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Correlations between Nutritional Screening Score and Anthropometric Parameters in Institutionalized Elderly

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Abstract

The aim of this study is to assess nutritional status in a group of institutionalized elderly and to establish correlations between nutritional screening score and anthropometric parameters. We analyzed a sample of 156 seniors, 62 (39.7%) men, 94 (60.3%) women, to whom we performed nutritional screening using Mini Nutritional Assessment - MNA and we evaluated anthropometric parameters (body mass index - BMI, waist circumference - WC, calf circumference - CC and mid-upper arm circumference - MUAC). In the group of elderly institutionalized to whom the MNA has been applied, 69.2% had optimal nutritional status, 24.4% had a score of screening indicating risk of malnutrition and 6.4% had a screening score corresponding to malnutrition. A significantly higher percentage of women had a screening score indicating malnutrition (9.6% vs. 1.6%) and a screening score showing risk of malnutrition (26.6% vs. 21%) (p=0.029). Analysis by gender showed strong correlation between BMI and WC value (r = 0.869) in men, and

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between MUAC and CC value (r = 0.838) in women (p<0.001). Nutritional screening score was positively correlated with all anthropometric parameters (r>0.400, p<0.001), the strongest correlation being recorded with CC (r = 0.528). MNA short form (MNA-SF) represents a useful tool for rapid nutritional screening of elderly, enabling the identification of individuals at risk for malnutrition and those with a score indicating malnutrition. Calf circumference is a parameter which is positively correlated with nutritional screening score in institutionalized elderly population, and can be proposed as a starting point in nutritional assessment algorithm.

Keywords: elderly, nutritional status, nutritional screening algorithm, institutionalized elderly, quality of life.

Introduction

Significant changes in the population structure of Romania have contributed greatly to increased dependency ratio and aging index. Rapidly increasing number of older people worldwide was characterized as a "Gray Tsunami" (Walker *et al,* 2012). Romania, like all European and developing countries with aging (WHO, 2014a, Luppa *et al*, 2010), has an increasingly degree of institutionalization of the elderly, both in private centers and in the state ones. Institutionalized elderly are more exposed to risk and health problems, which compromise their quality of life (Zaidi *et al,* 2013). Nutritional status of hospitalized or institutionalized elderly is often poor (de Lima, Moraes & Souza, 2012) and this should require particular attention in health care services, especially since social (Esmayel *et al*, 2013), psychological (Cederholm, 2003), cognitive (Gillette-Guyonnet, 2009) or functional problems (Oliveira, Fogaça & Leandro-Merhi, 2009) influencing negatively nutritional status add to the existing medical pathology (Rosen & Reuben, 2011). Malnutrition has negative consequences on these persons morbidity and mortality (Hickson, 2006, Raynaud-Simon, 2009a, Saunders & Smith, 2010), with increasing frequency of addressing health services, higher length of stay in hospital, increased risk of complications and beyond, pressure ulcers, increased need for institutionalization (Harris & Haboubi, 2005, Stratton, Green & Elia, 2003, Raynaud-Simon, 2009b, Badia *et al*, 2015). In this context, it becomes obvious the need for early and rapid identification of individuals at risk of malnutrition, for the establishment of a comprehensive evaluation algorithm and possibly specific treatment. In this sense, investigating the nutritional status in geriatric institutions becomes fundamental to the development of health politics for improvement of care and prognostic (British Geriatric Society, 2011). In the literature, at present day, there is no consensus on the optimal screening test (Wells & Dumbrell, 2006, Leandro-Merhi & De Aquino, 2011), taking into

account that classical biological and anthropometric parameters have limitations arising from changes associated with aging (Aussel & Cynober, 2009). The objectives of this research were nutritional characterization of a community of institutionalized elderly, and studying the relationship between the screening score obtained by evaluating MNA-SF and anthropometric parameters, which could lead to the proposal of a simple algorithm of nutritional assessment for older people, useful in communities and primary care.

