

ASSOCIATION BETWEEN NUTRITIONAL STATUS (MNA®-SF) AND FRAILTY (SHARE-FI) IN ACUTE HOSPITALISED ELDERLY PATIENTS

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Abstract: *Objective:* This study aimed to explore the association between the impaired nutritional status and frailty in acute hospitalised elderly patients by using two tools, the MNA®-SF (Mini Nutritional Assessment® short-form) and the SHARE-FI (Frailty Instrument for Primary Care of the Survey of Health, Ageing and Retirement in Europe). *Design:* Cross-sectional study. *Setting:* Acute hospitalised, community-dwelling elderly patients were recruited at internal medicine wards in Vienna, Austria. *Participants:* 133 men (39%) and women (61%) aged 74 (65-97) years. *Measurements:* MNA®-SF was used to investigate malnutrition (<7 points) and patients at risk of malnutrition (8 to 11 points). By using the SHARE-FI, subjects were classified as frail, pre-frail or robust. A factor analysis was applied to identify overlaps between the MNA®-SF and SHARE-FI items. Internal consistency of different dimensions was assessed by using Cronbach's Alpha. *Results:* Malnutrition or risk of malnutrition was found in 76.7% of the total sample and in 46.8% of robust, in 69.0% of pre-frail, and in 93.0% of frail participants. Frailty or prefrailty was found in 75.9% of the total sample and in 45.1% of the subjects with no risk of malnutrition, in 80.9% of subjects at risk of malnutrition, and in 94.1% of malnourished patients. The two used tools show overlaps in three dimensions: (1) nutrition problems, (2) mobility problems and (3) anthropometric items with a moderate to strong internal consistency (Cronbach's Alpha of 0.670, 0.834 and 0.946, respectively). 64.7% of the total sample (79.5% of frail and 87.9% of malnourished subjects) would participate in a home-based muscle training and nutritional intervention program. *Conclusions:* This study underlines the association and the overlap between frailty and impaired nutritional status. There is a high readiness to participate in a program to tackle the problems associated with malnutrition and frailty, especially in those, who would benefit most from it.

Key words: Screening, malnutrition, frailty, elderly, hospital.

Introduction

In elderly subjects nutrition-related problems are very common. Malnutrition is defined as a chronic state in which a combination of varying degrees of over- and undernutrition and inflammatory activity change body composition (1, 2). Malnutrition can lead to serious health hazards in elderly subjects (3-7). Therefore, a validated screening is recommended for early detection of malnutrition and the risk for developing malnutrition among older adults in hospitals, nursing homes and home-care programs (8). The Mini Nutritional Assessment (MNA®) is a validated tool and it is the most frequently used nutritional screening tool in older adults (9, 10).

Underweight (11) as well as obesity (12-14) are both associated with a higher risk of frailty. Frailty is considered a state of high vulnerability for adverse health outcomes, including disability, dependency, falls, need for long-term care (15). Additionally frail subjects are at a higher risk for increased mortality and morbidity, more frequent hospitalisation and longer length of stay, social isolation and decrease in quality of life (16, 17). Frailty is a geriatric syndrome that combines sarcopenia, malnutrition, chronic inflammation, low physical activity and exhaustion (11).

Therefore, there is a high overlap between malnutrition and frailty. However, we have identified only two studies (18, 19) which focus on the association between the assessment of the nutritional status (MNA® long-form) and frailty (Cardiovascular Health Study Frailty Index) (15), in older adults.

The aim of this study was to explore the association between the impaired nutritional status assessed by the MNA® short-form and frailty according to the SHARE-FI instrument in acute hospitalised older patients. Furthermore it was the aim to evaluate the willingness of these patients to participate in an exercise and nutritional program to tackle the problems associated with malnutrition and frailty.

