NUTRITIONAL RISK BY MINI NUTRITIONAL ASSESSMENT (MNA), BUT NOT ANTHROPOMETRIC MEASUREMENTS, HAS A GOOD DISCRIMINATORY POWER FOR IDENTIFYING FRAILTY IN ELDERLY PEOPLE: DATA FROM BRAZILIAN SECONDARY CARE CLINIC

M.S. ZUKERAN[1,2], R.M. RITTI-DIAS[3], F.G.M. FRANCO[2], M.S. CENDOROGLO[4], L.D.N. DE MATOS[2], S.M. LIMA RIBEIRO[1]

1. University of São Paulo, São Paulo, Brazil; 2. Hospital Israelita Albert Einstein, São Paulo, Brazil; 3. Universidade Nove de Julho, São Paulo, Brazil; 4. Federal University of São Paulo, São Paulo, Brazil. Corresponding author: Mariana Staut Zukeran, Hospital Israelita Albert Einstein; Universidade de Sao Paulo, Brazil, marizukeran@hotmail.com

Abstract: *Objectives:* To investigate, in elderly individuals registered at a secondary outpatient clinic, the prevalence of frailty and pre-frailty and to identify the discriminatory power of anthropometric measurements and nutritional risk in identifying these conditions. *Design:* Cross-sectional study with data extracted from medical records. *Setting and participants:* Elderly patients (60+ years) from a geriatric outpatient clinic, located in the southeast area of São Paulo, Brazil. *Measurements:* Frailty was assessed using five criteria proposed by Fried et al (2001), with some modifications. Nutritional risk was identified using Mini Nutritional Assessment (MNA). Body weight and body height were measured and used to calculate the body mass index (BMI). The discriminatory power of these parameters for the identification of frailty was determined by Receiver Operating Characteristics (ROC) curves. *Results:* The final sample was composed of 254 patients, from which 31.1% were identified as frail and 53.5% as prefrail. The MNA indicated that 3.1% were malnourished and 35.4% were at risk of malnutrition. The BMI values 39.4% as overweight/obese and 19.9% as undernourished. As just the MNA revealed differences for frailty classification, only this parameter was investigated by ROC curve. The discriminatory power of the MNA for frailty presented a best cut-off point of ≤23.0 and the AUC was 0.812 (sensitivity=55.7; specificity=94.9), with a youden index of 0.5057 (95%CI= 0.3146-0.5946). MNA did not present sufficient discriminatory power to detect pre-frailty. *Conclusion:* The MNA was capable of indicating frailty, but not pre-frailty in this sample. BMI did not display significant predictive power for frailty or pre-frailty.

Key words: Secondary care, mini-nutritional assessment, frailty, nutritional status, elderly.

Introduction

Despite the positive aspects of aging in the worldwide population, older individuals present a high prevalence of chronic diseases, incurring economic, social and emotional burden. In Brazil, low income is a common feature of many elderly individuals; as such, we can assume that older people in this country have an increased risk of food insecurity, and consequently, nutritional risk (1).

Epidemiological studies of elderly individuals, performed in Brazil, have shown two parameters to be associated to nutritional risk. Firstly, low body weight is associated with low income and food insecurity (1). Secondly, overweight and obesity have increased in community-dwelling elders with different incomes (2). Both nutritional deviations increase the risk of chronic diseases, frailty syndrome and disabilities (3).

Frailty syndrome is defined as a state of decreased functional reserve and resistance to stressors due to dysregulation of multiple physiological systems (4), and is related to a number of negative outcomes. Different studies have associated frailty syndrome with nutritional risk in community-dwelling, institutionalized and hospital settings, which reinforce the association between nutritional and functional status (5-9). Since frailty syndrome can be reversed, it is of fundamental importance to identify individuals displaying this condition in community settings, as well as in healthcare facilities, so they can receive appropriate treatment (10-12). However, the identification of frailty in clinical practice is rarely accomplished, due to issues related to time, physical space and professional support (13). Accordingly, difficulty is experienced in identifying frailty in the healthcare facilities of the Brazilian Unified Health System, both at the primary and secondary level of care (14, 15). As such, anthropometric measurements, as well as the identification of nutritional risk by screening tools, could be taken into consideration for such assessments, due to their low cost and practicality. Therefore, we intend to test the hypothesis that the identification of nutritional status, using anthropometric measures and the identification of nutritional risk by screening tools, present good discriminatory power to predict frailty and can be adopted an indirect tools to screen this syndrome. This study aims to investigate, in elderly individuals from a secondary care outpatient clinic in Brazil, the prevalence of frailty and pre-frailty and the discriminatory power of body mass index (BMI) and of the Mini-Nutritional Assessment (MNA) in identifying conditions of frailty and pre-frailty.