Material and methods

The study was conducted in "St. Parascheva" Nursing Home in Iasi. After signing informed consent, each participant was drawn up an evaluation sheet that contained personal data (age, sex) and clinical and nutritional assessment information. Anthropometric parameters analyzed were: current weight (in kg), body mass index (BMI, kg/m^2), waist circumference (WC, in cm) using standardized and calibrated equipment. Defining weight status was based on BMI values according to World Health Organization (WHO) criteria (WHO, 2014b): underweight (BMI < 18.5 kg/m^2), normal weight (BMI between 18.5 and 24.9 kg/m^2) and exces weight (overweight and obesity, BMI≥ 25 kg/m^2, respectively BMI ≥ 30 kg/m^2) and based on the WC values according to IDF criteria: thick waist, when WC values≥ 94 cm in men and≥ 80 cm in women (Zimmet, Alberti & Shaw, 2005). To complete anthropometric assessment, the calf circumference (CC) (Kawakami *et al*., 2014, Kaiser *et al.,* 2009) and mid-upper arm circumference - MUAC, in cm, were measured to each person included in the study. MUAC is measured in the left arm, at the midpoint between the tip of the shoulder and the tip of the elbow (olecranon process and acromium) and is a reproducible and fit for screening measurement, especially for acute malnutrition (Bur *et al.*, 2000).

The form MNA - Mini Nutritional Assessment (translated in Romanian) was used for nutritional assessment, a non-invasive screening and evaluation tool, validated for use both in hospital environment and in institutions providing care for the elderly (Guigoz,Vellas & Garry, 1996). MNA short form (MNA-SF) contains items that allow obtaining both a nutritional screening score and nutritional assessment of the elderly (Secher M *et al*., 2009, Guigoz, 2006). Regarding nutritional screening score, values between 12-14 indicate normal nutritional status, values between 8-11 indicate risk of malnutrition and values below 7 indicate malnutrition (Reuben, Greendale & Harrison, 1995). Statistical analysis of data was performed using SPSS 13.0.

Results

This study included 156 individuals, with a mean age of 78.37±7.211 years (*fig.1*), 62 men (39.7%) and 94 women (60.3%).

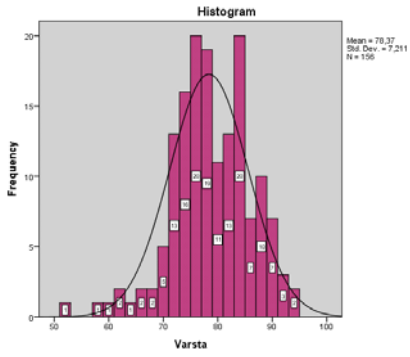

Figure 1. Sample characterization in terms of age

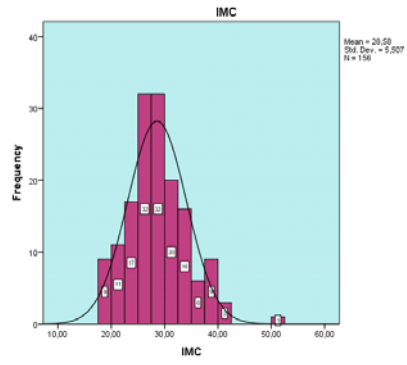

Figure 2. Sample characterization in terms of BMI

To calculate the screening score BMI was used (Figure 2) and on that basis we classified individuals into 3 categories of weight: 3 persons (1.9%) with weight deficit, 34 persons (21.8%) were normal weight individuals and 119 (76.3%) with excess weight (overweight and obesity). Mean value of WC was 100.78 ± 13.49 cm (Figure 3a), 87.2% (136 persons) having thick waist, meaning 80.64% of men and 91.48% of women, gender difference being statistically significant (p = 0.042) (*Figure 3b*).

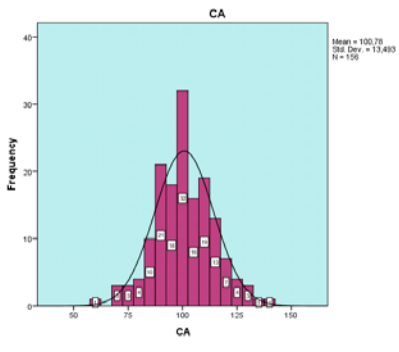

Figure 3a. Sample characterization in terms of WC total sample

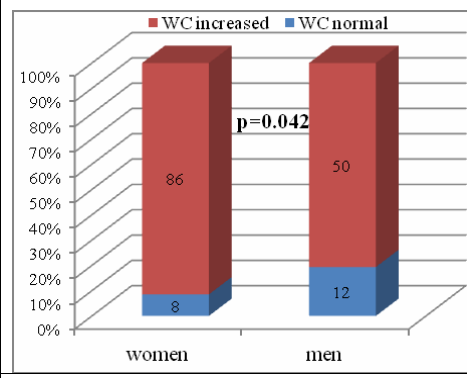

Figure 3b. Sample characterization in terms of gender analysis

Mean value of MUAC was 29.12 ± 4.71 cm (Figure 4) and of CC was 34.260 ± 5.14 cm (*Figure 5*). Results on nutritional screening score were: 108 people (69.2%) had a score of 12-1, meaning they had normal nutritional status, 38 people (24.4%) had a score of 8-11, therefore risk of malnutrition, and the remaining 10 persons (6.4%) had a score ≤ 7, a score indicator of malnutrition. Analysis by gender showed that a significantly higher percentage of women had a screening score showing malnutrition than men (9.6% vs. 1.6%) (p = 0.029), 77.4% of men having a screening score indicator for normal nutritional status (vs. 63.8% of women), and 21% of men having a screening score indicator for risk of malnutrition (vs. 26.6% of women). In *Table 1* are included descriptive characteristics of the parameters analyzed.

