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Agreement between the Body Mass Index and Mini Nutritional Assessment in elderly

Concordância entre o Índice de Massa Corporal e a Mini Avaliação Nutricional em idosos

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ABSTRACT
To evaluate the agreement between the Body Mass Index (BMI) and the Mini Nutritional Assessment (MNA) to assess the nutritional status of the elderly. Cross-sectional study with elderly in the Family Health Strategy program. Nutritional status was assessed using BMI and MNA, as well as the sociodemographic profile, comorbidities and lifestyle. The correlation between the indicators was calculated using the Spearman test and the agreement was assessed using the Bland-Altman estimator. According to the BMI, 29% of the elderly were underweight, while MNA demonstrated that 35% were malnourished or at risk of malnutrition. MNA showed a mean difference of -0.29 for BMI and a positive correlation (rho = 0.35; p = 0.01). There was agreement between the methods used to assess the nutritional status of the elderly, with a high prevalence of underweight, as well as malnutrition and risk of malnutrition.

Keywords: Aged. Nutritional assessment. Body mass index. Nutritional status.

RESUMO
Avaliar a concordância entre o Índice de Massa Corporal (IMC) e a Mini Avaliação Nutricional (MAN) para avaliação do estado nutricional de idosos. Estudo transversal, analítico descritivo, com idosos da Estratégia de Saúde da Família. Avaliou-se o estado nutricional pelo IMC e pela MAN, e foi descrito o perfil sociodemográfico, de comorbidades e estilo de vida. A correlação entre os indicadores foi calculada pelo teste de *Spearman* e a concordância avaliada através do estimador de *Bland-Altman*. Segundo o IMC, 29% dos idosos apresentaram baixo peso, enquanto a MAN demonstrou que 35% estavam desnutridos ou risco de desnutrição. A MAN apresentou diferença de média de -0,29 para o IMC e correlação positiva (rho = 0,35; p = 0,01). Houve concordância entre os métodos utilizados para avaliação do estado nutricional de idosos, sendo observada elevada prevalência de baixo peso, assim como de desnutrição e risco de desnutrição.

Palavras-chave: Avaliação nutricional. Estado nutricional. Idoso. Índice de massa corporal.

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INTRODUCTION

Demography demonstrates a growth in the percentage of people over 60 years old, an important characteristic of demographic transition.[1] Brazil falls within this trend, underscoring data retrieved from the Brazilian Institute of Geography and Statistics (IBGE) with elderly population reaching 29.6 million people in 2016 (14.4% of the population). The same study shows that life expectancy in the country increased by 7.9 years between 1940 and 2016.[2]

The aging process triggers several physiological changes that may impact the elderly´s general health. These changes contribute towards Noncomunicables Chronic Diseases (NCDs), such as Diabetes Mellitus (DM), Systemic Arterial Hypertension (SAH), Cardiovascular Diseases (CVD) and different types of neoplasia, all of which directly impact the nutritional status (NS). Consequently, NS impairment may be the cause of falls, increasing weakness, decreasing immune system, lack of social interaction and economic factors that lead towards food insecurity.[3,4]

Several anthropometric indicators may evaluate NS in elderly people. They have the advantage of easy measurements, low cost and slight intra- and inter-assessment variations. The Body Mass Index (BMI) classifies nutritional conditions, with specific cutoff points for the elderly population due to greater body fat deposits. It is a non-invasive, easy and quick method. Although body composition or body fat distribution is not provided, the method gives the correlation with morbidity and mortality indexes. [5,6,7,8]

The elderly´s nutritional diagnosis may also be provided by the Mini Nutritional Assessment (MNA) which has been developed from population studies conducted specifically with elderly people. MNA research demonstrates that its application becomes viable and reliable because it is low cost, simple, sensitive and specific to diagnose risk or malnutrition in the elderly.[5,6,8,9]