HIGH DISCRIMINATORY POWER OF NUTRITIONAL RISK, BUT NOT ANTHROPOMETRIC MEASUREMENTS

Methods

Population

This is a cross-sectional study of older adults (60+ years old) from a geriatric secondary care outpatient clinic located in the southeast of São Paulo city, SP, Brazil. The clinic forms part of the Brazilian Unified National Health System (SUS) of the Ministry of Health of Brazil sponsored by the Support Program for institutional Development (PROADI). Data were extracted from individuals' medical records, and evaluations were performed from 2011 to 2014. All patients signed an informed consent form and all procedures were conducted in accordance with the guidelines of the declaration of Helsinki and approved by the local ethics committee.

For the information attained from the medical records, we included those patients who had complete information regarding frailty, nutritional risk, and measurements of body weight and body height. Patients with the following conditions were excluded; presence of Parkinson's disease or stroke; identification of cognitive impairment (evaluated by the Mini-Mental State Examination, MMSE); patients in use of the medications, carbidopa, levodopa, donepezil hydrochloride and antidepressants. These exclusion criteria were based on those of the Cardiovascular health study conducted by Fried et al (2001) (16). The flow diagram of the study is presented in Figure 1.

Figure 1
Exclusion criteria and patient selection diagram
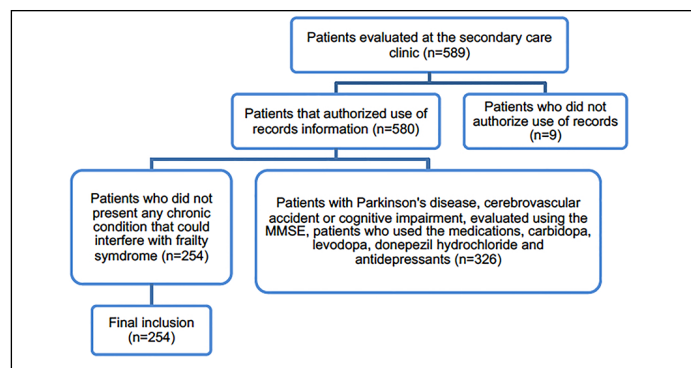
Evaluations extracted from the records

Frailty criteria were assessed according to Fried et al., with some modifications. Shrinking, weakness (assessed by handgrip strength), poor energy (evaluated using questions from the CES-D questionnaire) and slowness (assessed by gait speed analysis) were defined according to Fried's original study (4); in turn, energy expended with the exception of energy expended as physical activity, which was identified by the International Physical Activity Questionnaire (IPAQ) (short version), which considers a low activity level as less than 150 minutes of activity per week (17, 18). Pre-frailty was defined by the presence of one or two components and frailty as the presence of three or more of the five components (4).

Nutritional risk was determined using the MNA questionnaire (short form). The MNA contains 18 questions. According to the score obtained, the subject can be classified as "malnourished" (less than 17 points), "at risk of malnutrition" (scores of between 17 and 23.5 points), or "good nutritional status" (score of over 23.5 points) (19).

Body Mass Index (BMI) (weight/height^2) was computed for each patient; subjects were measured barefoot with light-weight clothing and in the Frankfourt plane. The anthropometric procedures were performed according to Lohman et al. (1988) (20). BMI was classified according to the Pan American Health Organization into three categories: "underweight" (less than 23.0 kg/m^2), "normal weight" (scores of between 23.0 and less than 28.0 kg/m^2) and "overweight" and "obese" (scores above 28.0 kg/m^2) (21).