Table 1. *Descriptive characteristics of the parameters analyzed in terms of nutritional screening score*

Score screening		N	Mean	Std. Deviation	95% Confidence Interval for Mean		min	max
					Lower Bound	Upper Bound		
BMI	12-14	108	29.5296	4.93824	28.5876	30.4716	19.70	41.50
	8-11	38	28.0289	5.78086	26.1288	29.9291	19.50	50.10
	?7	10	20.4000	2.90784	18.3199	22.4801	17.50	27.00
	Total	156	28.5788	5.50657	27.7079	29.4498	17.50	50.10
WC	12-14	108	103.95	11.012	101.85	106.05	77	133
	8-11	38	97.68	14.125	93.04	102.33	77	140
	?7	10	78.20	12.072	69.56	86.84	60	98
	Total	156	100.78	13.493	98.64	102.91	60	140
MUAC	12-14	108	30.16	4.158	29.36	30.95	20	53
	8-11	38	27.92	4.862	26.32	29.52	21	46
	?7	10	22.50	3.440	20.04	24.96	15	26
	Total	156	29.12	4.711	28.38	29.87	15	53
CC	12-14	108	35.750	4.1291	34.962	36.538	26.0	48.0
	8-11	38	31.947	5.4024	30.172	33.723	25.0	54.0
	?7	10	26.950	4.9129	23.436	30.464	19.5	34.0
	Total	156	34.260	5.1423	33.446	35.073	19.5	54.0

All individuals with weight deficit according to BMI had a screening score indicator for malnutrition and only 6 people (17.6%) of those with normal BMI had a screening score d≤7; 11 normal weight individuals (32.4%) and 27 individuals with excess weight (22.7%) had a screening score showing risk of malnutrition, the differences between percentages being statistically significant (p <0.001). The analysis conducted according to value of WC showed that 8 people (40%) of those with normal WC had normal nutritional screening score vs. 100 people (73.5%) of those with large WC, 7 people (35%) of those with normal WC had a screening score indicator for risk of malnutrition vs. 31 persons (22.8%) of those with large WC, and 5 people (25%) of those with normal WC had a screening score indicating malnutrition vs. 5 people (3.7%) of those with large WC, the differences between percentages being statistically significant (p <0.001) (*Table 2*).

Table 2. *Sample characteristics according to nutritional screening score and anthropometric parameters*

		Screening score			p
		12-14	8-11	0-7	
BMI	Denutrition	-	-	3 (100%)	<0.001
	Normal weight	17 (50%)	11 (32.4%)	6 (17.6%)	
	Excess weight	91 (76.5%)	27 (22.7%)	1 (0.8%)	
WC	Normal	8 (40%)	7 (35%)	5 (25%)	<0.001
	Large	100 (73.5%)	31 (22.8%)	5 (3.7%)	

Statistical analysis showed a high positive correlation (r > 0.700), statistically significant (p <0.001) between BMI and all other anthropometric parameters analyzed (WC, MUAC and CC) (*Figure 6*). The same correlation is observed when conducting gender analysis, maintaining statistical significance, the strongest correlations being found between BMI and WC in men (r â 0.869), and between MUAC and CC in women (r = 0.838).

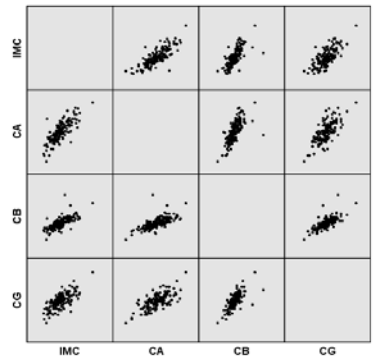

Figure 6. Correlations between anthropometric parameters

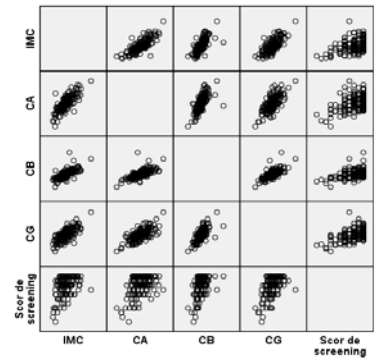

Figure 7. Correlations between nutritional screening score and anthropometric parameters

The same positive correlation, statistically significant (p <0.001) was observed between the value of nutritional screening score and all anthropometric parameters analyzed, the strongest correlation being recorded with CC value (r = 0.528) (*Figure 7*).