MNA is an internationally validated tool, translated into several languages, employed in different elderly care conditions, such as communities, hospitals and nursing homes.[10] Nevertheless, there is currently no consensus in the literature regarding the best nutritional assessment instrument. In fact, all tools have their limitations, advantages and disadvantages when employed in different populations. Since different nutritional assessment parameters result in different types of prevalence of malnutrition in the elderly, they should be compared to assess their applicability. Several studies evaluate the agreement between various methods to verify their application in a given population and the different care scenarios vis-à-vis elderly people.[7]

Current paper evaluates agreement between IMC and MNA as tools to evaluate the nutritional conditions of the elderly attended by the Family Health Strategy (FHS) and the manner they may be characterized for their demographic and health aspects.

METHODOLOGY

Current transversal study comprises a sub-sample of the research "Evaluation of Health in Elderly People in the Municipality of Barreiras, Bahia", with retrieval of primary data in elderly people residents in private homes and enrolled in a FHS unit. Sample of the project has been stratified according to the regions of 24 UBS covering the municipality´s urban zone at 90% and a sampling error of 5%.

The study was approved by the Committee for Ethics in Research, following Resolution 466/2012 of the National Health Council of the Ministry of Health by Act 1.447.361/2016. Elderly people who met inclusion criteria and accepted participation signed the statement of informed consent.

A specific cut was undertaken for current study taking into consideration the unit with the greatest number of elderly people and composed of three FHS teams. Based on the lists of enrolled elderly people, people aged 60 years or older, both

genders, were randomly selected. Bed-ridden people, people with functional and cognitive ailments which impaired them from answering questionnaire and from anthropometric measurements, people living in nursing homes and people who refused to participate were excluded.

Procedures for data collection (questionnaires, anthropometric evaluation and MNA) were standardized to control data quality and consistency. Data were collected between February and May 2017.

A previously standardized and coded questionnaire was used as an evaluation tool, with information on sociodemographic aspects (gender, age, education and marital status), lifestyle (alcohol consumption and smoking) and morbidity profile (DM and SAH).

Anthropometric evaluation included measurements of estimated height (cm) and weight (kg) for BMI (kg/m²). Knee Height (knee height - cm) estimated the height of the elderly and equations by Chumlea et al. (1985) were applied.[11] A portable infantometer was used to measure knee height.

Weight was measured by a 150kg portable digital platform scale. Elderly people were weighed while standing in the center, wearing light clothes, without any adornments and barefooted. Measurements were performed in duplicate and the arithmetic mean between the two results was considered.

Total body mass was evaluated by BMI, following the Pan American Health Organization (PAHO),[12] with special reference to the Brazilian population and changes in body composition due to aging, when compared to adults.

MNA, with 18 questions subdivided into 4 groups, was also applied, featuring anthropometric measurements, overall lifestyle assessment, eating and dietary habits, assessment of self-perception of health and nutritional status, with final scores featuring adequate NS, malnutrition risk or malnutrition.[9,13,14,15]

Variables were retrieved by descriptive analysis of data, with the distribution of relative and absolute frequencies of categorical variables and measures of central tendency and dispersion of quantitative variables. Data normality was verified by the Shapiro-Wilk test. Spearman's coefficient verified correlation between BMI and MNA, whilst Bland-Altman graph evaluated agreement.[16]

So that agreement between the indicators could be analyzed, a dispersion graph was constructed taking into account the difference between the two variables (y-axis) and the mean of variables (x-axis). Rates were standardized so that variables with different units of measure (BMI in kg/m²; and score by MNA) could be compared. The z score was obtained by the difference between rate and mean rate, divided by standard deviation (SD). The agreement was evaluated by Bland-Altman diagrams and by calculating the limits of agreement based on the differences between the two measurements. Great amplitude of the limits of agreement occurred when differences between means reached $\geq$ 1.5 SD; moderate when they were between 1.0 and 1.49 SD; agreement between methods when differences were lower than 1.0 SD.[16]

Significance level was 0.05 for all tests. Data analyses were done by Windows statistical R 3.6.1.