Methods

Design

For this cross-sectional study, a convenient sample of 143 older adults was recruited in two hospitals, one university and one acute care hospital in Vienna (Austria) from June to October 2011. In the university hospital, the recruitment took place at two different wards, one for endocrinology and metabolism, and one for gastroenterology and hepatology. At the acute care hospital, patients were recruited from a general

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ward for internal medicine. Inclusion criteria were men and women with an age of 65 years and older, planned discharge from the hospital within the next two weeks, capacity to consent, and signed informed consent.

The study was approved by the ethics committee at the Medical University Vienna (EC 306/2011). Informed consent was obtained from each patient. The study was performed according to the Helsinki declaration in 1964 (20).

Sample characteristics

Sample characteristics were assessed through interviews by well-trained personnel. Age was calculated from birth date. Level of education was defined as “primary” for participants with elementary school or no degree, “secondary” for those with apprenticeship certificate or a university entrance diploma and “tertiary” for participants with education after the university entrance diploma as university degrees. Regarding living situation subjects were asked, “Before your hospital transmission, did you live alone?”, and “Do you think that your living situation will change after hospital discharge?”. Questions regarding autonomy were “Up to now, did you live alone?”, “Do you manage your shopping alone?”, and “Do you have somebody who helps you with your household?”. Regarding participation in a training and nutrition intervention, subjects were asked “Could you imagine to participate in an exercise and nutritional program?”, “Could you imagine to let a person who is yet unknown to you into your home, who has been trained as a buddy, and who would conduct with you a training and nutrition intervention?”, and “Would you prefer a male or a female person to do that?”.

Mini Nutritional Assessment (MNA®)

Nutritional status was assessed with the short form of the MNA® (MNA®-SF) (21, 22). This is a short standardised questionnaire which comprises six questions about food decline, weight loss in the last three months, mobility, actual disease/distress, psychological situation, and additionally anthropometric measures (body mass index or calf circumference). For our study, calf circumference (CC) was used, which has been shown to be as sensitive as the version with BMI (21). Calf circumference was measured with a tape in the sitting patient in the left and the right free pendulous lower leg at the strongest circumference. The highest value reachable in the MNA® short-form is 14 points. Subjects with 7 points or less were classified as malnourished, subjects with 8 to 11 points as at risk of malnutrition and, 12 to 14 points indicated a normal nutritional status (10). The MNA®-SF has been shown to be a valid screening tool for malnutrition (21) in elderly acute medical patients (23).

Frailty assessment

For the assessment of frailty the Frailty Instrument for Primary Care of the Survey of Health, Ageing and Retirement in Europe (SHARE-FI) was used (24). The SHARE-FI criteria

(24) approximate Fried’s frailty definition (15). The SHARE-FI instrument is a validated screening tool, which assesses the main established self-reported criteria of frailty: fatigue (feeling to have too little energy to do the things someone wants to do), loss of appetite (diminution in desire for food and/or eating less than usual), functional difficulties (regarding walking 100 meters or climbing stairs), and low physical activity (hardly ever or never, one to three times a month, once a week, more than once a week) (24). Furthermore, the instrument measures physical weakness. Therefore, grip strength was measured with a standard dynamometer in the sitting patient with the elbow flexed at 90°. For each side two attempts were made, and the better one was used for the calculations. The criterion of weakness regarding grip strength was set to ≤ 29 kg in men and ≤ 17 kg in women. According to the results of the SHARE-FI, which provides a continuous frailty score, patients were categorized sex-specifically in frail (female < 6 , male < 7), pre-frail (female < 2.13 , male < 3.00), and robust (female < 0.32 , male < 1.21) (24).

Statistical analysis

Sample characteristics are presented as percentages for categorical variables, and median (minimum-maximum) for continuous variables. Differences in the distribution of categorical sample characteristics, MNA®-SF categories and SHARE-FI categories were tested for significance by the Chi-Squared-test. A procedure factor analysis (principal component analysis) was applied to test the relationship between the MNA®-SF items and SHARE-FI criteria. The internal consistency of the MNA® items and SHARE-FI criteria was determined by a reliability analysis (Cronbach’s Alpha). All statistical analyses were performed with IBM® SPSS® Statistics for Windows, Version 20 software (IBM Corp., Armonk, NY, U.S.). P-values < 0.05 were considered statistically significant and all tests were two-sided.