Discussion

In the group of institutionalized elderly where the MNA-SF form was applied, 69.2% had optimal nutritional status, 24.4% had a screening score indicator of risk of malnutrition and 6.4% had a screening score appropriate for malnutrition. Compared with men, a significantly higher percentage of women had a screening score of malnutrition (9.6% vs 1.6%) and a screening score indicator of risk of malnutrition (26.6% vs 21%) ($p = 0.029$). In the total sample, all anthropometric parameters analyzed were positively correlated, statistically significant with each other ($r > 0.700$, $p < 0.001$). Analysis by gender showed a strong correlation between BMI and WC values ($r = 0.869$) in men, and between MUAC and CC values ($r = 0.838$) in women ($p < 0.001$). Nutritional screening score was positively correlated, statistically significant, with all anthropometric parameters analyzed ($r > 0.400$, $p < 0.001$), the strongest correlation being recorded with CC value ($r = 0.528$). Our results add to existing international data on the evaluation of nutritional status in the elderly. Thus, a Swedish study published in 2005, performed on a population with a mean age of 85.5 years, reported a malnutrition prevalence of 30% and 59%risk of malnutrition (Olin Odlund, Koochek, Ljungqvist & Cederholm, 2005). A Finnish study reported a malnutrition prevalence of 3%, malnutrition risk of 48% and the remaining 49% had optimal nutritional status, assessed via the MNA form. Arm circumference was among parameters that correlated most strongly with the total score of the MNA. At the same time, the authors reported strong correlations, statistically significant, between BMI and MUAC and CC (Soini, Routasalo & Lagström, 2004). Calf circumference value was shown to be a relevant marker of nutritional assessment in other studies (Portero-McLellan *et al*, 2010). Thus, a study performed in a geriatric unit showed the existence of statistically significant correlations between CC value and the usual anthropometric parameters (BMI, $r = 0.706$, $p < 0.001$; tricipital fold, $p < 0.001$) or biological (albumin, $r = 0.219$, $p < 0.001$; transthyretin, $r = 0.162$, $p < 0.001$), the limit value of 30.5 cm even having diagnostic value (Bonnefoy, Jauffret, Kostka & Jusot, 2002). The importance and usefulness of the MNA-SF in nutritional assessment of the elderly has been demonstrated, including in acute episodes, being a quick tool for estimating mortality (Lilamand *et al*, 2015, Lundin *et al*, 2012, Formiga *et al*, 2010). Thus, it has been demonstrated that less than 1/3 of hospitalized elderly with acute conditions had optimal nutritional status and mortality at 1 year, 2 to 3 years is higher in patients classified as malnourished based on MNA (Persson, Brismar, Katzarski, Nordenström & Cederholm, 2002). Moreover, a study published in 2013 showed that the short form of MNA has at least the same ability as the original form of MNA in what concerns prediction of mortality at 4 years, (Wang & Tsai, 2013) suggesting that the short form, which includes calf circumference measurement, could represent a comprehensive tool in nutritional screening on geriatric population (Tsai, Chang & Wang, 2013).

MNA-SF associated with CC is better as a screening test than MNA with BMI in a Spanish study conducted on institutionalized elderly (Garcia-Meseguer & Serrano-Urrea, 2013). Our study is only a preliminary step in nutritional assessment of institutionalized elderly in this unit. Next steps will include completing existing data with items included in the evaluation score and MNA total score, allowing a complete characterization of these individuals. One of the limitations of the study could be the fact that no specific nutritional biological exploration was carried out, enabling the extraction of correlations with anthropometric parameters and screening and nutritional evaluation scores.

Conclusions

MNA short form (MNA-SF) is a useful tool for rapid nutritional screening of elderly, enabling the identification of individuals at risk for malnutrition and those with a score indicating malnutrition. Classic anthropometric parameters retain their usefulness in nutritional assessment of geriatric population. Calf circumference value is a parameter which is positively correlated, statistically significant, with the score of nutritional screening in the elderly population studied, and can be proposed as a starting point in nutritional assessment algorithm.

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