RESULTS

Fifty-one elderly people were assessed, with a predominance of females (68.60%). Mean age of males and females was 73 $\pm$10.30 years old and 71 $\pm$ 7.64 years old, respectively. Approximately 35.29% of the elderly were illiterate and more than one half were single and widow/ers (51%). The sample´s morbidity profile revealed arterial hypertension in 66.66% and diabetes in 15.67%. Moreover, 7.84% of the elderly were smokers and 15.59% were alcoholics (Table 1).

Table 1. Characterization of sample of elderly people evaluated. 2017

Variables	Elderly n = 51	
	n	(%)
Age (years)		
60-69	27	52.94
70-79	14	27.45
≥ 80	10	19.61
Schooling		
Illiterate	18	35.29
Up to 4 years schooling	28	54.90
More than 4 years schooling	5	9.80
Civil status		
Single/widow/er	26	51.00
Married/partner	25	49.02
Diabetes		
Yes	8	15.69
No	43	84.31
Arterial Hypertension		
Yes	34	66.66
No	17	33.34
Smoking		
Yes	4	7.84
No	47	92.16
Alcoholic beverages		
Yes	8	15.69
No	43	84.31

n = absolute frequency, % = relative frequency.

The sample´s BMI showed that 29.41% of the elderly had underweight; 43.13% had normal weight; 27.45% were overweight. According to MNA, 35% suffered from or from risk of malnutrition and 64.70% were without any nutritional risk. Table 2 shows percentages by gender.

Table 2. Nutritional status per gender according to Body Mass Index (BMI) and Mini Nutritional Assessment (MNA) of evaluated elderly people. 2017

Nutritional Status	Male n = 16		Female n = 35		Total n = 51	
	n	(%)	n	(%)	N	(%)
Body Mass Index (BMI)						
Low weight	6	37.50	9	25.71	15	29.41
Adequate weight	6	37.50	16	45.71	22	43.13
Overweight	4	25.00	10	28.57	14	27.45
Mini Nutritional Assessment (MNA)						
Malnutrition/Nutritional risk	2	12.50	16	45.71	18	35.29
Without Nutritional risk	14	87.50	19	54.29	33	64.70

n = absolute frequency, % = relative frequency.

When agreement of methods was evaluated, the Bland-Altman graph demonstrated that there was agreement between the two tools for nutritional diagnose (Figure 1) since bias rate was -0.29. Spearman's coefficient between the two was positive and significant, albeit moderate (rho: 0.35) (Figure 2).[17]

