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MINI-NUTRITIONAL ASSESSMENT SCORE AND THE RISK FOR UNDERNUTRITION IN FREE-LIVING OLDER PERSONS

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Abstract: Background: many scales have been proposed for the brief nutritional assessment of older persons, with the goal of increasing undernutrition detection and the detection of nutritional risk. The Mini-Nutritional Assessment (Guigoz et al., 1994) has been increasingly used worldwide, but its efficacy has been assessed in few countries. Objectives: this study aimed to assess, through complete clinical evaluation, anthropometric measurements and laboratorial tests, the nutritional state of older persons living in the community and compare the results with the score obtained by the application of the Mini Nutritional Assessment. Design: forty-two persons aged 60 years or older (55% women, mean age 70,9 years) were studied. All volunteers were submitted to a criterious clinical evaluation, anthropometric measures and laboratorial testing (serum albumin, hemoglobin, lymphocite count, iron and unsatured iron binding capacity). Results: twenty-seven volunteers (64%) were considered eutrophic, 12 volunteers were considered obese (28,6%) and three volunteers were considered undernourished. Thirteen volunteers were classified as in risk of undernutrition by the Mini-Nutritional Assessment score, 29 scored within the normal range and no volunteer was considered to be undernourished. The Mini Nutritional Assessment score was significantly associated with age and with the unsatured iron binding capacity. When compared to the final nutritional diagnosis, the questionnaire showed 100% sensibility and 74.3% specificity. Conclusion: this study detected a prevalence of undernutrition in the elderly living in the community similar to those described in developed countries. In this population, the Mini Nutritional Assessement showed to be specially efficient for the detection of nutritional risk.

Key words: Mini-Nutritional Assessment, nutritional epidemiology, anthropometry, elderly, undernourishment, obesity, nutritional risk.

Introduction

Since its publication, in 1994 (1), the Mini-Nutritional Assessment (MNA) has been increasingly employed, worldwide, for the brief evaluation of older persons' nutritional status (2,3). The MNA is composed by an anthropometric assessment, a brief questionnaire about diet characteristics, global health and environment and a self evaluation of health and nutritional state. The final score classifies nutritional state as well-nourished (scores higher than 23.5), in risk for undernutrition (scores from 17 to 23.5) and undernourished (scores lower than 17).

Most of the published studies shows the MNA to have high sensitivity and specificity and good predictive value for higher mortality, hospital admissions and other adverse outcomes (4-6). The lack of a gold-standard assessment for the nutritional state in older persons, however, remains a problem. Also, populations of different countries are heterogeneous in anthropometric and nutritional characteristics, which makes the evaluation of this test in a country not readily applicable to other ones. In a Chilean population, for instance, the MNA failed to identify persons at risk for undernutrition (7).

Therefore, this study intended to correlate the MNA score with clinical, anthropometric and biochemical data of a free-living elderly population in Brazil.

Methods

Studied population

Eighty persons, aged 60 years or over, out of 104 enrolled in a universitary Family Medicine Program were invited to participate. Exclusion criteria were severe diseases that would make impossible or too uncomfortable the transportation of the patient to the hospital and severe cognive impairment. Thirty-seven persons refused to participate, 35 because of lack of time (active persons employed full time or caring for others) and two because they felt too ill to participate. One person was excluded because of advanced neoplastic disease. The 42 participants gave their written informed consent to participate in this study, which was approved by the local human research ethical committee.

Nutrititional Assessment

Each volunteer underwent a detailed clinical assessment, including physical examination, in order to detect acute and chronic diseases and signs of undernutrition (skin, hair and nail signs of vitamin or mineral deficiency, distribution of subcutaneous tissue, muscle trophysm, signs of peripheral neuropathy). All medications in use were registered.

Nutritional assessment was obtained through a nutritional interview, including a 24-hour food recordatory questionnaire,

anthopometric measurements (height, weight, body mass index, arm circumference, triceps skinfold and muscle circumference of the arm) and a biochemical assessment, including total blood cell count, serum albumin, iron and unsatured iron binding capacity (UIBC). Reference values are shown with the results.

