ORIGINAL RESEARCHES

https://doi.org/10.52418/moldovan-med-j.64-3.21.01
UDC: 616-053.9:613.2:614.21

Assessment of the nutritional pattern in frailty syndrome dependent institutionalized elderly

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Manuscript received March 29, 2021; revised manuscript May 10, 2021; published online September 10, 2021

Abstract

Background: Problems of nutritional status are widespread, of which malnutrition occurs more frequently in vulnerable groups of the population, especially in the low-income elderly, including the institutionalized elderly.
Material and methods: The study was performed on a group of 50 participants over the age of 65, from the nursing home; the nutritional status was assessed according to the Mini-Nutritional Assessment (MNA) score, the frailty syndrome (FS) was established based on Fried criteria and severity of FS – based on the Clinical Frailty Scale. The obtained data were statistically processed by using the "Statistica 6.0" software program. The difference was considered statistically significant with $p < 0.05$.
Results: The MNA score showed a positive correlation with reduced physical activity: r= 0.4*, between reduced physical activity and reduced walking speed: r= 0.66*, reduced physical activity and fatigue (lack of energy): r= 0.94* ($p \leq 0.05$). The cluster analysis revealed that against the background of the same food intake, body weight, mobility, neurological status can easily change, the phenomenon underlying the separation of the elderly in different clusters (1 and 2), while moderately low food intake in the last 3 months led to significantly reduced mobility, impaired neurological status (severe dementia or depression).
Conclusions: This study reported that the elderly in the nursing home have an increased risk of malnutrition, being associated with nutritional pattern, such as: involuntary weight loss, the presence of neuropsychiatric disorders, decline in food consumption, affecting the quality of life.
Key words: nutritional status, malnutrition, elderly.

Cite this article
Lupascu-Volentir F, Soric G, Popescu A, Negara A, Cosciug E, Stoicova I. AAssessment of the nutritional pattern in frailty syndrome dependent institutionalized elderly. *Mold Med J.* 2021;64(3):5-10. https://doi.org/10.52418/moldovan-med-j.64-3.21.01.

Introduction

Globally, there is an increase in the number of the elderly population, which will increase from 841 million in 2013 to over 2 billion by 2050, i.e. an increase from 11 to 22%, respectively [1]. The elderly are considered to be a vulnerable group of population, with an increased risk of co-morbidities, nutritional problems, frailty and geriatric syndromes [2]. Physical and social changes resulting from old age, polypharmacy, loss of autonomy and appetite are just some of the factors that influence the nutritional status of this social group of the population [3].

The study of nutrition in frailty syndrome is of particular interest to public health, as it investigates multiple aspects of human functionality: mobility, gait and balance, sarcopenia, physical activity, etc., along with the increase of medical and social resources resulting in considerable economic costs at the national level [5]. The consequences of malnutrition lead to social isolation, increased prevalence of infections, hospitalizations, institutionalizations, morbidity and mortality [4, 6, 7]. The prevalence of malnutrition in geriatric wards varies between 30 and 70%, and in nursing homes up to 74%, depending on demographic factors, educational level and assessment tools [8]. The indicators responsible for the diagnosis of malnutrition are: nutritional, anthropometric, biochemical parameters, cognitive status and associated diseases [9].

The author Wei K. pointed out that the interrelationship between malnutrition and frailty has common pathophysiological determinants and mechanisms, such as: reduction of adipose tissue, the presence of chronic inflammation, cognitive decline and functional disorders [10, 11]. Insufficient nutrient intake and involuntary weight loss aggravate the body's nutritional reserve against stressors [12].

There is currently no defining criterion for early identification of nutritional risk or malnutrition [13], but physicians, nurses and nutritionists use a wide range of tools for early assessment of the diagnosis of malnutrition in the geriatric population, such as: Mini-Nutritional Assessment (MNA) [9, 12], Geriatric Nutritonal Risk Index (GNRI) [14], Nutritional Risk Screening 2002 (NRS-2002) [15], Malnutrition Universal Screening Tool (MUST) [16], Short Nutritional Assessment Questionnaire (SNAQ) [17] and Nutrition Risk in the Critically Ill (NUTRIC) [18].

The European Society for Parenteral and Enteral Nutrition (ESPEN) recommends the evaluation of nutrition in the elderly by the MNA method [9, 12], being the most common and practical method for early estimation of nutritional deficiency and prevention of complications.