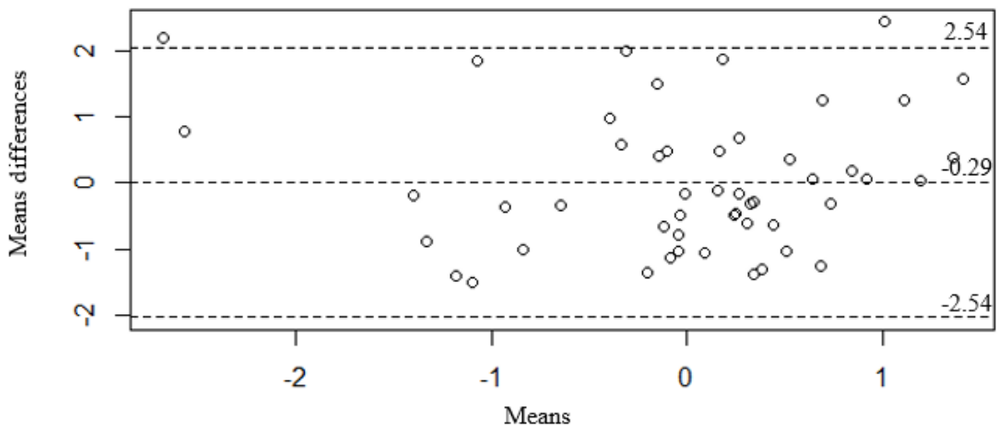
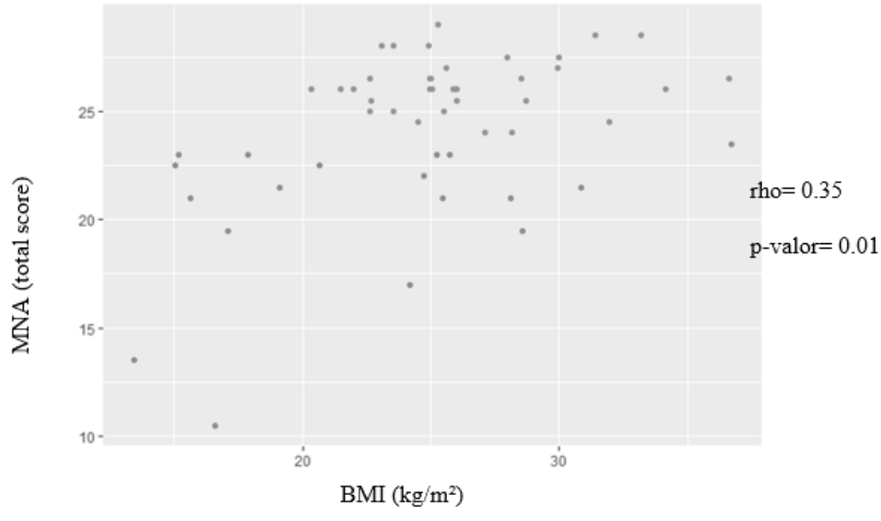


Figure 1. Bland-Atman agreement analysis between Mini Nutritional Assessment (MNA) and Body Mass Index (MMI) of evaluated elderly people. 2017.



rho: coefficient of Spearman co-relationship

Figure 2. Spearman´s Co-relationship between Mini Nutritional Assessment (MNA) and Body Mass Index (BMI) of the sample of elderly people evaluated. 2017.

DISCUSSION

Nutritional Status (NS) is the equilibrium between the demand and supply of nutrients for the body´s balance. BMI is the most anthropometric parameter employed to evaluate elderly people´s NS in clinical practice, due to its practicality, ease to operate and rapid identification of nutritional disorders such as obesity and malnutrition.[7] Current analysis shows that disorders were significant when evaluated by BMI. In fact, more than 50% failed to show nutritional adequacy by this index.

Underweight (UW) prevailed among the elderly evaluated since alteration in NS was perceived in approximately one third according to BMI. Pereira et al.[6] detected such prevalence (23.7%) in northeastern Brazil, whilst in the town of Jequié it reached 36%.[18] Although rates were relatively high, as a rule, among residents in a community the prevalence of LW is proportionately less when compared to that in elderly people hospitalized or in institutions.[10] This is due to residence with relatives with more access to food and to being more active. Consequently, all these factors interfered positively in NS.[10] One complication associated with UW in elderly people occurs in low muscular mass amount which contributes towards less muscular force and decrease of physical activity. Further, difficulties in mobility may compromise food acquisition and preparation of meals, with negative effects on NS.[13,19]

Overweight was detected in 27% of elderly people. Other investigations in similar contexts also reported very similar results. In a study with elderly people in a town in the interior of Bahia[20], overweight was prevalent at the rate of 39.7%. Another study estimated overweight prevalence in the northeastern region of Brazil[6] and detected 32.5%. Since the subjects were elderly residents in a community and in a context similar to current analysis, prevalence results agree with those in current study, although different cut-off points have been used.