Results

Response rate and sample characteristics

Of the 143 subjects who fulfilled the inclusion criteria, a total of 133, (81, 60.9% women and 52, 39.1% men) agreed to participate in the study (response rate: 93.0%). Non-response (n=10) was caused by lack of interest, difficulties in the German language or advanced dementia. Finally, 133 patients were included in the following analysis. 73.7% of the participants were recruited from the university hospital and 26.3% from the acute care hospital. Median age of the study participants was 74 years with a range from 65 to 97 years.

Seventy-two patients were frail and 29 were pre-frail. Furthermore, 34 patients were classified as malnourished and another 68 were at risk of malnutrition. In figure 1 the overlap between the categories of the MNA®-SF and the SHARE-FI is shown.

Table 1 shows the populations’ characteristics of the patients

Table 1

Sample characteristics in the three groups according to the SHARE-FI and the three groups according to the MNA®-SF

Characteristics	Robust (n=32)	Pre-frail (n=29)	Frail (n=72)	p-value *	No risk of malnutrition (n=31)	At risk of malnutrition (n=68)	Malnutrition (n=34)	p-value *
Total [%]	24.1	21.8	54.1		23.3	51.1	25.6	
Female sex [%]	22.2	19.8	58.0	0.530	23.5	51.9	24.7	0.958
Age								
65-74 years [%]	34.8	26.1	39.1	<0.001	29.0	50.7	20.3	0.153
75-84 years [%]	20.0	20.0	60.0		25.7	45.7	28.6	
85+ years [%]	3.4	13.8	82.8		6.9	58.6	34.5	
Living alone [%]	18.0	26.2	55.7	0.251	24.6	41.0	34.4	0.055
Educational level								
Primary [%]	16.9	20.2	62.9	0.010	18.0	50.6	31.5	0.022
Secondary [%]	46.7	23.3	30.0		43.3	46.7	10.0	
Tertiary [%]	21.4	28.6	50.0		14.3	64.3	21.4	
Manage shopping on their own [%]	37.5	32.5	30.0	<0.001	32.5	50.0	17.5	0.002
With help for household [%]	11.5	16.7	71.8	<0.001	17.9	47.4	34.6	0.012
Receiving care allowance [%]	6.7	11.7	81.7	<0.001	6.7	58.3	35.0	<0.001
Interested in nutritional intervention & exercise program [%]	16.3	20.9	62.8	0.008	18.6	46.5	34.9	0.003
No risk of malnutrition [%]	54.8	29.0	16.1	<0.001				
At risk of malnutrition [%]	19.1	20.6	60.3	<0.001				
Malnutrition [%]	5.9	17.6	76.5	<0.001				
Robust [%]					53.1	40.6	6.2	<0.001
Pre-Frail [%]					31.0	48.3	20.7	<0.001
Frail [%]					6.9	56.9	36.1	<0.001

Note: primary = elementary school or no degree; secondary = apprenticeship certificate or university entrance diploma; tertiary = education after university entrance diploma as university degrees; a Chi-square test

in the three groups according to the SHARE-FI (robust, pre-frail and frail). There was a significant difference between the three groups regarding age. Frail patients were significantly older. Frail and pre-frail older adults tended to have a lower educational level compared to robust subjects. They were significantly less able to do the shopping on their own, needed more often help for household, and were receiving more often care allowance. There was no significant difference between frail, pre-frail and robust older adults who lived alone in their own flats or houses before hospital submission.

The sample characteristics of the patients in the three groups according to the MNA®-SF are also shown in table 1. There was a significant difference between the three groups (no risk of malnutrition, at risk of malnutrition and malnutrition) regarding educational level. Malnourished older adults were significantly less able to do the shopping on their own, needed more often help for household, and were more often receiving care allowance.

