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Identification of the Frailty Syndrome in the Elderly - A Cross-Sectional Study

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Abstract

Purpose: The aim of the study was characterized the frailty syndrome in community-dwelling elderly individuals in Brazil, according to the main sociodemographic, physical, and mental health variables.

Methods: This is a cross-sectional study with an observational design that included 80 older adults aged equal to or greater than 60 years old, of both genders that reached the score stipulated on the MMSE. We assessed the components of frailty phenotype. Data were collected from households and were used a structured questionnaire containing socio-demographic variables (age, gender, marital status, education, morbidities, occurrence or non-occurrence of falls). We evaluated the physical activity level, muscle strength and gait speed.

Results: During the frequency distribution of frailty phenotype items, we observed that, regarding weight loss, exhaustion and slow gait speed, there were significant differences among the pre-frail, frail, and non-frail groups, but there were no differences between the pre-frail and frail groups. Therefore, the results indicate the frail group with 100% frequency for muscle weakness, and 83.4% for low physical activity level.

Conclusion: The results suggest that, muscle weakness, low physical activity, low level of education and comorbidities are decisive for the classification of pre-frail, frail and not fragile elderly.

Keywords: Frailty; Muscle; Functional Performance

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Introduction

In the aging process, high rates of chronic degenerative diseases associated to external factors, like widowhood and death of family members, are observed. These factors may interfere in the autonomy and functional independence of the elderly individual, predisposing this person to develop the Frailty Syndrome [1]. This syndrome can lead to consequences that range from vulnerability to adverse clinical outcomes such as falls, disability, institutionalization, hospitalization, and in more severe cases, death [1].

The Frailty Syndrome (FS) has been defined as a clinical syndrome characterized by decreased physiologic reserves and imbalance in multiple systems, with the main changes related to this process being the sarcopenia, neuroendocrine dysregulation and immune dysfunction; these three changes are named triad of frailty [2,3].

The classification of frailty results from the applicability of the phenotype of frailty proposed by Fried *et al.*, [2], and is based on data from the Cardiovascular Health Study. According to the phenotype, an elderly person is frail when features three or more components, pre-frail when features one or two components with high risk of developing the syndrome, and non-frail when there is no impairment [4].

The studies of Lowry *et al.*, [5], and Diez-Ruiz *et al.*, [6], emphasize the importance of the study of this syndrome in the elderly population due to the onset of adverse events that significantly

compromise the quality of life of the elderly person and their family members, in addition to the increase in spending on health care. Therefore, the purpose of this study is to identify elderly individuals with the frailty syndrome and classify them according to the phenotype of frailty, as well as relate the sociodemographic variables with the occurrence or non-occurrence of falls and the presence of comorbidities [7].

Material and Methods

This is a cross-sectional study with an observational design that included 80 elderly individuals with ages equal to or greater than 60 years old, of both sexes. It was approved by the Research Ethics Committee of the Federal University of Mato Grosso do Sul, MS - Brazil, notion number 180.900, according to the resolution 466/12 of the National Health Council. The structuring of the research met STROBE recommendations [7].

The volunteers were registered at the Basic Health Unit (BHU), signed the Informed Consent Form (ICF), reached the minimum score (12 points) in the Mini-Mental State Examination – MMSE [8], with the use of gait assistive devices allowed when necessary, except wheelchair users and the ones that were institutionalized or bedridden. This study was done between January and April 2016. Inclusion criteria: be 60 years of age or older, of both genders and be able to communicate verbally. Exclusion criteria: have a medical diagnosis of dementia, the MMSE score lower than 12 points, refused to participate; bedridden and up to 6 months post-surgery. The outcomes were the identification and classification of the frailty syndrome according to the fragility phenotype.

Previously, the researchers were trained so that there was homogeneity during the recording of information. The data were collected from households, and they utilized a structured questionnaire containing sociodemographic variables (age, sex, marital status, education, morbidities, occurrence or non-occurrence of falls).

In the participants that reached the score stipulated on the MMSE it was performed the evaluation of the components of the phenotype of frailty, following the protocol recommended by Fried *et al.*, [2]. The item weight loss was evaluated by asking the volunteers if they unintentionally lost 4, 5 kg or a percentage of body weight above 5% in the last 12 months, in other words, if they lost weight with no diet or exercises.

In order to verify the presence of exhaustion, two questions from the Center for Epidemiologic Studies – Depression (CES-D) scale were applied: "I felt I had to make an effort to perform common tasks" and "I could not get going", with the following responses: never or rarely = 0; occasionally = 1; frequently = 2; always = 3. Elderly individuals who scored 2 or 3 on any one of the two questions, scored for the frailty criteria [8].