The prevalence of overweight among the elderly in current study and in others[5,6,20,21] underscores the importance of identifying total body mass. A recent study [21] demonstrated that overweight increases the chance of multimorbidity by 37% when compared to that in people with adequate weight. Excess total body mass in the elderly identified by BMI becomes an important predictor of morbidities and presents good correlations with body fat. Associated with changes in their distribution, they are risk factors for the development of cardiovascular and metabolic diseases in the elderly.[5,20.21]

With regard to NS, according to MNA, 35.0% of elderly people showed signs of malnutrition or risks of malnutrition. Another study with non-institutionalized elderly people also revealed a similar prevalence with (35.1%).[22] High malnutrition prevalence rates in a community may be due to advanced age and dependence level, even though detected more in institutions for the elderly and in hospitals.[5,8] Consequently, more significant results were reported in a study by Burman et al.[5], in which 53.6% had the same disorders, whilst in research by Pereira et al.[14], 66.3% also revealed malnutrition and risks of malnutrition. Results were due to elderly people within different scenarios whose lifestyle and health conditions compromise more effectively nutritional conditions such as greater difficulties in access to food, changes in functionality, financial deficit and psychological and cognitive changes.

When NS classified by MNA is analyzed with regard to gender, malnutrition or high risk of malnutrition proved to be more prevalent in females than in males. Similar results have been found in other studies. Damian et al.[1] reported prevalence of malnutrition in 30.5% of females and 24.7% in males. In a study by Donini et al.[22], 41.1% of females and 34.9%

of males suffered from malnutrition or malnutrition risks. A higher prevalence was also detected in an analysis by Liguori et al.[23] in which 72.6% of females proved to be malnourished or at malnutrition risks, perhaps due to female life expectancy which exceeds male life expectancy worldwide. However, the nutritional condition tends to deteriorate with advancing age.[5] Consequently, aging may make liable to diseases and their complications, elderly people, especially females, because they live longer and thus are predisposed to malnutrition risks.[1] Further, subjective information in the MNA protocol favors the early diagnosis of nutritional risk.

Current analysis revealed agreement between MNA and BMI as NS evaluation methods in elderly people and a fair co-relationship proved to be significant ($p<0.05$), very similar to results in other studies on elderly people in communities and long-stay institutions.[5] A co-relationship with BMI was also significant in studies with reduced MNA.[24,26]

The Bland-Altmann analysis demonstrated that both tools screened effectively NS (bias -0.29). Consequently, within the sample´s scope, it is important to highlight that BMI and MNA tracked the condition of low weight and malnutrition or malnutrition risks among the elderly, respectively with 29.0% and 35.0% prevalence. Agreement has been exploited by researchers through other methods of analysis since such tools had to be employed in different scenarios. Several studies evaluated the Kappa coefficient and also found significant relationships between MNA and BMI, ranging between moderate and strong.[27,26,24]

Viable, low-cost, universally applicable and portable means are needed in clinical practice to predict and monitor NS. On the one hand, there is BMI with its classical profile in NS characterization at different degrees and its relationship with health indicators in the elderly population.[21,5,28] On the other hand, MNA is conspicuous since it involves other subjective issues that complement the screening of NS, and should be used as a clinical and outpatient follow-up tool, in addition to anthropometric parameters.[9,13,15,29] Although there is no consensus on which method is best, current study suggests that the two tools assess NS in elderly people and contribute towards reducing the risk of diseases and mortality when previously diagnosed.

Although results were satisfactory in identifying agreement between methods, it should be underscored that even more robust results may be observed in studies with larger samples and other types of methods. They may be employed with other populations under different conditions.

CONCLUSION

Results reveal that agreement between BMI and MNA existed in the NS of elderly people. Percentages of nutritional disorders in the population under analysis was significant by the two methods.

Approximately one third of elderly people had underweight, according to BMI, or they were classified with malnutrition or with malnutrition risks, according to MNA. Results by the two tools revealed the need of an adequate nutritional approach in elderly care which, even in the context of community living, they have physiological, psychosocial and pathological changes affecting NS.