In residential homes or nursing homes, early identification of malnutrition plays a major role in the prophylaxis of nutrition in institutionalized elderly.

The purpose. This study aims to highlight and identify the main nutritional pattern aspects of the elderly patient from the nursing home by using statistical processing methods to identify valuable information indices and establish the associative links of nutrition through the cluster method.

Material and methods

The epidemiological study was the part of the Institutional Project 20.80009.8007.25 Frailty: diagnosis and prophylaxis in relation to the medico-psycho-social problems of the vulnerable elderly, with a positive opinion of the Ethics Committee No 51 of 16.06.2020, which included 50 elderly people between 65 and 93 years old, institutionalized at the Republican Asylum for the disabled persons and retirees. Participants were enrolled in research only after signing the informed consent to participate in the study.

All the elderly were examined according to the complex geriatric assessment (CGA), which included: physical status by assessment of autonomy – Activities of Daily Living / Instrumental Activities of Daily Living (ADLs and IADLs score) [19], assessment of gait and balance (Tinetti test) [20] and memory by test Mini-Mental State Examination (MMSE) [21, 22].

Data relating to ADLs and IADLs were assigned scores from 0 to 6 and 0 to 8, respectively; the highest of the score was the greater degree of functional independence for the parameters evaluated. Gait and balance disorders are among the most common causes of falls in older adults and often lead to injury, disability, loss of independence and limited quality of life, a score of 22 or less (total 28) indicates a patient at risk. For the analysis on MMSE scores, a minimum expected score of 24 was used for elderly individuals with normal activity of cognition, 20-23 – mild cognitive disorder, 10-19 – moderate cognitive disorder, 0-9 – severe cognitive disorder.

Nutritional status was determined by MNA (Mini-Nutritional Assessment) [9], it contains general data, anthropometric, dietary, self-assessment of nutritional status and health with 18 questions divided into two sections: screening with 6 questions, if the score is less than or equal to 11, the assessment is continued with 12 questions to get the malnutrition index. The maximum screening score is 14 points, if a score is obtained ≥12 – it is considered normal nutritional status, ≤11 points – malnutrition, and for evaluation – the maximum score is 16 points. The final MNA assessment shows the following scores: 24 – 30 normal nutritional status, 17-23.5 – risk for malnutrition and less than 17 – malnutrition.

The frailty syndrome (FS) was established by applying the Fried criteria and the severity of FS – by the Clinical Frailty Scale (CFS). The Fried frailty phenotype comprises five dimensions: involuntary weight loss (> 5% G / last year); decrease in the digito-palmar gripping force (clenching force of the fist) measured with a dynamometer, fatigue, normal walking speed low over the distance of 5 m (≤1 m/s), low level of physical activity [23, 24].

In the specialized works of the last years, the researchers reported the complexity of the frailty syndrome in the elderly population, mentioning the importance of the subtypes of frailty: functional – Groningen Frailty Index (GFI), The Short Physical Performance Battery (SPPB), Vulnerable Elders Survey (VES) – 13, SARC – F (A Simple Questionnaire to Rapidly Diagnose Sarcopenia) and biopsycho-social (Charlson Comorbidity Index) [25].

Data relating to GFI scores consists of 15 self-report items, a person is considered to be frail when the GFI sum score is 4 points or higher. The SPPB tool, establishes the physical activity of the elderly, the scores ≥10 out of 12 points correspond with higher levels of balance, lower body strength, mobility and physical function.

Vulnerable Elder's Survey (VES-13) includes 13 items relating to patient age, self-rated health, ability to perform six physical tasks and five items relating to function, the maximum score is 10 points and a cut-off of ≥3 denotes high-risk of experiencing future functional decline.

The components of SARC-F are: strength, assistance with walking, rise from a chair, climb stairs and falls, a score equal to or greater than 4 is predictive of sarcopenia and poor outcomes.

The Charlson Comorbidity Index is a method of categorizing comorbidities of patients based on the International Classification of Diseases (ICD) diagnosis codes found in administrative data, such as hospital abstracts data. Each comorbidity category has an associated weight (from 1 to 6), based on the adjusted risk of mortality or resource use, and the sum of all the weights results in a single comorbidity score for a patient. A score of zero indicates that no comorbidities were found. The higher the score, the more likely the predicted outcome will result in mortality or higher resource use.

In order to improve the testing systems, identify the informational value indices, elucidate the character variability, the dependence between various factors and classify the parameters of the elderly, it was necessary to use different

statistical methods that increase the degree of objectivity in interpreting the data. For this purpose, the data obtained from the program investigations were analyzed by methods of variational, correlational and cluster analysis.