Statistical procedures

The descriptive features of the sample were presented as mean and standard deviation (SD). Normality was tested with the Shapiro-Wilk test. The variables were compared according to the three categories of frailty (non-frail, pre-frail and frail) by one-way ANOVA and LSD post hoc test (continuous variables), and by the chi-square test (categorical variables). The Receiver Operating Characteristic (ROC) curves and their parameters [sensibility, specificity, area under curve (AUC) with 95% confidence interval (95%CI)] were used to identify a cut off point for the MNA, associated to frailty. The maximum Youden index (sensitivity + specificity -1) was computed to determine the most accurate MNA cut-off to reflect frailty. Statistical analyses were performed using the Statistica software (DELL version 13.0) and MedCalc software (version 16.8.4), and the significance level was set at 0.05.

Results

The initial sample included 589 individuals. Nine were excluded due to non-consent for participation in the research study and 326 were excluded due to the specified exclusion criteria. Therefore, 254 patients were included in the final analysis file, where 178 (70.0%) were female and 76 (30.0%) were male (Figure 1).

Data regarding frailty, BMI and nutritional risk are described in Table 1. The prevalence of frailty was 31.1% and of pre-frailty was 53.5%. The MNA identified 3.1% of the sample as malnourished, 35.4% at risk of malnourishment and 61.4% as well-nourished. BMI identified 39.4% of participants as overweight/obese and 19.9% as undernourished. Frail elders were older than non-frail and pre-frail. The mean values for BMI did not statically differ between groups, and frailty and pre-frailty were equally distributed among the different BMI classifications (Figure 2). Considering the MNA classification, results showed that pre-frail and frail patients are, in the majority, malnourished (Figure 3).

The MNA score, but not the BMI, presented significant

THE JOURNAL OF NUTRITION, HEALTH & AGING©

difference for the different frailty groups. As such, only the MNA values were investigated for their discriminatory power to identify pre-frailty and frailty. The pre-frailty ROC curve identified an MNA value of ≤25.0 as the best cut-off point for pre- frailty, while the AUC was 0.625 (sensitivity = 47.1; specificity = 76.9) and the youden index was 0.2398 (95%confidence interval = 0.1112 to 0.3203). When the discriminatory power of the MNA was examined for frailty, the best cut-off score was found to be ≤23.0, with an AUC of 0.812 (sensitivity=55.7; specificity=94.9), and youden index of 0.5057 (95% confidence interval = 0.3146 to 0.5946).

Table 1
Descriptive feature of the participants, according to frailty classification

	Non-frail (n=39)	Pre-frail (n=136)	Frail (n=79)	p-value
Age (years)	73.6 ±5.7[a]	75.3 ±7.2[a]	78.9 ±7.6[b]	0.10
Waist circumference (cm)	92.2 ±13.2	96.7 ±12.1	94.7 ±12.6	0.90
Calf circumference (cm)	34.4 ±3.0	34.6 ±4.0	33.2 ±4.4	0.30
BMI (Kg/m2)	26.4 ±5.0	27.7 ±5.3	26.7 ±5.1	0.80
MNA (score)	26.3 ±2.0[a]	24.8 ±3.4[b]	22.4 ±4.1[c]	<0.001
BMI Classification, n (%)				
Underweight	11 (23)	22 (46)	15 (31)	
Normal weight	13 (12)	58 (55)	35 (33)	
Overweight/obese	15 (15)	56 (56)	29 (29)	<0.001
MNA Classification, n (%)				
Malnourished	0 (0)	2 (25)	6 (75)	
At risk of malnourishment	5 (6)	42 (47)	43 (33)	
Well nourished	34 (22)	92 (59)	30 (19)	<0.001

All continuous variables data are represented in means with standard deviation. All discrete variables are represented in numbers and percentages. BMI: Body Mass Index; MNA: Mini-Nutritional Assessment. The same superscript letters throughout the groups represent no significant difference between the groups, and different superscript letters represent significant statistical differences.

