risk of malnutrition among the participants, as evidenced by the full MNA score was higher than that found in non-institutionalized Spanish elderly populations by other authors (8, 22, 23) and, as in most of these studies, these percentages are higher in women (8, 23, 24), although some (22) found that these gender differences varied within the same country, depending on the geographic area. In northwestern and southern Spain the incidence of malnutrition and risk of malnutrition was higher among men. These problems of malnutrition were also more frequent among those involved in this work than among elderly people living at home in Brazil (25, 26), Sweden (27) and Finland (28, 29). In elderly Taiwanese (30, 31) there were much lower rates than here reported for both the prevalence of malnutrition (2.0% and 0.5% respectively) and for those who were at risk (13.1% and 13.6% respectively). These differences could be due to, according to its

authors, anthropometric differences, different food consumption patterns and different lifestyles in the Caucasian and Taiwanese populations.

**Table 4**
Comparison of the four MNA full subgroups in the undernutrition, undernutrition risk and adequate nutritional status

| Variable | Undernutrition | Undernutrition risk | Adequate nutritional status |
|---|---|---|---|
| Anthropometrics | 4.42±1.70[a] | 1.41±0.07[b] | 7.65±0.05[c] |
| Global assessment | 3.45±1.32[a] | 5.76±1.63[b] | 7.46±1.01[c] |
| Dietary assessment | 4.57±1.12[a] | 5.95±1.03[b] | 7.11±0.70[c] |
| Subjective assessment | 1.90±0.76[a] | 2.85±0.78[b] | 3.46±0.59[c] |

Different superscripts in the same row indicate that values are significantly different ($p<0.000$)

In the literature evidence has also been found more value of incidence of malnutrition and risk of malnutrition in elderly people living at home, but in cases in which the elderly received home care such as the elderly in southeastern Spain (32), elderly Peruvians (33) and a population of elderly Japanese (34). This increased incidence is probably due to the more impaired health status of these populations (disease, weak dementia, social isolation or even pluripathologies) which make home care necessary.

According to some authors (18) the MNA-SF can not distinguish clearly between the elderly at risk and those malnourished, but the misclassification that can lead to the MNA-SF is less problematic than if it had an incorrect diagnosis of full MNA. Those with compromised nutritional status would be considered well-nourished people and there would not be an adequate nutritional intervention to improve their nutritional status. In this population, the MNA-SF classified 83.7% correctly or in a lower category than that accruing under the full MNA. However, 16.3% would be classified at a higher level and of these 95 (13%) were diagnosed in elderly good nutritional status when they were actually at risk according to the full MNA, and therefore these people would be misdiagnosed and nutritional intervention would not be scheduled. If the process of assessment of nutritional status by the MNA is repeated about three times a year as recommended in the elderly (35), it should be noted that the possibility of misclassification is minimized (18). The high sensitivity observed in the MNA-SF when compared with the full MNA indicates that the short version could be a useful tool for the detection of problems in the nutritional status of the elderly and presents a number of advantages over version complete as it is very easy to use and just takes about four minutes to do. The high value of specificity obtained also confirms its usefulness for identifying people with an adequate nutritional status to avoid intervention in people who do not need it and direct this only to those who actually have a compromised nutritional status.

Regarding the predictive value of the 341 participants classified at risk by the MNA-SF, only 4.7% could be false positives, compared with 20% obtained by Rubenstein et al (17), the rest (95.3%) could be confirmed with the full MNA as cases in which nutritional intervention is required.

By comparing the values of sensitivity, specificity, negative predictive value and positive predictive value of MNA-SF against the full MNA with the literature (8,36,37,38), it was found that the sensitivity is slightly lower than reported in these works, but higher values were found for specificity than those proposed by Cuervo et al (8), Kuzuya et al (36) and Wikby et al (38), and positive predictive values were higher than those proposed by those authors and Cohendy et al (37).

The multiple regression analysis showed that all items of the full MNA had a significant association with the final score of the questionnaire, and the six included in the MNA-SF were among those that most helped to explain the regression model, which confirms what was reported by Rubeinstein et al (17), who additionally noted that the choice of these items was also not influenced by recurring questions, easy to remember and they were the ones with the lowest percentage of "missing values".

The item that showed a greater contribution was *weight loss*, which was also reported by others (8, 28). The 28.1% of elderly participants experienced an involuntary loss of weight (12.6% were severe and 15.5 % moderate), but in other Spanish elderly population studies (8) it was reduced to 22.2% and the prevalence was higher in women than in men. In this work only in the case of moderate weight loss was it higher in women, whereas more men suffered severe weight loss. Christensson et al (39) found that the item with the highest predictive power w*as self-perceived health status*. These authors note that, despite the importance of this question in assessing the nutritional status of the elderly, it is one that presents a higher rate of missing values especially in certain sectors of the elderly population (with reduced mental capacity, very old, chronically ill, …). In our case, only 15.5% answered "do not know" about *self-perceived health status*. Regression analysis showed some differences between sexes and, thus, the BMI had a higher contribution to the MNA in women than in men.

The significant differences found regarding the anthropometric, global, dietetic and subjective assessments among the malnourished, at risk and those with a good nutritional status showed that an inadequate nutritional status is the result of deterioration in all four areas. The same results were found in Spanish elderly populations (40). However, in the elderly in southern Finland (28) there were no significant differences in the subjective assessment, but there were significant differences in the other three. It should be noted that the participant population were receiving care in their homes.

In conclusion, the high rate of malnutrition is remarkable, and such is the risk of malnutrition found among this population that it is of great importance to detect this risk group before severe changes in weight occur especially since these people are more likely to have a lower caloric intake which can be corrected through nutritional intervention. In addition, the results of this

study indicate that the MNA-SF can be used as a fast, simple, valid tool to make a first screening of the elderly living at home and are at a nutritional risk, and by performing the full nutritional assessment (full MNA) exclusively in malnourished elderly or at risk of malnutrition, one can confirm the situation and take appropriate action. This strategy reduces the need for a new assessment for people who are in a normal nutritional status.

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