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FACTORS ASSOCIATED WITH FRAILTY SYNDROME IN OLDER ADULTS

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Abstract: *Objective:* Frailty is a common geriatric syndrome, characterized by a decrease in energy reserve and stress resistance, resulting in an accumulated decline of multiple physiological systems and greater vulnerability. Frailty syndrome has a multifactorial etiology involving a biological basis associated with sociobehavioral factors. We verify the association of frailty syndrome with family functionality level, nutritional status and medication adherence in older adults. *Design:* Observational and analytical study. *Setting and Participants:* Conducted at ambulatory the university hospital, with patients aged 60 years or older. *Measurements:* Cognitive function was measured using the Mini-Mental State Examination (MMSE); nutritional status was evaluated using the Mini Nutritional Assessment (MNA) and Body Mass Index, BMI; the 5-item FRAIL scale was used for frailty screening; family functioning was assessed using the Family APGAR Index, which evaluates Adaptability, Partnership, Growth, Affection, and Resolve; Self-reported medication adherence was measured by the eight-item Morisky Medication Adherence Scale (MMAS-8). *Results:* The study involved 308 older adults, with a mean age of 70.40 years, There was an association between frailty and highly dysfunctional family with an OR of 5.9 (95% CI 1.9-18.5)($p<0.05$), nutritional risk assessed by BMI, where low weight presented an OR of 2.5 (95% CI 1.1-5.8) and obesity an OR of 2.8 (95% CI 1.1-7.0)($P <0.05$) and a nutritional risk assessed by MNA with an OR 6.3(95% CI 1.9-20.4) and low medication adherence with an OR of 8.9 (95% CI, 3.6-21.6)($P = 0.01$). *Conclusion:* Frailty syndrome is associated with high levels of family dysfunction, nutritional risk and poor medication adherence amongst older people.

Key words: Family relationships, medication adherence, nutritional status, depressive symptoms.

Introduction

The progressive increase in the population of older adults in Brazil has presented fresh challenges to the health sector. Several clinical conditions expose older adults to a state of vulnerability. Within this context, frailty syndrome (FS) is particularly outstanding (1), and results in diminished energy reserves and reduced resistance to stressors. Its identification and classification are made up of 5 phenotypes: unintentional weight loss, self-reported fatigue, reduced handgrip strength, a decrease in walking speed and low levels of physical activity. (2)

Decreased basal metabolic rate, a redistribution of body mass, changes in sensory perception, and decreased sensitivity to thirst are frequent changes in older people. These alterations affect the nutritional status, either through calorie and nutrient deficiencies, or caloric excess, thereby making older adults more susceptible to nutritional risk (3). Studies indicate that malnutrition leads to a negative cycle in FS and assessing the nutritional status assumes an important function in providing appropriate nutritional intervention (4).

Changes due to aging may also affect the functional capacity of older adults and generate a greater need for help from third parties or family (5). Considering the family as the main care provider for older people, the manner in which each family system «functions» is decisive in providing either the best or the worst care for this population (6, 7).

With advancing age, an increase in the prevalence of chronic diseases becomes more frequent, which often requires a greater use of medications. The complexity of therapeutic regimens, reduced autonomy, low schooling, and polypharmacy may be cited as risk factors for non-adherence to medication within this population (8, 9). Thus, identifying the degree of medication adherence is fundamental in investigating its impact on clinical outcomes (10).

Frailty syndrome is considered reversible in its initial stages, and may be treated and prevented. Therefore, a better understanding of the factors involved in its progression is of the utmost importance (11). Understanding the often-neglected family context may benefit the care provided to older adults and facilitate the identification of their health needs, since the presence of family dysfunction may result in a poor provision of care with regard to nutrition and taking medications. The objective of this article is to verify the association of FS with the level of family function, the nutritional status, and the medication adherence of older adults attending specialized outpatient clinics.

Materials and methods

This was an observational, quantitative, cross-sectional study. The study included older adults selected by spontaneous demand from the specialized outpatient clinics, at a tertiary center. Inclusion criteria were defined as being aged 60 years or over, of either sex with a score equal to or greater than 17 in the Mini-Mental State Examination (MMSE) (12, 13).

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Exclusion criteria were being unable to walk and cognitive impairment. All participants signed the informed consent forms, and the study was approved by the Research Ethics Committee at UPE (50159615.7.0000.5207).

The sociodemographic profile was obtained through an adapted questionnaire including: sex (male and female); age (in complete years); marital status (with and without partner); family arrangement (alone, spouse, relatives and others); schooling (years of formal study); income (retirement, other sources of income and no retirement) and self-reported morbidities.