Diet composition was obtained by the analysis of the 24-hour recall questionnaire by a food composition software (Programa de Apoio à Nutrição, versão 2.5, EPM/UNIFESP, Sao Paulo, Brazil), based on the USDA Human Nutrition Information Service: composition of foods (8).

In the final nutritional diagnosis, undernutrition was diagnosed when: (1) Body mass index (BMI) was below 18.5 (WHO, 1997) and two or more biochemical tests were below the normal range; (2) BMI within the range of 18.5 to 24.9 or above, but more than one biochemical test was below the normal range with clinical assessment and nutritional and clinical interview suggestive of undernutrition. Volunteers with BMI between 25.0 and 29.9 and normal biochemical tests were considered overweight. Obesity was diagnosed when BMI was 30.0 or above and biochemical tests were within the normal range.

Mini-Nutritional Assessment

The Mini-Nutritional Assessment was applied to all volunteers, by the same researcher. For research purposes, the full test was applied to every volunteer, despite the score of the first part of the test. Volunteers with a score of 23.5 points or more were considered in adequate nutritional state, those with scores ranging from 17 to 23.5 were considered in risk for undernutrition and those with score of less than 17 were considered undernourished (1).

Statistical Analysis

Results are shown as mean and standard deviation. The Student's T test was employed for group comparisons according to the final nutritional diagnosis and MNA score classification. Pearson's correlation coefficient and multiple linear regression were used to verify associations between the different variables. Significance level of 5% was adopted. The Minitab Release 12.1 statistic software (Minitab Inc.) was employed for statistical analysis.

Results

Mean age of the volunteers was 70.9 ± 6.7 years. Twenty-three volunteers were female (55%), 19 male. Two volunteers had mobility restrictions, the remaining 40 being fully independent for daily activities. Nineteen of the volunteers were in use of three or more medications. Ten volunteers had clinical complaints (23.8%), mainly related to chronic diseases, as vertigo, arthralgia, muscle weakness due to cerebrovascular disease. Five volunteers referred alcohol intake, three of them on a daily basis. Four volunteers were cigarette smokers. Twenty-three volunteers had high blood pressure and ten were diabetic. Chronic heart failure, mild cognitive deficit and periferal atherosclerotic disease were diagnosed, in three patients each. Twenty-five volunteers (59.5%) were in regular use of medications, with 36 different medications listed. All volunteers were free-living and had their main meals (breakfast, lunch, dinner) at home.

According to the criteria shown above for the final nutritional diagnosis, 27 volunteers (64.3%, 11 male, 16 female) were considered well-nourished or overweight; 12 volunteers (28.6%, six male, six female) were considered obese and three volunteers (7.1%) were considered undernourished.

The mean anthropometric results are shown in Table 1. Thirteen volunteers had their BMI above 29.9, 15 had BMI within the range of 18.5 to 24.9, 12 had values between 25.0 and 29.9 and two had their BMI below 18.5. BMI was concordant with the final nutritional diagnosis in 95.2% of the volunteers. The mean biochemical results are shown in Table 1.

Table 1
Anthropometric and biochemical characteristics of the 42 studied volunteers.

	Range	mean ± sd
Weight (Kg)	33 – 98	67 ± 15
Height (m)	1.37 – 1.76	1.57 ± 0.09
Body Mass Index (Kg/m2)	16 – 41	27 ± 6
Triceps skinfold (mm)	5 – 35	20 ± 7
Arm Circunference (cm)	21 – 43	31 ± 5
Arm Fat Index (mm/dm2)	0.4 – 3.2	1.8 ± 0.8
Muscle Circunference of the Arm (cm)	18 – 32	24 ± 3
Albumin (g/L, n.r.* 3.5 – 5.5)	15 – 47	38 ± 8
Hemoglobin (g/dL, n.r. 13.3 – 16.7 and 11.8 – 14.8**)	10.5 – 17.8	14.1 ± 1.6
Lymphocyte count (cel/mL, n.r. > 1500)	600 – 6300	1881 ± 869
Unsatured Iron Binding Capacity (mg/dL, n.r. 112-346)	107 – 327	207 ± 40
Iron (mg/dl, n.r. 53 – 167 and 49 – 151**)	27 – 283	103 ± 44

* normal range; ** men and women, respectively.