The International Physical Activity Questionnaire (IPAQ) was applied to evaluate the physical activity level, which estimates the weekly amount of time spent in moderate and vigorous-intensity physical activities, in different everyday contexts [9].

Muscle strength was measured in Kgf with the Jamar® handgrip dynamometer, with the result adjusted by sex and BMI [10]. Three successive measures were performed, with intervals of 60 seconds, to avoid muscle fatigue. The final result was obtained by calculating the arithmetic mean of the three registered values.

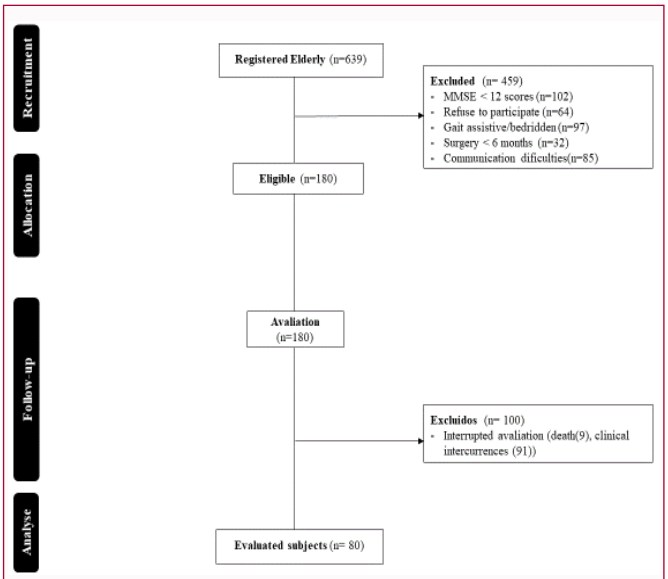

Figure 1: Flow chart of participant selection according to STROBE.

During the evaluation of the last item of the phenotype, slow gait speed, it was performed a measurement of the time the individual spent to walk a distance of 4, 6m, wearing their usual footwear and gait assistive device, if necessary, on flat terrain with good structure. The reference values for these last two variables followed the recommendations of the European Consensus on Definition and Diagnosis on Sarcopenia [11].

Individuals who scored in three or more components of the phenotype were classified as frail and the ones who scored in one or two components were considered pre-frail; in other words, they were more likely to develop the syndrome. As potential risks of bias we had the absence of sample calculation, because all elderly enrolled in the BHU were included in this study; as well as, the loss of continuity during the trial, due to death and clinical intercurrences of some subjects.

Statistical analysis

The sample consisted of all the elderly enrolled in de BUH who met the eligibility criteria of the study and accepted to participate of the study.

Goodman test has been applied to compare two or more proportions of multinomial groups/populations, and to analyze linear contrasts among and within multinomial proportions. In the present study, there were 2 variables, and both were measured by categories, usually at the nominal level, when Goodman test was applied. Previously, groups' homogeneity was analyzed from Pearson's contingency and Cramer's coefficients, respectively. All the results were discussed for 5% of statistical significance.

Results

The evaluated subjects (n=80; Figure 1) met the pre-established criteria in the research and reached a score higher than the one established by the MMSE, and were considered able to continue in the research, with the overall average score on the MMSE being 23,97 (±3, 20) points; therefore these individuals were considered 100% of the sample.

The average age of participants was 71, 18±7, 71 years old, with

Table 1: Descriptive analysis of sociodemographic data.

Variable	Distribution by categories	n	%
Age	60-69	33	41,25
	70-79	37	46,25
	80 or, older	10	12,5
Sex	Female	58	72,5
	Male	22	27,5
Marital Status	Married	47	58,75
	Single/Divorced/Widowed	33	41,25
Occupation	Retiree/Pensioner	65	81,25
	"Househusband/Housewife"	9	11,25
	Other	6	7,5
Education (years)	0	8	10
	1-7	38	47,5
	8-11	29	36,25
	12 or more	5	6,25
Live alone	Yes	5	6,25
	No	75	93,75

Table 2: Distribution of the frailty profile.

Frailty profile	n	%
Non-frail	17	21,25
Pre-frail	45	56,25
Frail	18	22,5

predominance of the female sex (n=58; 72, 5%). The sociodemographic data are described on Table 1.

Regarding the distribution of the frailty profile, it was observed that there was a prevalence of individuals classified as pre-frail (56, 25% of the sample), according to the Table 2.