Owing to the identification of the nutritional status in the sample, current research contributes towards an in-depth comprehension of the phenomenon in Brazilian elderly populations with similar features. Moreover, it emphasizes the need for preventive interventions enhancing tracking and identification of risks with adequate tools and enhancing further research on the theme.

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REFERENCES

1. Damião R, Santos ÁDS, Matijasevich A, Menezes PR. Factors associated with risk of malnutrition in the elderly in south-eastern Brazil. Rev Bras Epidemiol. 2017; 20(4):598–610.

2. Instituto Brasileiro de Geografia e Estatística (IBGE). Em 2016, expectativa de vida era de 75,8 anos**.** Available at: https://agenciadenoticias.ibge.gov.br/agencia-sala-de-imprensa/2013-agencia-de-noticias/releases/18470-em-2016-expectativa-de-vida-era-de-75-8-anos.html. on 14/08/2019.

3. Shlisky J, Bloom DE, Beaudreault AR, Tucker KL, Keller HH, Freund-Levi Y, Fielding RA, Cheng FW, Jensen GL, Wu D, Meydani SN. Nutritional Considerations for Healthy Aging and Reduction in Age-Related Chronic Disease. Adv Nutr. 2017; 17;8(1):17-26.

4. Tavares EL, Santos DM, Ferreira AA, Menezes MFG. Nutritional assessment for the elderly: modern challenges. Rev. Bras. Geriatr. Gerontol. 2015;18(3):643-50.

5. Burman M, Saatela S, Carlsson M, Olofsson B, Gustafson Y, Hornsten C. Body mass index, mini nutritional assessment, and their association with five-year mortality in very old people. J Nutr Heal Aging. 2015; 19(4):461-7.

6. Pereira IFS, Spyrides MHC, Andrade LMB. Estado nutricional de idosos no Brasil: uma abordagem multinível. Cad. Saúde Pública. 2016; 32(5):1-12.

7. Souza R, Fraga JS, Gottschall CBA, Busnello FM, Rabito EI. Avaliação antropométrica em idosos: estimativas de peso e altura e concordância entre classificações de IMC. Rev. Bras. Geriatr. Gerontol. 2013; 16(1):81-90.

8. Nazan S, Buket K. Evaluation of nutritional status of elderly patients presenting to the Family Health Center. Pak J Med Sci. 2018; 34 (2): 1–7.

9. Guigoz Y, Jensen G, Thomas D, Vellas B. The Mini Nutritional Assessment (MNA®) review of the literature – what does it tell us?. J Nutr Health Aging. 2006; 10 (6): 466-85

10. Pereira DS, Oliveira ACS, Pereira MHQ, Pereira MLAS. Mini Avaliação Nutricional: utilização e panorama nos diferentes cenários de atenção ao idoso. Rev. Saúde.Com. 2017; 13(1):824-32.

11. Chumlea WC, Roche AF, Steinbaugh ML. Estimating Stature from Knee Height for Persons 60 to 90 Years of Age. J Am Geriatr Soc. 1985; 33(2):116–20.

12. Marucci MFN, Roediger MA, Dourado DAQS, Bueno DR. Comparação do estado nutricional e da ingestão alimentar referida por idosos de diferentes coortes de nascimento (1936 a 1940 e 1946 a 1950): Estudo Saúde, Bem-Estar e Envelhecimento (SABE). Rev Bras Epidemiol. 2019; 4:(21Suppl):02:e180015.

13. Valentini A, Federici M, Cianfarani MA, Tarantino U, Bertoli A. Frailty and nutritional status in older people: the Mini Nutritional Assessment as a screening tool for the identification of frail subjects. Clin Interv Aging. 2018; 13(13):1237-44.