Association between nutritional (MNA®-SF) and frailty (SHARE-FI) status

We found significant differences in the proportion of those who were affected by various items of the MNA®-SF in the three SHARE-FI categories. Moderate or severe food decline, impaired mobility, and calf circumference <31 cm were significantly found more often in frail or pre-frail subjects. Similarly, we found significant differences in the proportion of those who were affected by various items of the SHARE-FI in the three MNA®-SF categories. Loss of appetite and fatigue

were found more often in subjects who are at risk of malnutrition. Weakness was found more often in malnourished subjects (table 2).

To identify the dimensions which overlap in the two applied tests, a factorial analysis was performed. This analysis revealed three dimensions for the items of the two tests. One dimension was constituted by the frailty criteria (SHARE-FI) loss of appetite and MNA® items moderate or severe food decline and weight loss >1kg/3 months or unknown. The reliability analyses of these nutrition-related items showed a Cronbach's Alpha of 0.670. A second dimension was formed by the MNA® item impaired mobility and the SHARE-FI criteria fatigue, functional difficulties (walking 100 meters or climbing stairs) and low physical activity. The Cronbach's Alpha coefficient of these mobility-related items was 0.834. Finally, the third dimension was composed by the MNA® item low calf circumference and the SHARE-FI criteria weakness (low handgrip strength). The Cronbach's Alpha of these anthropometric-related items of 0.946 indicated a strong internal consistency.

Program participation

Eighty-six (64.7%) of the total sample were interested in a home-based program, which would be based on a muscle training and the improvement of the nutritional status and integrated in the personal living circumstances. 43.3% of robust, 62.5% of pre-frail, and 79.5% of frail subjects would participate in such a program. In subjects with no risk, with risk of malnutrition, and with apparent malnutrition, the respective

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Table 2

Prevalence of MNA®-SF items in the three groups according to the SHARE-FI and prevalence of SHARE-FI items in the three groups according to the MNA®-SF groups [%]

MNA®-SF items	MNA® categorizations	Robust (n=32)	Pre-frail (n=29)	Frail (n=72)	p-value *
A: Moderate or severe food decline	dietary	8.9	17.9	73.2	<0.001
B: Weight loss >1kg /3 months or unknown	anthropometric	15.3	27.1	57.6	0.081
C: Impaired mobility	functional	2.5	5.0	92.5	<0.001
D: Stress or acute disease	general	24.1	21.8	54.1	
E: Neuropsychological problems	functional	50.0	50.0	0.0	0.601
F2: Calf circumference <31 cm	anthropometric	7.4	14.8	77.8	0.017

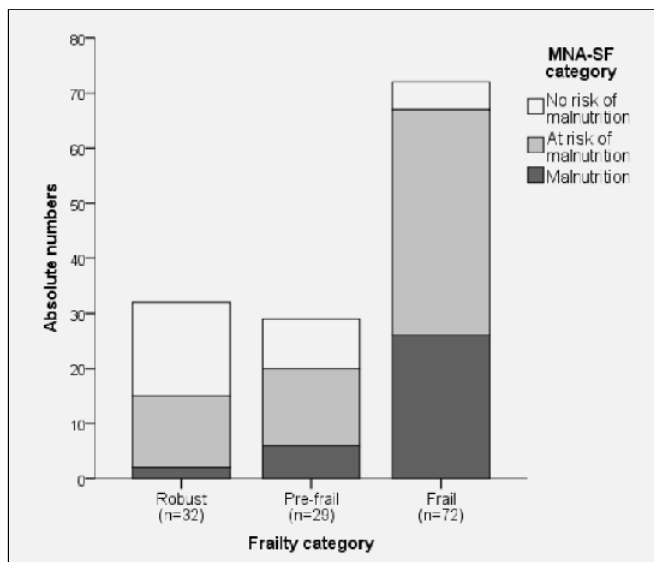
SHARE-FI items	SHARE-FI categorizations	No risk of malnutrition (n=31)	At risk of malnutrition (n=68)	Malnutrition (n=34)	p-value *
A: Loss of appetite	dietary	1.7	55.2	43.1	<0.001
B: Fatigue	functional	13.5	57.3	29.2	<0.001
C: Weakness	anthropometric	8.3	16.7	75.0	<0.001
D: Functional difficulties	functional	13.8	56.3	29.9	
E: Low physical activity	functional	9.5	61.9	28.6	0.166