The distribution of the variables within the phenotype is described on Table 3.

In the analysis of the frequency distribution of the items of the frailty phenotype, it was observed that with regard to weight loss, exhaustion and slow gait speed, there was significant difference between the pre-frail, frail, and non-frail groups, but no difference between the pre-frail and frail groups.

In relation to muscle weakness and the presence of low physical activity level, there was significant difference between the three study groups, being higher in the frail group with 100% frequency for muscle weakness and 83, 4% for low physical activity level; the pre-frail group had a frequency of 42, 2% for muscle weakness and 31, 1% for low physical activity level. The non-frail group had 0% frequency for muscle weakness and low physical activity level.

In the correlation of sociodemographic information with the frailty profile (Table 4), intergroup analysis, there was statistically significant difference only in education between the non-frail, pre-frail and frail groups. In the sample, 47, 5% did not finish elementary school, with a higher occurrence in the pre-frail group when compared to the non-frail group.

The relationship between fall, morbidity and frailty is described on Table 5. In the study population the occurrence of fall in the last 12

Table 3: Frequency distribution of the items of the frailty phenotype.

Items of the phenotype	Non-frail	Pre-frail	Frail
	n (%)	n (%)	n (%)
Weight loss			
No	17(100,0) ^{Bb}	33(73,4) ^{Ba}	10(55,6) ^{Aa}
Yes	0(0,0) ^{Aa}	12(26,6) ^{Ab}	8(44,4) ^{Ab}
Muscle weakness			
No	17(100,0) ^{Bc}	26(57,8) ^{Ab}	0(0,0) ^{Aa}
Yes	0(0,0) ^{Aa}	19(42,2) ^{Ab}	18(100,0) ^{Bc},
Exhaustion			
No	17(100,0) ^{Bb}	38(84,5) ^{Ba}	12(66,7) ^{Aa}
Yes	0(0,0) ^{Aa}	7(15,5) ^{Ab}	6(33,3) ^{Ab}
Slow gait speed			
No	17(100,0) ^{Bb}	23(51,2) ^{Aa}	6(33,3) ^{Aa}
Yes	0(0,0) ^{Aa}	22(48,8) ^{Ab}	12(66,7) ^{Ab}
Low physical activity level			
No	17(100,0) ^{Bc}	31(68,9) ^{Bb}	3(16,6) ^{Aa}
Yes	0(0,0) ^{Aa}	14(31,1) ^{Ab}	15(83,4) ^{Bc}

A, B: p<0, 05 for vertical comparisons; a,b,c: p<0,05 for horizontal comparisons; different characters reveal significant differences, with A<B e a<b<c. Goodman test to contrast between and within multinomial populations.

Table 4: Absolute and relative distributions of sociodemographic data and correlation with the frailty profile.

Variable	Non-frail	Pre-frail	Frail
	n (%)	n (%)	n (%)
Age			
60-69	7(41,3) ^{Ba}	22(48,9) ^{Ba}	4(22,2) ^{Aa}
70-79	9(52,9) ^{Ba}	18(40,0) ^{Ba}	10(55,6) ^{Aa}
80 or older	1(5,88) ^{Aa}	5(11,1) ^{Aa}	4(22,2) ^{Aa}
Sex			
Female	9(52,9) ^{Aa}	34(75,5) ^{Ba}	15(83,4) ^{Ba}
Male	8(47,1) ^{Aa}	11(24,5) ^{Aa}	3(16,6) ^{Aa}
Marital Status			
Married	13(76,5) ^{Ba}	24(53,4) ^{Aa}	10(55,5) ^{Aa}
Single/Divorced/Widowed	4(23,5) ^{Aa}	21(46,6) ^{Aa}	8(44,5) ^{Aa}
Occupation			
Retiree/Pensioner	13(76,4) ^{Ba}	37(82,4) ^{Ba}	15(83,4) ^{Ba}
"Househusband/Housewife"	3(17,6) ^{Aa}	4(8,8) ^{Aa}	2(11,1) ^{Aa}
Other	1(6,0) ^{Aa}	4(8,8) ^{Aa}	1(5,5) ^{Aa}
Education (years)			
0	3(17,6) ^{Aa}	4(8,8) ^{Aa}	1(5,5) ^{Aa}
1-7	2(11,9) ^{Aa}	27(60,0) ^{Bb}	9(50,0) ^{Bab}
8-11	9(52,9) ^{Aa}	12(26,2) ^{ABa}	8(44,5) ^{Ba}
12 or more	3(17,6) ^{Aa}	2(4,4) ^{Aa}	0(0,0) ^{Aa}
Live alone			
No	16(94,2) ^{Ba}	41(91,2) ^{Ba}	18(100,0) ^{Ba}
Yes	1(5,8) ^{Aa}	4(8,8) ^{Aa}	0(0,0) ^{Aa}

A, B: p<0, 05 for vertical comparisons, a,b,c: p<0,05 for horizontal comparisons, different characters reveal significant differences, with A<B e a<b<c. Good man test for contrast between and within multinomial populations.