14. Pereira MLAS, Moreira PA, Oliveira CC, Roriz AKC, Amaral MTR, Mello AL. Nutritional status of institutionalized elderly Brazilians: a study with

the Mini Nutritional Assessment. Nutr Hosp. 2015; 31(3):1198-1204.

15. Guigoz Y, Vellas B, Garry PJ. Mini Nutritional Assessment (MNA): Research and Practice in the elderly. Nestle nutrition workshop series. Clinical & programme. 1999; 1:1-12.

16. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986; 1(8476): 307-10.

17. Cohen J. Difference between Correlation Coefficients. In: Statistical power analysis for the behavioral sciences. 2nd Ed. New York, NY: Lawrence Erlbaum Associates; 1988.

18. Santos PHS, Fernandes MH, Casotti CA, Coqueiro RS, Carneiro JAO. Perfil de fragilidade e fatores associados em idosos cadastrados em uma Unidade de Saúde da Família. Cien Saude Colet. 2015; 20(6): 1917–24.

19. Cruz-Jentoft AJ, Kiesswetter E, Drey M, Sieber CC. Nutrition, frailty, and sarcopenia. Aging Clin Exp Res. 2017; 29(1):43-8.

20. Jesus AS, Rocha SV. Comportamento sedentário como critério discriminador do excesso de peso corporal em idosos. Revista Brasileira de Atividade Física & Saúde. 2018; 23(1):1-6.

21. Leite BC, Oliveira-Figueiredo DST, Rocha FL, Nogueira MF. Multimorbidade por doenças crônicas não transmissíveis em idosos: estudo de base populacional. Rev. bras. geriatr. gerontol. 2019; 22(6):e190253.

22. Donini LM, Marrocco W, Marocco C, Lenzi A. Validity of the self- mini nutritional assessment (Self- MNA) for the evaluation of nutritional risk. A cross- sectional study conducted in general practice. J Nutr Heal Aging. 2018; 22(1): 44-52.

23. Liguori I, Curcio F, Russo G, Cellurale M, Aran L, Bulli G, et al. Risk of Malnutrition Evaluated by Mini Nutritional Assessment and Sarcopenia in Noninstitutionalized Elderly People. Nutr Clin Pract. 2018; 33(6): 879-86.

24. Kizilarslanoglu MC, Kilic MK, Gokce D, Sakalar T, Ulger Z. Is It Possible Using Handgrip Strength Instead of Body Mass Index in MNA-SF Test to Assess the Nutritional Status of Geriatric Patients?. J Nutr Health Aging. 2017; 21(5):579-84.

25. Lozoya MR, Martínez-Alzamora N, Clemente MG, Guirao-Goris SJA, Ferrer-Diego RM. Predictive ability of the Mini Nutritional Assessment Short Form (MNA-SF) in a free-living elderly population: a cross-sectional study. PeerJ. 2017; 18(5):e3345.

26. Jian-Ping M, Xiao-Qing Q, Cun-Tai Z, Hong Z, Mei Y, Li-Ya S, et al. Comparison of two malnutrition risk screening tools with nutritional biochemical parameters, BMI and length of stay in Chinese geriatric inpatients: a multicenter, cross-sectional study. BMJ Open. 2019; 9(2):e022993

27. Leandro-Merhi VA, Aquino JLB, J. gonzAgA TeixeirA de Camargo JGT. Agreement between body mass index, calf circumference, arm circumference, habitual energy intake and the MNA in hospitalized elderly. J Nutr Health Aging. 2012; 16(2):128-32.

28. Perkisas S, De Cock AM, Vandewoude M, Vandewoude M, Verhoeven V. Prevalence of sarcopenia and 9-year mortality in nursing home residents. Aging Clin Exp Res. 2019; 31(7):951-9.

29. Riobó SP, Sierra PR, Soldo RJ, Gómez-Candela C, García LPP, Serra-Majem L. Special considerations for nutritional studies in elderly. Nutr Hosp. 2015; 31(Suppl 3):84-90.