Frailty status was assessed using the five frailty phenotype indicators, described by Fried et al (2): 1) Unintentional weight loss: Indicating weight loss greater than or equal to 4.5kg or greater than or equal to 5% of body weight, assessed through self-reporting. 2) Self-reported fatigue: assessed with 2 questions, referring to items 7 and 20 from the Center for Epidemiological Studies Depression Scale (CES-D) (14). 3) Walking speed: assessed by measuring the time taken in seconds to walk 4.6 meters. The cutoff points were determined by the 80th percentile of the time, adjusted by sex and height (in meters). 4) Grip strength: assessed with the handgrip strength test using a Saehan® portable hydraulic hand dynamometer, adjusted for gender and body mass index (BMI). 5) Level of physical activity: The Physical Activity Questionnaire for older adults was composed of 20 questions, 7 on the practices of systematic physical activities, 7 on domestic tasks/heavy work, and 6 on social and leisure activities (15). Participants were classified as not frail (met none of the frailty criteria), pre-frail (met one or two criteria), or frail (met three or more criteria) according to the cutoffs described (2).

To evaluate the level of family function we used the Family APGAR, which is an instrument composed of semi-open questions in order to identify satisfaction with current family function and support provided by his/her family. The items are related to the following components: Adaptability, Partnership, Growth, Affection, and Resolve The response options were: (0) Hardly Ever, (1) Some of the time or (2) Almost Always and the final total representation corresponded to a level of family function: (0 to 4 – a severely dysfunctional family, 5 and 6 – a moderately dysfunctional family and 7 to 10 – a highly functional family) (16).

Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8), which consists of 8 questions, the first 7 being dichotomous items (yes/no) and the final question presented on a Likert scale. The degree of medication adherence is determined according to the score obtained from the sum of all responses. Individuals were classified as high adherers (8 points), medium adherers (6 to 8 points) and low adherers (6 points or less). Those who obtained 8 points were considered as adherers (17).

The nutritional status was assessed with the Mini Nutritional Assessment (MNA®) according to the classifications: normal nutritional status (over 23.5 points), at risk of malnutrition (17 to 23 points) and malnourished (17 points or less) (18). The BMI of the older adults was classified according to cut-off points recommended by the Pan American Health Organization (19).

Statistical analysis

The analyzes were performed with Statistical Package for the Social Sciences (SPSS) 25. The Pearson's Chi-Square test was used for the association of qualitative variables. We also opted for the Multinomial Model with the objective of evaluating the effect of each variable on the risk of frailty with a non-frail reference group. The strength of the association between variables was expressed as odds ratio (OR), with a 95% confidence interval (95% CI) and a statistical significance level of 5%. The analyzes of each explanatory factor were performed independently.

Results

The total population of the study was 319 older adults, of whom 4 were excluded after the MMSE, and 7 due to loss and non-fulfilment of inclusion criteria, thereby leaving 308 older adults. The mean age of the older adults was 70.4 years (SD = 6.74).

The population was characterized as being predominantly women (61.4%), with a predominant age range of 60 to 69 years (52.3%), married (47.1%), with 4 to 7 years of schooling (47.1%), a mean per capita income of 2 minimum wages (43.2%) and less than 3 morbidities (69.8%). The frailty profile was 31.8% frail, 39.3% pre-frail and 28.9% non-frail. The sociodemographic characterization of the participants according to the condition of frailty is presented in Table 1.

The Multinomial Logistic Regression Model, adjusted for confounding factors (Table 2), demonstrated that in the EN-MAN® factor older adults with nutritional risk presented an OR of 6.3 when comparing the frail and non-frail group (95% CI, 9-20.4). In the pre-frail group in relation to the non-frail group, the odds corresponded to 3.4 (95% CI 1.0-10.9), and both analyzes were statistically significant ($p< 0.05$).

The nutritional status assessed with the BMI, presented an association in the frail group when compared to the non-frail group, both for those with low weight with an OR of 2.5 (CI 95% 1.1-5.8) and for those overweight and obese with an OR of 2.8 (95% CI 1.1-7.0) ($p< 0.05$).

When assessing the level of family function, there was a higher probability of family dysfunction in the frail older adults than the non-frail (95% CI 1.9-18.5). The same occurred in the pre-frail group when compared to the non-frail group with an OR of 2.9 times (95% CI 1.0-8.6), both with ($p< 0.05$).