Table 5: Absolute and relative distributions of the variables fall and presence of morbidities and correlation with the frailty profile.

Clinical variables	Non-frail	Pre-frail	Frail	Total n (%)
	n (%)	n (%)	n (%)	
Falls				
No	11(64,7) Aa	27(60,0) Aa	80(44) Aa	46(57,5)
Yes	6(35,3) Aa	18(40,0) Aa	10(56) Aa	34(42,5)
Presence of morbidities				
None	5(29,4) Aa	3(6,6) Aa	2(11,1) Aa	10(12,5)
1	4(23,5) Aa	23(51,2) Ab	6(33,3) Ab	33(41,2)
2 or more	8(47,1) Aa	19(42,2) Aab	10(55,6) Ab	37(46,3)

A, B: p<0, 05 for vertical comparisons, a,b,c: p<0,05 for horizontal comparisons, different characters reveal significant differences, with A<B e a<b<c. Good man test for contrast between and within multinomial populations.

months was 42, 5% (n=34) and the non-occurrence of fall was 57, 5% (n=46); in the intergroup analysis, there was no significant difference in the number of falls between the study groups.

Regarding the presence of morbidities, 12, 5% (n=10) of the subjects did not report; 41, 2% (n=33) registered only a dysfunction; 46, 3% (n=37) had two or more morbidities, with the most cited being cardiovascular, respiratory, diabetes and orthopedic/rheumatological disorders, respectively.

The report of only one comorbidity was significantly higher in the pre-frail and frail groups; however there was no significant difference between the pre-frail and frail groups. On the other hand, the association of two or more comorbidities was significantly higher in the frail group, to the non-frail, with no significant difference to the pre-frail group.

Discussion

In this study, the average age (71, 18±7, 71 years old) and the predominance of the female sex are in accordance with the studies of Amaral et al., [12], that in a sample of 300 individuals had an average age of 74, 3 (±6, 9) years old and also the predominance of the female sex (202; 67, 3%). Another study [13], with a sample of 816 elderly individuals and age group varying from 65 to 75 years old, the women were predominant. Lustosa et al., [14], had an average age of 70, 1±7, 3 years old in their studies, the subjects were mostly women (111; 86, 3%), and the majority was classified as pre-frail (58, 7%) which corroborates our study, because it was verified that 56, 25% of the study population was classified as pre-frail.

In the research of Ferrer et al., [15], with a sample of 273 community-dwelling elderly individuals it was verified that 54, 2% (148) of the elderly were pre-frail. Amaral et al., [12], also identified, in the 300 elderly individuals they studied, that 54, 3% (163) were in a pre-frailty condition. In the study of Rede FIBRA, Neri et al., [16], developed in seven Brazilian cities, 3.478 elderly individuals (65 years old or older) were selected, of which 9, 1% were frail, 51, 8% pre-frail, and 39, 1% non-frail.

The slow gait speed, exhaustion and weight loss there was significant difference between the pre-frail, frail and non-frail groups. Verghese *et al.*, [17], with a sample of 655 elderly individuals, concluded that the average of gait speed was 0, 94±0, 23 m/s; in Madrid, a sample consisted of 1.327 individuals with ages of 65 or older, average age of 75, 41±7, 41 years old, and gait speed inferior to 0, 8 m/s was found in 42, 6% of the cases and in 56, 4% of the people with age ≥75 in the study of Castell *et al.*, [18]. The gait speed has been used as a tracking measure that reflects the integration of health, disease, fitness, and emotional state of the elderly.

In the study of Drey *et al.*, [19], in which a total of 298 elderly individuals were evaluated, the exhaustion was more prevalent with 24% and the third was slow gait speed (8%), followed by weight loss (2%). Amaral *et al.*, (2013) pointed out exhaustion (38, 7%) and unintentional weight loss (30, 7%), followed by slowness (19, 0%).

These three reports may be related to muscle mass loss, considering the substitution of muscle tissue by fat and fibrosis, which may lead the elderly to other difficulties in physical performance: deficits in balance, flexibility and muscle strength, increased risk of falls, morbidities and mortality [2,20,21].