The MNA scores ranged from 19 to 29.5 points (mean 25.3 ± 3.0). Thirteen volunteers were classified as in risk for undernutrition, none as undernourished.

The correlation between the MNA score and the studied variables is shown in table 2. Age and UIBC were significantly and inversely correlated with the MNA score. Serum iron was significantly correlated with the MNA score and hemoglobin was correlated with near-significance. After multiple linear regression, correlation with age remained significant but correlations with iron, hemoglobin and UIBC became insignificant, although correlation with UIBC maintained near-significance (Table 3).

Table 2
Correlations between the different variables and the Mini-Nutritional Assessment score.

Variable	r	(P)
Age (years)	-0.31	(0.045)
Weight (Kg)	-0.01	(0.981)
Height (m)	-0.02	(0.875)
Body Mass Index (Kg/m2)	0.02	(0.892)
Triceps skinfold (mm)	-0.08	(0.607)
Arm Lenght (cm)	-0.01	(0.987)
Arm Circunference (cm)	0.01	(0.979)
Arm Fat Index (mm/dm2)	-0.07	(0.651)
Arm Muscle Circunference (cm)	0.04	(0.771)
Albumin (g/dL)	-0.01	(0.915)
Hemoglobin (g/dL)	0.28	(0.071)
Lymphocyte (cel/mL)	0.06	(0.702)
Unsatured Iron Binding Capacity (μg/dL)	-0.32	(0.033)
Iron (μg/dL)	0.31	(0.043)

Table 3
Multiple linear regression model with the different variables and the Mini-Nutritional Assessment score

Variable	Regression coefficient (b)	beta coefficient	P
Age (years)	- 0.14	- 0.31	0.040
Unsatured Iron Binding Capacity (μg/dL)	- 0.02	- 0.29	0.066
Hemoglobin (μg/dL)	0.32	0.17	0.267

When compared to the final nutritional diagnosis, the MNA showed sensitivity of 100% and specificity of 74.3%, with a positive predictive value of 23% and negative predictive value of 100%. Three volunteers diagnosed as undernourished and ten volunteers with diagnosis ranging from well-nourishment to obesity had MNA score below 23.5 and 29 volunteers diagnosed as well-nourished had MNA score above 23.5.

Ten volunteers (23.8%) with final nutritional diagnosis of well-nourishment (two), overweight (two) or obesity (six) were classified as in risk for undernutrition by the MNA score. The clinical data of these volunteers were reviewed, in order to identify potential nutritional risk factors. Eight of the ten volunteers referred, during their clinical assessment, significant weight loss during the last three months; nine were in use of more than three medications; nine had two or more chronic diseases and one had had an acute infection in the last three months; six had pessimistic views about their general health and nutritional state.

Anthropometric characteristics were similar between the group classified as "in risk for undernutrition" and the well-nourished group. Regarding biochemical variables, hemoglobin, albumin and lymphocyte count were similar while iron was significantly lower and unsatured iron binding capacity was significantly higher in the "in risk for undernutrition" group (Table 4).

Table 4
Mean anthropometric and biochemical results for the groups classified by the Mini-Nutritional Assessment score as "in risk for undernutrition" – RU - and "well-nourished" - WN.

Variable	GROUP		P
	WN	RU	
Age	70.7 ± 6.6	71.1 ± 6.9	0.874
Weight (Kg)	67 ± 14	71 ± 15	0.340
Height (m)	1.57 ± 0.8	1.56 ± 1.0	0.849
Body Mass Index (Kg/m2)	26 ± 4	27 ± 7	0.648
Triceps skinfold (mm)	19 ± 6	20 ± 10	0.707
Arm Circunference (cm)	30 ± 4	31 ± 7	0.644
Arm Muscle Circunference (cm)	24 ± 3	25 ± 4	0.855
Albumin (g/L, n.r.* 3.5 – 5.5)	38 ± 8	37 ± 6	0.615
Hemoglobin (g/dL, n.r. 13.3 – 16.7 and 11.8 – 14.8**)	14.2 ± 1.4	13.5 ± 1.8	0.173
Lymphocyte (cel/mL, n.r. > 1500)	1803 ± 530	2054 ± 1370	0.393
Unsatured Iron Binding Capacity (mg/dL, n.r. 112-346)	197 ± 36	230 ± 38	0.010
Iron (mg/dl, n.r. 53 – 167 and 49 – 151**)	114 ± 45	77 ± 29	0.010

* normal range; ** men and women, respectively.