Figure 2
Distribution of non-frail, pre-frail and frail elderly individuals ina geriatric outpatient clinic, according to BMI classification
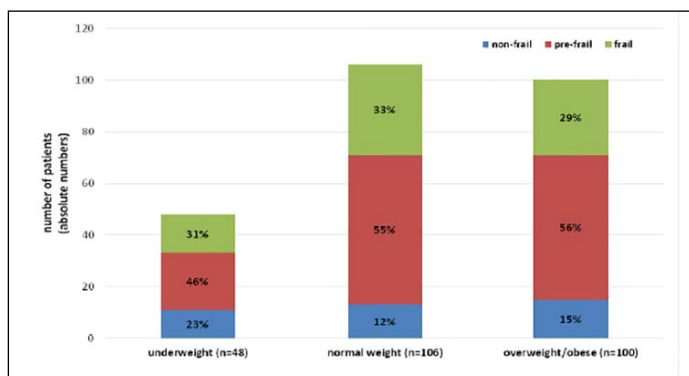

Figure 3
Distribution of non-frail, pre-frail and frail elderly individuals in a geriatric outpatient clinic, according to MNA classification
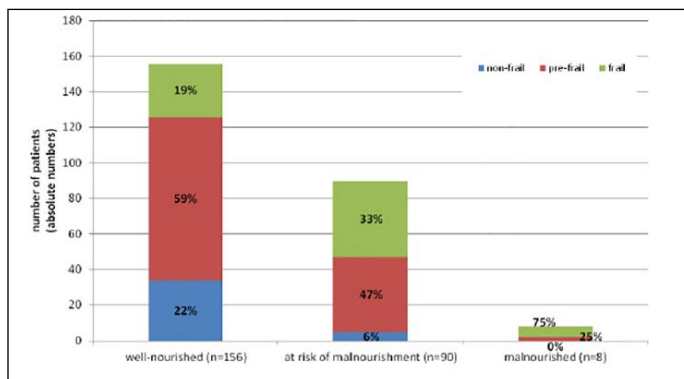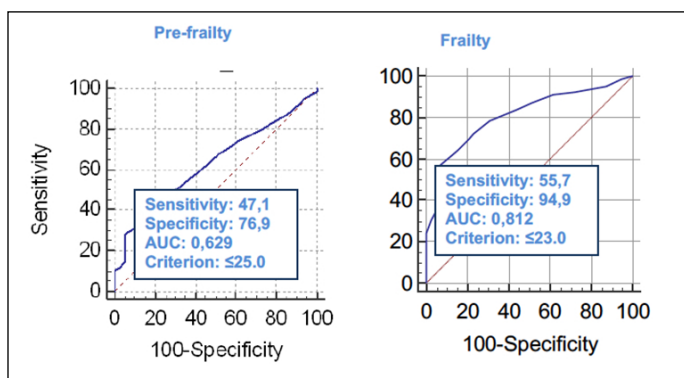

Figure 4
ROC curves demonstrating the discriminatory power of nutritional risk for identifying pre-frailty and frailty conditions

Discussion

Our aim was to identify the prevalence of frailty and pre-frailty in a sample of patients attended at a Brazilian geriatric secondary care outpatient clinic, and to test the discriminatory power of nutritional risk (determined by the MNA score) and body mass (from BMI) to identify frailty and pre-frailty in this population. A major finding of the study was that the majority of the patients were pre-frail, and about 30% were frail. The majority of the participants presented risk of malnourishment. Frail patients represented 75% of the malnourished individuals. The MNA demonstrated significant discriminatory power to identify frailty, but not to identify pre-frailty. According to the ROC curve, an MNA score of ≤23.0 has the best sensitivity and specificity to detect frailty. BMI was not statistically different according to frailty status and, therefore, was not investigated by ROC curve.