The correlational analysis highlighted the correlation coefficient (r) which shows the degree of dependence between factors (0.0 ... 1.0) and the orientation of the dependence (+ or -) [26]. Cluster analysis of *k*-media [27, 28] highlighted the association of clinical manifestations (qualitatively assessed – absence/presence: 0/1) by dividing them into 3 clusters. The obtained results were processed in the STATISTICA 6.0 software package.

Results and discussion

The study was performed on a group of 50 participants, whose age exceeded 65 years, the average age of the group being 77.72±1.08 years. Regarding the distribution by age categories according to the Canadian Classification of the Elderly from 1998, the majority were elderly-mature (75-84 years) – 42%, followed by the young-elderly (65-74 years) – 40% and the old-elderly group (≥85 years) – 18%. The female sex predominated – 62% versus the male 38%. Most of them were from the central region of the country, constituting 84%, from the northern region of the country –6%, and from the southern – 8%. Referring to the place of residence of the elderly, a higher share was registered in urban areas – 74.62% versus rural areas – 25.38%.

According to the examination of the MNA nutritional score, 40±0.07% of the participants were at risk of malnutrition, 22±0.06% were malnourished and 38±0.07% had nutritional status within the norm (fig.1), and nutritional values after BMI revealed an average value of 27.77±0.78, muscle mass of 27.69±0.55, arm circumference – 28.36±0.56 and triceps fold thickness – 2.3±0.12.

The evaluation of the institutionalized elderly according to the frailty criteria registered the following average values: weakness measured by dynamometry – 70±0.06, fatigue – 78±0.06, reduced physical activity – 80±0.05, reduced walking speed – 76±0.06 and unintentional weight loss had 28±0.06% of the elderly (fig. 1). Thus, based on the frailty criteria, 16% of pre-fragile elderly people were diagnosed, who had one or two Fried positive criteria, 66% of fragile elderly people, who had three or more positive criteria, and 18% were robust patients.

CGA is an interdisciplinary approach to determine the medical, psychological and functional capabilities of a frail elderly person, with a view of developing a coordinated and integrated plan for prophylaxis and treatment [29]. Thus, according to the results of the geriatric and subtypes of frailty examination, it was established that the elderly included in the study showed functional, cognitive and social frailty, according to the researched items: ADL scores – 8.70±0.43 points, IADL – 7.84±0.67 points, Tinetti – 12.78±1.21 points, MMSE – 21.98±0.67 points, Charlson comorbidity – 6.02±0.33 points, Groningen frailty index – 7.50±0.59 points, sarcopenia SARC – F – 6.1±0.40 points and VES-13 – 9.0±0.96 points (fig. 2).