Low medication adhesion was associated with FS in the frail group compared to the non-frail group and in the pre-frail group compared to the non-frail group, with an OR of 8.9 (95% CI: 3.6-21.6) ($p = 0.01$) and an OR of 3.7 (95% CI 1.6-8.4) ($p = 0.02$), respectively. The same occurred in the classification of

Table 1
Sociodemographic characteristics stratified by frailty status

Sociodemographic Characteristics	Frailty status				
	Frail (31,8%)	Pre-Frail (39,3%)	Non-frail (28,9%)	Total Sample N (%)	p value
Sex					
Female	61 (32.3%)	73 (38.6%)	55 (29.1%)	189 (61.4%)	0.954
Male	37 (31.1%)	48 (40.3%)	34 (28.6%)	119 (38.6%)	
Age Group					
60 to 69 years	37 (23.0%)	63 (39.1%)	61 (37.9%)	161 (52.3%)	0.001
70 to 79 years	40 (36.4%)	47 (42.7%)	23 (20.9%)	110 (35.7%)	
80 years and over	21 (56.8%)	11 (29.7%)	5 (13.5%)	37 (12.0%)	
Civil Status					
Single	14 (37.8%)	16 (43.3%)	7 (18.9%)	37 (12.0%)	0.002
Married	38 (26.2%)	57 (39.3%)	50 (34.5%)	145 (47.1%)	
Separated	3 (9.7%)	16 (51.6%)	12 (38.7%)	31 (10.1%)	
Widowed	43 (45.3%)	32 (33.7%)	20 (21.1%)	95 (30.8%)	
Schooling					
0 to 3 years of schooling	50 (47.6%)	39 (37.1%)	16 (15.2%)	105 (34.1%)	0.001
4 to 7 years of schooling	40 (27.6%)	60 (41.4%)	45 (31.0%)	145 (47.1%)	
> 7 years of schooling	8 (13.8%)	22 (37.9%)	28 (48.3%)	58 (18.8%)	
Per capita monthly income					
Up to 1 minimum wage	41 (35.7%)	40 (34.8%)	34 (29.6%)	107 (37.3%)	0.032
2 minimum wages	48 (36.1%)	57 (42.9%)	28 (21.1%)	133 (43.2%)	
3 minimum wages or more	9 (15.0%)	24 (40.0%)	27 (45.0%)	60 (19.5%)	
Morbidity					
0 to 3	47 (21.9%)	89 (41.4%)	79 (36.7%)	215 (69.8%)	0.001
More than 3	51 (54.8%)	32 (34.4%)	10 (10.8%)	93 (30.2%)	

*p = level of significance calculated with the Pearson chi-squared test

medium adhesion, in the frail group in relation to the non-frail group with an OR of 4.8 (95% CI: 1.9-11.8) (p = 0.001) and in the pre-frail in relation to the non-frail with an OR of 3.2 (95% CI 1.5-7.0) (p = 0.002).

Discussion

In the findings of this study, frailty syndrome, in older adults attended at an outpatient service, was associated with a high degree of family dysfunction, a nutritional risk and low adherence to medication. The sociodemographic profile was characterized by a majority of females, with a low level of schooling and low per capita income, presenting with less than 3 morbidities. No statistically significant difference was observed between FS and gender in the present study, although women presented a greater susceptibility to developing FS, due to the greater physiological loss of muscle mass with aging, and were more prone to sarcopenia, which is an intrinsic risk for developing the syndrome (2). Other hypotheses are in the fact that survival is higher in women, and that they present a higher prevalence of morbidities when compared to men (20).

In relation to the educational levels of those participating in this study, it was identified that the majority of frail older adults were illiterate or reported having up to 3 years of study, while the majority of those classified as pre-frail reported having attended school between 4 and 7 years, indicating a low level of education in these groups. It was also observed that, most of the older adults who received one and two minimum wages were considered pre-frail. These results seem to be in accordance with a previous study by Fried et al (2), who reported that older adults with a low socioeconomic level, are more likely to become frail. Hoogendijk et al (21), also found associations of low education and low income with frailty (OR adjusted for low education = 1.76; (95% CI = 1.05-2.97); OR adjusted for low income = 1.90 (95% CI = 1.20-3.01);

Table 2
Multinomial Logistic Regression Analysis of the frailty status with the variables of Nutritional Status, Level of Family Function and Medication Adherence adjusted by the confounding factors