Note: a Chi-square test

proportions were 52.0%, 60.0%, and 87.0%. Seventy-one (82.6%) of those interested patients could imagine to be trained by an unknown trained person as a buddy at their home. They would be prepared to undergo a training and participate in a nutritional intervention. Additionally, 95.5% of women preferred a female person and 60.0% of men a male person as a buddy.

Figure 1

Association between MNA®-SF groups and SHARE-FI groups in absolute numbers



Discussion

The aim of this study was to investigate the association between malnutrition according to the MNA® short-form and frailty according to SHARE-FI. We found a close relationship between nutritional status and frailty due to a strong association

between frailty criteria (SHARE-FI) and MNA®-SF items. Our results revealed that about three-quarters of malnourished hospitalised older adults were frail and over 90% of malnourished participants were pre-frail or frail. Furthermore, about 36% or 57% of the frail persons were malnourished or at risk of malnutrition.

We used the SHARE-FI for the assessment of frailty, a calculator, in which Fried’s frailty definition (15) is operationalized (25). In our study, frail participants were older than pre-frail and robust persons, and more often female. Furthermore, frail individuals were not able to do the shopping on their own, needed help in the household and had a lower educational level. Noteworthy was also that pre-frail and frail older adults tended to live alone more often than the robust ones. The prevalence of malnutrition was significantly higher in subjects, who lived alone, were not able to do the shopping on their own, needed help for their household, and were receiving care allowance.

Half of the hospitalised older adults in this study were frail. On the contrary, in a Norwegian study (26), 80% of the patients (n=76) who were 75 years or older admitted to an internal medicine ward were frail. In contrast, in our study, the frail participants were younger (76.4±8.2 years vs. 81.2±5.1 years) than in the Norwegian study. Prevalence of frailty and pre-frailty in hospitalised patients is clearly higher than in those of the general population of the same age. A European population-based survey, in which the same instrument as in our study was used, revealed a prevalence of frailty and pre-frailty of 17.0%, and 42.3%, respectively, in subjects aged 65 years and older (27).

Three-quarters of the hospitalised older adults in this study were malnourished or at risk of malnutrition. We found a similar high prevalence of malnutrition or risk of malnutrition compared to a Norwegian (23) and a recent Spanish study (28). On the other hand, our prevalence rates of malnutrition in hospitalised elderly patients were higher than those in the home-living older population; this was reported in two German

studies (19, 21) and in a Swedish study (29). This lower prevalence may not be unexpected, because it can be assumed that people living at home are healthier than people at a similar age who are admitted to a hospital. In a review Guigoz (30) described the prevalence of malnutrition in hospitalised patients (35 studies, n=8596) which made up 23% and an even higher prevalence for at risk of malnutrition, which was observed with 46% (30).

However, it is not expected that in our study population the prevalence of malnutrition and frailty will change at home. The prevalence of malnutrition was 6 times higher in frail older adults compared to robust subjects. Nevertheless, in our sample we also detected 13 robust patients who were at risk of malnutrition, and two robust subjects who were malnourished. On the other hand we also detected 9 well-nourished patients who were pre-frail, and five well-nourished subjects who were frail.