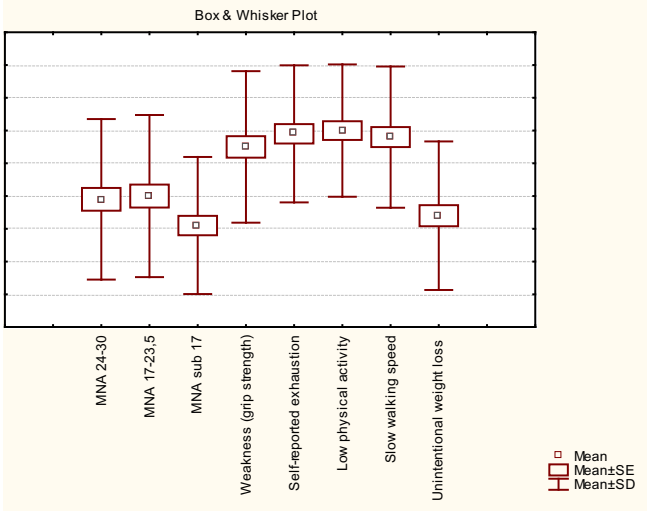

Fig. 1. Graphical representation of mean values of MNA score and Fried frailty

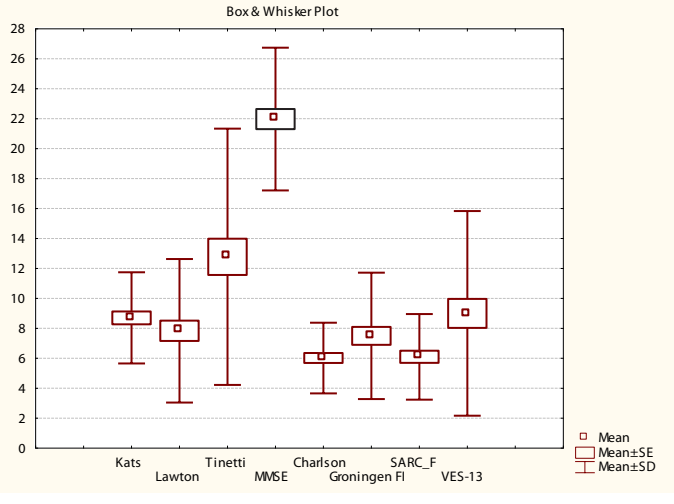

Fig. 2. Graphical representation of the average values of geriatric syndromes and instruments of frailty

Manifestations of pathological conditions are characterized not only by the presence of certain clinical indices, but also by their correlative associations [26]. Thus, significant dependencies were found, on the one hand, between malnutrition and frailty syndrome, on the other hand – between various clinical features. For example, there were high positive correlations between reduced physical activity and reduced walking speed: r= 0.66*, fatigue (lack of energy) and reduced physical activity: r= 0.94* (p≤0.05). It should be noted that the relatively low correlation coefficient (r) for the interrelationship risk of malnutrition –- reduced physical activity: r= 0.41* (p≤0.05), indicates that the dependencies found are a trend, rather than a strict relationship, which can be explained by the specificity of patients' response to the same mode of nutrition. The data obtained reveal that different clinical indices of malnutrition increase the risk of frailty of the elderly through various correlative dependencies.

The cluster analysis [28] by the centroid method of *k*-media established that the elderly groups, evaluated, separated into 3 clusters were divided according to the level and variability of the researched parameters. As members of cluster 1 were the elderly with numbers 16, 17, 20, 21, 26, 27, 29-33, 37, 39, 40, 42, 46; cluster 2 – 1-14, 23, 25, 43, 45, 47, 49; cluster 3 – 18, 19, 22, 23, 26, 28, 31-33, 44, 46, 48. The people in cluster 1 and 2 recorded the highest values of neuropsychiatric disorders, body mass index ≥23, food intake and body weight unchanged in the last 3 months, and those in cluster 3 showed values slightly above the 50% threshold for the aspect of mobility, the presence of psychological stress in the last 3 months, severe dementia or depression according to screenning (stage 1) of the MNA nutrition questionnaire (tab.1).

Table 1. Cluster analysis of nutritional screening (MNA) data of the association of clinical indicator frequencies

Cluster	Frequent indices in clusters (≥50%)
1, n=16	Unchanged food intake in the last 3 months – 81.25%; body weight unchanged in the last 3 months – 93.75%; mobility partially affected – 56.27%; psychological stress the last 3 months – 62.50%; neuropsychiatric disorders (mild dementia) – 100%; BMI ≥23 – 93.75%.
2, n=20	Unchanged food intake in the last 3 months – 100%; body weight unchanged in the last 3 months – 85.0%; unaffected mobility – 85%; unaffected neurological status – 90.0%; BMI ≥23 – 100%.
3, n=14	Moderately low food intake in the last 3 months – 57.14%; unknown body weight if it has changed in the last 3 months – 71.42%; mobility partially affected – 71.42%; psychological stress in the last 3 months – 57.14%; neurological status (severe dementia or depression) – 50.0%; BMI ≥23 – 78.57%.

Regarding the evaluation of nutrition (stage 2) according to the MNA nutrition questionnaire, members of cluster 1 were the elderly with numbers 1-14, 21, 40-43, 45, 47, 49, 50; cluster 2 – 15-17, 20, 24, 25, 27, 29, 30, 34, 35-39; cluster 3 – 18, 19, 22, 23, 26, 28, 31-33, 44, 46, 48. The people in cluster 1 recorded the highest values of self-care and daily diet with 3 meals per day or weekly protein intake (dairy, meat/fish), vegetables/eggs, polypharmacy, arm and leg circumference within the norm, cluster 2 presented the highest values of the daily diet of 3 meals per day or weekly intake of protein (dairy), vegetables/eggs, fluid intake per day (3-5 cups/day), and polypharmacy, self-sufficient and self-perception of nutritional status showed lower values, and cluster 3 demonstrated the highest values of self-care but with some difficulty in eating daily with 3 meals included daily or weekly intake of protein (dairy, vegetables/eggs), and pressure abrasions/ decubitus or skin ulcers showed the lowest values (tab. 2).