Our results suggest that there is a higher prevalence of frail elderly individuals in secondary health care, compared to other studies of community-dwelling elderly. For instance, a Brazilian study, FIBRA, showed a lower prevalence of frailty

in Belo Horizonte city-MG, where the prevalence of frailty was 8.7% and pre frailty was 46.3% (22). A multicenter study performed in the cities of Campinas, Belém, Parnaíba, Poços de Caldas, São Paulo (Ermelino Matarazo district) and Ivotí, reported 9.17% of participants as demonstrating frailty and 51.8% pre frailty (23). A more recent study in the city of Uberaba, indicated that frailty in the community-dwelling elderly was prevalent in 15.9% and pre frailty occurred in 52.2% (24). Among studies from other countries, we found only one study published with outpatient clinic patients in the Netherlands. This study showed higher prevalences of frailty (46%) and nutritional risk (56%) as well as undernutrition (15%) than our study (25). We suggest that this difference may be due to the different evaluation of frailty used in the Netherlands, which included information about incontinence, mobility, and impairment in basic and instrumental activities of daily living.

The link between MNA and frailty has been consistently reinforced in different studies of the elderly at different health care levels, supporting the hypothesis of this study. For instance, Bollwen et al (2014) showed a higher prevalence of risk of malnourishment in frail community elders, even though this population did not present a significant frequency of malnourished patients. Similarly, Dorner et al (2014) found that malnourishment was associated to frailty in hospitalized elderly patients.

With regards to the ROC analysis, an Australian study with hospitalized elders showed, from ROC, an AUC of 0.780 for MNA and a cut-off point for frailty of 17.5 (5). The FRALLE study, which investigated community-dwelling elders from Spain, also showed an AUC=0.80 for the MNA when identifying frailty (26).

Some limitations of our study should be highlighted. We studied a convenience sample, which does not allow the extrapolation of data to the general population. In addition, cross-sectional studies cannot indicate the cause and effect of the variables. However, our research was able to identify the prevalence of frailty and its association with an elderly population in a secondary health care setting.

In conclusion, the MNA was capable of indicating frailty, but not pre-frailty, in elderly individuals in a secondary health care setting. BMI did not show significant predictive power for frailty or pre-frailty. As such, MNA can be adopted as an indirect tool to screen only frailty syndrome.

Conflict of interest disclosures: MSZ, RMRD, FGMF, MSC, LDNM and SMLR declare that they have no conflicts of interest.