Explanatory factors	OR (CI 95%)		OR (CI 95%)	
	Pre-Frail x Non-Frail	P value	Frail x Non-Frail	p value
Nutritional Status - MAN®				
Nutritionally normal	Reference	-	Reference	-
Nutritional risk	3.4 (1.0 - 10.9)	0.035	6.3 (1.9 - 20.4)	0.002
Nutritional status - BMI				
Eutrophy	Reference	-	Reference	-
Low weight	1.8 (0.8 - 4.1)	0.110	2.5 (1.1 - 5.8)	0.028
Overweight and Obese	3.5 (1.6 - 7.7)	0.001	2.8 (1.1 - 7.0)	0.018
Level of Family Function				
Highly Functional	Reference	-	Reference	-
Moderately Dysfunctional	0.6 (0.2 - 1.6)	0.418	1.4 (0.5 - 3.4)	0.413
Highly Dysfunctional	2.9 (1.0 - 8.6)	0.049	5.9 (1.9 - 18.5)	0.002
Medication adherence				
High Adherence	Reference	-	Reference	-
Medium Adherence	3.2 (1.5 - 7.0)	0.002	4.8 (1.9 - 11.8)	0.001
Low Adherence	3.7 (1.6 - 8.4)	0.001	8.9 (3.6 - 21.6)	0.001
No Medication	-	-	-	-

† Adjusted for age, schooling, civil status and morbidities; ‡ The analysis of each explanatory factor was performed independently.

Although income and schooling do not act directly in the pathophysiology of FS, they nonetheless strongly affect the style and quality of life of older adults, and consequently, with factors that coexist with the socioeconomic condition, including sex and age, which may influence the process of becoming frail (22).

In the case of comorbidities, the majority of the older adults presented with less than three comorbidities. However, older adults with more than three comorbidities were more frequent in the frail group. Although the presence of associated comorbidities is not always accompanied by FS, this presence may also indicate an increased risk of adverse health events, leading older adults towards a greater probability of becoming frail, due to the limitations that may be triggered by the diseases (2).

In this study, the prevalence of frailty was 31.8%. In the literature, the prevalence of frailty varies from 4.0% to 59.1% (23, 24).

When assessing the association of FS with the level of family function, there was a higher probability of frail older adults having a dysfunctional family in relation to the non-frail. When assessing the level of family function, the Health, Well-being and Aging Study (SABE), verified a greater number of frail older people with families that were highly or moderately dysfunctional (25), thereby corroborating our findings.

Being a dysfunctional family, their capacity in providing care may well be impaired, and thus they may not be able to provide the appropriate systematic care to cover the needs of the older relatives, which therefore affects the quality of life of this population and compromises the necessary care given towards food and medicine (26). According to Souza et al (27), older people who are well integrated into their families and their social environment present greater survival rates and a better ability to recover from diseases, since social isolation is an important risk factor for morbidities and mortality.

An association was also observed between nutritional risk, assessed with MAN®, and FS. Our study presented 79.9% with eutrophy, 18.5% with a risk of malnutrition and 1.6% malnourished. A cross-sectional study carried out in the interior of Spain with 640 older adults, with a mean age of 81.3 ± 5.0 years, also demonstrated an association between the results of MAN® and the frailty criteria of Fried et al., and evidenced 78.1% with eutrophy, 19.6% at risk of malnutrition and 2.3% malnourished (P <0.01) (28). These results corroborate those observed in the present study.

An association of low weight and overweight and obesity with FS was also observed when we assessed the nutritional status, according to the BMI. The percentage of frail older adults with low weight corresponded to 39.8%, while 21.4% were overweight or obese, with an OR of 4.6 (95% CI: 2.2-9.5)

and 2.9 (95% CI: 1, 2-6.5), respectively. Studies by Figueiredo (29) recorded an association between BMI classification and a frail status, in which 41.2% of older adults with low weight were frail or pre-frail (p = 0.031) and at the other extreme, 22.4% of older adults who were overweight were also frail. This demonstrates that the frailty/BMI relationship seems to develop in two manners, one related to low weight and sarcopenia that predisposes to greater vulnerability, and the other related to obesity that predisposes to greater comorbidity and functional disability.

Our study also presented an association between FS and poor medication adherence. Although the population investigated presented a greater frequency of high medication adherence (40.9%), this figure was well below that recommended by the World Health Organization, which corresponds to 80% (19). Compared to other studies, Aquino et al. [30] obtained a prevalence of medication adherence of 47.0%, similar to that reported in the study by Han et al. (31), which presented an adherence of 50%. The disease itself may be a determining factor for medication adherence, and may be understood by the manner in which older adults view their own status and understand their health condition. For example, side effects caused by some drugs are one of the difficulties, especially when older adults need to take a large number of drugs.

The limitation in this study was the exclusion of older adults presenting with an impaired cognitive status, which is considered a factor for developing FS. However, the focus of this research was on the self-reports of older adults with regard to their state of health, so that the data became more reliable. In conclusion, we have demonstrated that frailty syndrome is associated with a highly dysfunctional family, a nutritional risk and low medication adherence in older adults attended at an outpatient service. We would emphasize the importance of identifying these associated factors early, thereby enabling immediate intervention and preventing the occurrence of adverse outcomes.

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