When the diet composition of the group in risk for undernutrition was compared to that of the group classified as well nourished by the MNA, it was found to be composed by significantly less carbohydrates (44% vs 51%, p = 0.033) and more lipids (36% vs 30%, p = 0.047).

Discussion

In this study, the Mini-Nutritional Assessment failed to classify as undernourished three volunteers with the diagnosis of undernutrition according with a comprehensive clinical and nutritional assessment and classified as 'in risk for undernutrition' ten volunteers considered well-nourished.

According to Vellas et al., the best indication for the questionnaire application is the assessment of frail older persons, as those with functional limitations, living alone or the old old (aged 85 years or older) living in the community (9). Those with scores lower than 17 should be considered severely undernourished and therapeutic interventions should be readily implemented (10). The three undernourished volunteers were not severely so. Also, all of our volunteers were younger than 85 years and most were fully independent, what may partially explain our results.

However, the group considered in risk for undernutrition differed of the well-nourished one in, at least, three different aspects, which seems to really separate them as a group: they had clear risk factors in their clinical history for future undernutrition, including weight loss, use of multiple

medications, presence of chronic diseases and a low self-perception of their health state; they had biochemical markers for lower iron stores, as lower serum iron and higher UIBC; their nutrient intake was different, with a lower intake of carbohydrates and higher intake of lipids.

This last finding may be explained by a volume limitation of the diet in this group, as carbohydrates, in a typical brazilian diet, is in great part represented by rice and beans. Low volume intakes, then, as caused by hyporexia, may limit considerably the intake of these components, with a consequent reduction of the carbohydrate component of the diet.

The association of obesity, sarcopenia and frailty in the elderly is a matter of increasing concern (11). Eight of the ten volunteers classified as 'in risk for malnutrition' in this study were overweight or obese, according to their body mass index. This finding indicates a need for caution when antropometrically obese elderly patients are evaluated, as the risk for malnutrition may be neglected in this situation. The detection of risk for malnutrition in obese elderly may allow the implementation of preventive programs, associating weight loss with physical training and dietetic intervention (12). The MNA may prove an important tool for the detection of obese sarcopenia and this issue demands further investigation.

This study adopted strict and well defined criteria for the final classification of the nutritional state. Isolated anthropometric and laboratorial values showed very low predictive value for the detection of undernutrition, as the literature has extensively described (13-15). The mean height (1.57m), and weight (67.1Kg) of our studied population were much lower than those of european and north-american populations, the BMI being similar (1-17). Anthropometry also showed to be very inespecific in this population.

The prevalence of undernutrition, in this study, was low, as it has been described in other studies for free-living elderly populations in Brazil and in developed countries (18-20). Obesity, as well as in other studies, had an alarming prevalence (26% of the women and 31% of the men), the prevalence among the male volunteers being higher than that of most of other published studies (15,21).

The low prevalence of undernutrition may explain the low specificity and positive predictive value of the MNA found in this study (22).

In conclusion, the Mini-Nutritional Assessment score was able to define, in this study, a sub-population with well defined risk factors for undernutrition, which, although classified as well-nourished in a comprehensive clinical and nutritional assessment, already had some biochemical markers of a worse nutritional state and a differing diet composition. This finding shows a potential benefit of the application of the MNA in the clinical assessment of independent older persons, free-living in the community, including the obese elderly.