References

1. Marin-Leon L, Segal-Correa AM, Panigassi G, Maranha LK, Sampaio Mde F, Perez-Escamilla R. Food insecurity perception in families with elderly in Campinas, Sao Paulo, Brazil. Cad Saude Publica 2005;21(5):1433-40.
2. Souza BFdNJdM-L, Leticia MARIN-LEON Camargo, Daniele Flaviane Mendes Segall-Corrêa, Ana Maria. Demographic and socioeconomic conditions associated with food insecurity in households in Campinas, SP, Brazil Rev Nutr 2016;29(6):845-57.
3. Frasca D, Blomberg BB. Adipose Tissue Inflammation Induces B Cell Inflammation and Decreases B Cell Function in Aging Front Immunol. 2017;8:1003.
4. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. Journal of Gerontology 2001;56(03):M146-M56.
5. Dent E, Visvanathan R, Piantadosi C, Chapman I. Use of the Mini Nutritional Assessment to detect frailty in hospitalised older people. J Nutr Health Aging 2012;16(9):764-7.
6. Bollwein J, Volkert D, Diekmann R, Kaiser MJ, Uter W, Vidal K, et al. Nutritional status according to the mini nutritional assessment (MNA(R)) and frailty in community dwelling older persons: a close relationship. J Nutr Health Aging 2013;17(4):351-6.
7. Smit E, Winters-Stone KM, Loprinzi PD, Tang AM, Crespo CJ. Lower nutritional status and higher food insufficiency in frail older US adults. Br J Nutr 2013;110(1):172-8.
8. Dorner TE, Luger E, Tschinderle J, Stein KV, Haider S, Kapan A, et al. Association between nutritional status (MNA(R)-SF) and frailty (SHARE-FI) in acute hospitalised elderly patients. J Nutr Health Aging 2014;18(3):264-9.
9. Martinez-Reig M, Gomez-Arnedo L, Alfonso-Silguero SA, Juncos-Martinez G, Romero L, Abizanda P. Nutritional risk, nutritional status and incident disability in older adults. The FRADEA study. J Nutr Health Aging 2014;18(3):270-6.
10. Ballard J, Mooney M, Dempsey O. Prevalence of frailty-related risk factors in older adults seen by community nurses. J Adv Nurs 2013;69(3):675-84.
11. Duarte MC, Fernandes M, Rodrigues RA, Nobrega MM. Prevalence and sociodemographic factors associated with frailty in elderly women. Rev Bras Enferm 2013;66(6):901-6.
12. Shafto MA, Tyler LK, Dixon M, Taylor JR, Rowe JB, Cusack R, et al. The Cambridge Centre for Ageing and Neuroscience (Cam-CAN) study protocol: a cross-sectional, lifespan, multidisciplinary examination of healthy cognitive ageing. BMC Neurol 2014;14:204.
13. The Orlando Frailty Cobference Group. Raising awarness on the urgent nedd to implment frailty into clinical practice. J Frailty Aging 2013;2(3):121-4.
14. Erdmann AL, Andrade SRd, Mello ALSFd, Drago LC. Secondary Health Care: best practices in the health services network. Rev Latino-Am. 2013;21(spe):131-9.
15. Ferreira FPC, Bansi LO, Paschoal SMP. Serviços de atenção ao idoso e estratégias de cuidado domiciliares e institucionais. Rev Bras Geriatr Gerontol 2014;17(4):922-6.
16. Fried LP, Ferrucci L, Darer J, Williamson JD, Anderson G. Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. J Gerontol A Biol Sci Med Sci 2004;59(3):255-63.
17. Matsudo S, Araújo T, Matsudo V, Andrade D, Andrade E, Oliveira L, et al. Questionário internacional de atividade física (IPAQ): estudo de validade e reprodutibilidade no Brasil. Rev Bras Ativ Fís Saúde 2001;6(2):5-18.
18. Knuth A, Bacchieri G, Victora C, Hallal P. Changes in physical activity among Brazilian adults over a 5-year period. J Epidemiol Community Health 2010;64(7):591-5.
19. Abellan Van Kan G, Vellas B. Is the Mini Nutritional Assessment an appropriate tool to assess frailty in older adults? J Nutr Health Aging 2011;15(3):159-61.
20. Lohman TG, Roche AF, Martorell R. Anthropometric standardization reference manual, Human Kinetics Book, Illinois, 1988.
21. Lebrão M, Duarte Y. Organização Pan-Americana de Saúde-OPAS/OMS, SABE-Saúde, Bem-Estar e Envelhecimento - O Projeto SABE no Município de São Paulo: uma abordagem inicial, Athalaia Bureau, São Paulo, 2003.
22. Vieira RA, Guerra RO, Giacomin KC, Vasconcelos KSS, Andrade ACdS, Pereira LSM, et al. Prevalência de fragilidade e fatores associados em idosos comunitários de Belo Horizonte, Minas Gerais, Brasil: dados do Estudo Fibra. Cad Saúde Pública 2013;29(8):1631-43.
23. Moretto MC, Alves RMdA, Neri AL, Guariento ME. Relação entre estado nutricional e fragilidade em idosos brasileiros. Rev Soc Bras Clín Méd 2012;10(4):267-71.
24. Belisario MS, Dias FA, Pegorari MS, Paiva MM, Ferreira P, Corradini FA, et al. Cross-sectional study on the association between frailty and violence against community-dwelling elderly people in Brazil. Sao Paulo Med J. 2018;136. p. 10-9.
25. Kurkcu M, Meijer RI, Lonterman S, Muller M, de van der Schueren MAE. The association between nutritional status and frailty characteristics among geriatric outpatients. Clin Nutr ESPEN 2018;23:112-6.
26. Jürschik P, Botigué T, Nuin C, Lavedán A. Association between Mini Nutritional Assessment and the Fried frailty index in older people living in the community. Med Clin (Barc) 2014;143(5):191-5.