Moreover, we found that three out of six MNA® categorizations were significantly different within the SHARE-FI categories. First, food decline increased significantly with frailty level. It is in accordance with the results of Morley et al. (31), who concluded that anorexia can be an early risk factor of frailty (32, 31). On the other hand, we investigated frailty and food decline at the same time. This could also mean that frailty is a risk factor of food decline. The SHARE-FI criteria do not include the Fried criteria weight loss, but the question about loss of appetite. However, MNA® items food decline and weight loss were significantly associated with the SHARE-FI frailty item loss of appetite. Anorexia and weight loss are common findings in older adults, and weight loss is a known risk factor for frailty (32). Secondly, the MNA® item impaired mobility was significantly associated with the frailty level. This MNA® item was highly associated with the SHARE-FI frailty criteria fatigue, functional difficulties, and low physical activity because the SHARE-FI focused on the physical performance. Moreover, an impaired mobility is a risk factor for frailty (33). It has already been shown that malnutrition compromises the functional status (34). At the same time, impaired mobility increases vulnerability and may affect food consumption negatively (35). The third MNA® item was low calf circumference, which was also associated with frailty groups. The SHARE-FI includes grip strength, and the frailty criteria weakness was highly associated with low calf circumference. It indicates a loss of muscle mass, and therefore increased prevalence of sarcopenia (36).

Taken together, the strong association between the SHARE-FI frailty assessment and the MNA® short-form underlines the close relationship between malnutrition and frailty in older persons. The patients who are at risk of malnutrition are more likely to be frail and have an impaired mobility. Therefore, there is an interrelationship between nutritional and functional status. Consequently, it is essential to pay attention to a decline in functionality and to the nutritional status in frail elderly adults.

Additionally, the present results suggest that measuring both, nutritional (with the MNA®-SF) and frailty status (with the SHARE-FI), provides a more accurate indication of health status and the early need of intervention than assessing either one alone. However, these results illustrate also the fact that parts of the MNA®-SF may have the value to identify frailty or, the other way round, parts of the SHARE-FI may have the potential to identify malnutrition in acute hospitalised older patients.

Frailty and malnutrition have a significant impact on mortality and morbidity, dependency, hospitalization, falls, disability, social isolation and a decrease in the quality of life (16). In view of these findings, it is important to screen patients in hospitals and afterwards continuity of care is necessary. There can often be a breakdown in the continuity of care between the hospital setting and the post-discharge setting. Moreover, the presence of impaired nutritional and frailty status is increasingly shifting to the post-discharge setting (37). Up to now, no data is available in Austria, that nutritional support and physical training is realised in a post-discharge setting for example in community-dwelling and institutionalized older adults. However, our data showed that malnutrition and frailty are quantitatively major problems and more attention should be paid in the discharge management. We assume that a home-based well-structured exercise program in combination with a nutritional intervention (38) could reduce the negative outcomes and help people maintain or even improve their quality of life and positively influence independence. Indeed, most of our study population, and especially most of the malnourished and frail patients, were willing to participate in a home-based muscle training and nutritional intervention program.

A major limitation of this study is the small sample size. Therefore, our results have a limited external validity. Nevertheless, the prevalence rates of malnutrition and frailty of our sample were in line with previous studies.

A major strength of this study is the association between the MNA®-SF and the frailty assessment according to the SHARE-FI because the MNA®-SF is a rapid screening tool in clinical practice (21) and is also validated in elderly acute medical patients (23).

In conclusion, our study underlines the association and the overlap between frailty (SHARE-FI) and nutritional status (MNA® short-form) particularly in hospitalised patients. Our results also suggest that the MNA®-SF appears to be a good screening tool for predicting malnutrition and the SHARE-FI predicts frailty in acute hospitalised elderly adults. Moreover, based on our factor analysis a combination of both screening tools (MNA®-SF and SHARE-FI) could detect malnutrition and frailty. However, further studies are required to assess the usefulness of this tool as a method for predicting malnutrition and frailty. Additionally, our study reveals a high readiness to participate in a home-based muscle training and nutritional intervention program, especially malnourished and frail older

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adults would benefit most of it.

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