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References

1. Guigoz Y., Vellas B.J., Garry P.J. Mini Nutritional Assessment: a practical assessment tool for grading the nutritional state of elderly patients. Facts. Res. Gerontol., 1994, 4(suppl 2):15-59.
2. Garry P.J., Goodwin J.S., Hunt W.C., Hooper E.M., Leonard A.G. Nutritional status in a healthy elderly population: dietary and supplemental intake. Am. J. Clin. Nutr., 1982, 36: 319-331.
3. Gazzotti C., Albert A., Pepinster A., Petermans J. Clinical usefulness of the mini nutritional assessment (MNA) scale in geriatric medicine. J. Nutr. Health Aging, 2000, 4: 176-181.
4. Van Nes M.C., Herrman F.R., Gold G., Michel R.P., Rizzoli R. Does the mini nutritional assessment predict hospitalization outcomes in older people? Age Ageing, 2001, 30: 221-226.
5. Cohendy R., Gros T., Arnaud-Battandier F., Tran G., Plaze J.M., Eledjam J. Preoperative nutritional evaluation of elderly patients: the Mini Nutritional Assessment as a practical tool. Clin. Nutr., 1999, 18: 345-348.
6. Vellas B., Hunt W.C., Romero L.J., Koehler K.M., Baumgartner R.N., Garry P.J. Changes in nutritional status and patterns of morbidity among free-living elderly persons: a 10-year longitudinal study. Nutrition, 1997, 13: 515-519.
7. Urteaga C.R., Ramos R.I.H., Atalah E.S. Validación del criterio de evaluación nutricional global del adulto mayor. Rev. Med. Chile, 2001, 129: 871-876.
8. United States of America Department of Agriculture. Human Nutrition Information Service. Composition of foods: raw, processed, prepared. Agriculture handbook no. 8, series 1-16, reviewed 1976-1986.
9. Vellas B., Guigoz Y., Garry P.J., et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition, 1999, 15: 116-121.
10. Vellas B., Guigoz Y., Baumgartner M., Garry P.J., Lauque S., Albarede J.L. Relationships between nutritional markers and the Mini-Nutritional Assessment in 155 older persons. J. Am. Geriatr. Soc., 2000, 48: 1300-1309.
11. Villareal D.T., Banks M., Siener C., Sinacore D.R., Klein S. Physical frailty and body composition in obese elderly men and women. Obes. Res., 2004, 12: 913-920.
12. Kennedy R.L., Chokkalingham K., Srinivasan R. Obesity in the elderly: who should we be treating, and why, and how? Curr. Opin. Clin. Nutr. Metab. Care, 2004, 7: 3-9.
13. Bowman B.B., Rosenberg I.H. Assessment of the nutritional status of the elderly. Am. J. Clin. Nutr., 1982, 35: 1142-1151.
14. Chumlea W.C., Baumgartner R. Status of anthropometry and body composition data in elderly subjects. Am. J. Clin. Nutr., 1989, 50: 1158-1166.
15. Euronut SENECA investigators (Study on Nutrition and the Elderly). Nutritional status: anthropometry. Eur. J. Clin. Nutr., 1991, 45(suppl.3): 31-42
16. Roberts S.B., Fuss P., Heyman M.B., Young V.R. Influence of age on energy requirements. Am. J. Clin. Nutr., 1995, 62: 1053S-1058S.
17. Elia M., Ritz P., Stubbs R.J. Total energy expenditure in the elderly. Eur. J. Clin. Nutr., 2000, 54: 92S-103S.
18. Cederholm C., Hellerstrom K. Nutritional status in recently hospitalized and free-living elderly subjects. Gerontology, 1992, 38: 105-110.
19. Löwink M.R.H., van den Berg H., Schrijver J., Odink J., Wedel M., van Houten P. Marginal nutritional status among institucionalized elderly women as compared to those living more independently. (Dutch Nutrition Surveillance System). J. Am. Coll. Nutr., 1992, 11: 673-681.
20. Tavares E.L., Anjos L.A. Perfil antropométrico da população brasileira. Resultados da Pesquisa Nacional sobre Saúde e Nutrição. Cad. Saúde Públ., 1999, 15: 759-768.
21. Madrid L.F., Piñero M.C., Rodríguez N.Z., Quintero J., Gabarrón A.S., Márquez N.A. Estado nutricional y composición corporal de un grupo de adultos mayores no institucionalizados del Estado Zulia, Venezuela. Arch. Latinoam. Nutr., 1996, 46:190-195.
22. Dempsey D.T., Mullen J.L. Prognostic values of nutritional indices. J. Parenter. Enteral Nutr., 1987, 11: 109S-114S.