In the present study, there was significant difference between the three study groups in muscle weakness and low physical activity level. The frail group obtained a frequency of 100% of muscle weakness and 83, 4% for low physical activity level; the pre-frail group had a frequency of 42, 2% of muscle weakness and 31, 1% for low physical activity level. The non-frail group had 0% frequency of muscle weakness and low physical activity level.

Tribess and Oliveira [22] in a systematic review about the frailty syndrome in the elderly reported that in the 18 studies that were analyzed they found significant differences between the groups of elderly individuals, according to the characteristics of frailty, indicating that the ones with greater frailty had muscle weakness and low physical activity level.

The FS is a state of vulnerability to stressors that cause a decrease of physiologic reserves, with consequent impairment of homeostasis. The factors involved include neuromuscular disorders, deregulation of the neuroendocrine system, immune system dysfunction, chronic malnutrition, sarcopenia and decline in physical activities [2,3].

Muscle weakness can decrease an individual's ability to perform activities of daily living and could also lead the individual to a condition of dependence, demonstrating that muscle strength training is a variable that can determine the classification of the phenotype of frailty [21,23].

In this present research, the only sociodemographic factor that showed significant statistical difference was the education level, which was lower in the pre-frail group while compared to the non-frail group. Income and education do not act directly in the physiopathology of frailty, but they strongly interfere in the lifestyle and quality of life of the individual and, consequently, in the socioeconomic status, which may have influence on the development of frailty [24]. In the study of de Duarte *et al.*, [25], while analyzing the correlation between the raw scores of frailty and income, using the Chi-Squared test, Kruskal-Wallis, they found a statistically significant correlation between the frailty and the years of education, and also frailty and income of the elderly person and family. Mello *et al.*, [26], conducted a systematic review about the influence of the main sociodemographic and psycho-behavioral factors, health condition, nutritional status and lifestyle associated to frailty in the elderly. Regarding the results of the main sociodemographic factors, the authors observed that there was a positive association of frailty with: age, female sex and race/black skin color, and a negative association with: education, income and cognitive function.

In the relationship between fall, morbidity and frailty, the

scholars have developed several studies about the importance of these variables in the quality of life of elderly individuals, however, our results indicated that in the last 12 months 42, 5% (n=34) reported an episode of fall, and 57, 5% (n=46) the non-occurrence of falls; in the intergroup analysis, there was no significant difference in the number of falls between the study groups.

The literature suggests that the occurrence of falls and the presence of frailty are related bi-directionally, since the fall may lead the elderly person to develop frailty, and the frailty can also lead to a fall [25]. A study developed in India with 300 elderly in the age group of 60-97 years old, 31% reported having an episode of falls, and 87% reported 1 to 3 falls [27]. A total of 150 elderly individuals that were seen in Basic Health Units were evaluated. Their ages varied from 60 to 96 years old, with average age of 71, and from the ones who had falls, about 71, 4% experienced 1 or 2 falls in the last twelve months [28].

The results of the present research showed higher prevalence of individuals with two or more comorbidities in the frail group, with the most cited being diabetes, cardiovascular, respiratory, orthopedic and rheumatologic disorders.

With regards to the diseases associated to frailty, cardiovascular disease and the presence of two or more comorbidities are relevant conditions for the occurrence of this syndrome in the elderly [2,26].

This result can be justified by the fact that frailty is determined by immune dysfunction, neuroendocrine dysregulation and chronic inflammatory processes [29]. Some researchers support the hypothesis that cardiovascular disease and some comorbidities are related to atherosclerosis, a state of chronic inflammation that could result in systemic catabolism, besides other pathophysiological changes that could contribute to the clinical manifestation of the frailty [2].

Santiago & Mattos [30] observed that the following factors were associated to frailty in institutionalized elderly individuals: advanced age, illiteracy, comorbidities and polypharmacy. Fragility and comorbidity are different clinical manifestations of two processes related to aging, namely decreased functional reserves and accumulation of pathological processes. However, brittleness and comorbidity often overlap in the elderly and compromise the quality of life and functional status.

Regarding the limitations of this study, the results presented are specific to the population studied, and the most difficulty was obtaining a more significant sample, due to the clinical intercurrences characteristic of this population.

Conclusion

Based on the results of this study, muscle weakness, low physical activity, low level of education and comorbidities are decisive for the classification of pre-frail, frail and not fragile elderly individuals. Therefore, these factors should be considered in the development of preventive intervention programs, and therapy for individuals with frailty syndrome.

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