Table 2. Cluster analysis of nutritional status indices (MNA) and clinical indicator frequencies

Cluster	Frequent indices in clusters (≥50%)
1, n=23	Polymedication more than 3 drugs per day – 82.60%; pressure abrasions/decubitus or skin ulcers – 82.60%; diet with 3 meals per day – 100%, daily intake of protein: dairy – 95.65%, meat or fish – 91.30%, weekly intake (vegetables/eggs) – 95.65%, daily intake of fruits or vegetables – 60.87%, fluid consumption (≥5 cups / day) – 56.52%; food at own choice – 95.65%; self-perception of nutritional status unaffected – 86.95%; self-assessment of health: good – 52.17%; arm circumference ≥22 (cm) / leg ≥31 (cm) – 100%.
2, n=15	Polymedication more than 3 drugs per day – 60%; diet with 3 meals a day – 100%, daily protein intake: dairy – 100%, weekly intake (vegetables / eggs) – 93.33%, fluid intake (3-5 cups / day) – 80.0%; food at own choice – 66.66%; self-perception of nutritional status: no idea – 80%; arm circumference ≥22 (cm) – 93.33% and leg circumference ≤31 (cm) – 53.33%.
3, n=12	Pressure abrasions / decubitus or skin ulcers – 58.33%; diet with 3 meals per day – 100%, daily protein intake: dairy – 100%, weekly intake (vegetables / eggs) – 100%; food at own choice but with some difficulty – 100%; self-assessment of nutritional status: being insecure – 100%; arm circumference ≥22 (cm) – 83.33% and leg circumference ≥31 (cm) – 91.66%.

This study identified groups with specific care requirements that would reduce the limitations and loss of quality of life resulting from MNA and frailty score. A good functioning of nutritional status is related to self-assessment and should take priority over primarily clinical and medical approaches. Studies have shown that functional losses can be reversed through training for ADLs and IADLs, with positive consequences for self-perception of health [27].

Also it must be noted that the presence of subtypes of frailty, such as: Groningen Frailty Index, The Short Physical Performance Battery, Vulnerable Elders Survey, A Simple Questionnaire to Rapidly Diagnose Sarcopenia and Charlson Comorbidity Index should be taken into account when planning care actions, as this is an important parameter in overall geriatric assessment [25].

Conclusions

1. Following a broad approach, the study highlighted that the MNA nutritional score is a useful and effective method for identifying malnutrition among the elderly population in the nursing homes in the Republic of Moldova.

2. According to the cluster analysis (*k*-average method) of the MNA test stage of screenning and evaluation, the best ability to differentiate the parameters of the nutritional pattern presented: unaffected food intake and lack of weight loss in the last 3 months, neuropsychiatric disorders, polypharmacy, presence of pressure abrasions, provision of 3 meals per day with an intake of protein, vegetables, fluids

more than 5 cups a day and self-assessment of nutritional status as being without nutritional problems.

3. It was found that against the background of the same food intake, body weight, mobility, neurological status, can remain virtually unchanged or change slightly, the phenomenon underlying the separation of the elderly into different clusters (1 and 2), while moderately low food intake in the last 3 months has led to significant disorders of mobility, neurological status (severe dementia or depression).

4. The results obtained characterize the profile of institutionalized elderly and can be used as a basis for the development of effective strategies aimed at reducing functional dependence, self-assessment of nutritional status and quality of life.

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Authors' contribution

FLV conceptualized the study, designed the research, collected and interpreted the data, drafted the first manuscript; GS conducted the laboratory work and revised the manuscript critically; AP collected data and revised the manuscript critically; AN conducted the management work and revised the manuscript critically; EC and IS collected the data. All the authors revised and approved the final version of the manuscript.

Funding

The study was supported by institutional research projects #20.80009.8007.25 Frailty: diagnosis and prophylaxis in relation to the medico-psycho-social problems of the vulnerable elderly, *Nicolae Testemitanu* State University of Medicine and Pharmacy. The authors are independent and take responsibility for the integrity of the data and accuracy of the data analysis.

Ethics approval and consent to participate

The research was approved by the Research Ethics Committee of *Nicolae Testemitanu* State University of Medicine and Pharmacy (protocol No 51 of June 16, 2020).

Conflict of Interests

The authors have no conflict of interests to declare.