OBJECTIVES: To investigate the association between Frailty syndrome, lipid profile, anthropometric variables, and the functional capacity of older adults; and to analyze an explanatory model of variables with higher predictive capacity for Frailty syndrome.

METHODS: This cross-sectional study included 36 and 86 older adults residing in long-term care facilities and in their households, respectively. Anamnesis was followed by evaluation of anthropometric data, risk of falls, functional tests, and biochemical tests. Frailty syndrome was determined according to the criteria suggested by Fried et al. RESULTS: Geriatric patients classified as frail were older; had higher medication consumption; and presented lower performance in handgrip strength, sit-to-stand, and gait speed tests as compared to pre- and non-frail older adults. CONCLUSION: Gait speed and sit-to-stand tests were significant predictors of Frailty syndrome. Specifically, a good performance in these tests represents a protection factor against Frailty syndrome. Furthermore, gait speed performance was explained by age, handgrip strength performance, and frailty status, while sit-to-stand performance was explained by risk of falls and muscular strength.

KEYWORDS: frail older adults; aging; health of the elderly.

OBJETIVOS: Investigar a associação entre síndrome da fragilidade, perfil lipídico, variáveis antropométricas e capacidade funcional de idosos; e analisar um modelo explicativo de variáveis com maior capacidade preditiva para a síndrome da fragilidade.

MÉTODOS: Este estudo transversal incluiu 36 e 86 idosos residentes em instituições de longa permanência e em suas residências, respectivamente. A anamnese foi seguida pela avaliação dos dados antropométricos, risco de quedas, testes funcionais e testes bioquímicos. A síndrome da fragilidade foi determinada de acordo com os critérios sugeridos por Fried et al. RESULTADOS: Os idosos classificados como frágeis eram mais idosos; tiveram maior consumo de medicação; e apresentaram menor desempenho nos testes de força de preensão palmar, levantar e sentar e velocidade da marcha quando comparados aos idosos pré e não frágeis. CONCLUSÕES: Os testes velocidade da marcha e levantar e sentar foram preditores significativos de síndrome da fragilidade. Especificamente, um bom desempenho nesses testes representa um fator de proteção contra a síndrome da fragilidade. Além disso, o desempenho da velocidade da marcha foi explicado pela idade, desempenho da força de preensão palmar e estado de fragilidade, enquanto o desempenho do levantar e sentar foi explicado pelo risco de quedas e força muscular.

PALAVRAS-CHAVE: idoso fragilizado; envelhecimento; saúde do idoso.
INTRODUCTION

With aging, older adults present a unique physiological vulnerability, which has been reported as frailty. This term has been widely used to describe a condition characterized by a cumulative multidimensional decline in physiological reserves, which results in greater susceptibility to adverse health events in the older population. It is estimated that up to 50% of individuals of more advanced age are considered frail. Additionally, the number of individuals classified as frail is expected to increase with the world population aging. This has important implications for health systems because frail individuals are at a greater risk for developing chronic noncommunicable diseases, longer hospitalization, and early mortality.

Although frailty syndrome (FS) is recognized as a condition that negatively influences the health of older individuals, the literature still lacks a consensual definition of its characterization. In a widely used approach, as described by Fried et al., the “frailty phenotype” is the most common measurement, in which the following five criteria are used to determine frailty level: involuntary weight loss, exhaustion, low physical activity, slowness, and muscle weakness.2,10,11

It seems that, in older adults with the frailty phenotype, both functional capacity and different physiological system disorders show more pronounced declines, whereas compensatory homeostatic mechanisms begin to fail. Thus, frail older individuals tend to be more dependent and vulnerable, which affects anthropometric, biochemical and functional aspects, as well as general health, usually resulting from functional capacity loss. Additionally, frail aging adults generally have greater difficulties in performing activities of daily living, presenting a decrease in muscle strength and gait speed and, consequently, a greater risk of falls.14

The decline of such functions leads older adults to demand greater care from the family, which is often not possible due to the lack of financial resources, technical skills, or time. Therefore, some aging adults are institutionalized in long-term care institutions (LTCIs).15 Once institutionalized, they tend to exhibit decreased physical-motor capacity and functional autonomy, depression, and impaired cognition, putting them at particular risk to develop FS.16-18

In this sense, it is important to identify variables that predict FS and to understand the relationship between these variables and FS to facilitate early diagnosis and increase the chances of successful management of this condition. Therefore, the objectives of the present study were as follows:

• to investigate the association between FS, lipid profile, anthropometric variables, and functional capacity of older adults;
• to analyze an explanatory model of variables with greater predictive capacity for FS.

METHODS

Study characterization and ethical criteria

This cross-sectional study included older adults living in LTCIs and in the community. The study was approved by the Research Ethics Committee of the Educational Association of Brazil (SOEBRAS) (under n. 2 076 559/2017).

General procedures

The study commenced with anamnesis. It included information on the number of medications consumed and history of diseases, which were confirmed by the medical staff and medical chart for individuals living in LTCIs.

After screening and application of exclusion criteria, we conducted anthropometric measurements, a fall risk assessment using the QuickScreen Clinical Falls Risk Assessment, functional tests, as well as collection of blood samples, and participants were classified according to their FS status.

Sampling and exclusion criteria

As shown in Figure 1, initially, 279 elderly individuals were invited to participate in the study. The eligibility criteria were voluntary participation, being aged ≥ 60 years, and completing all physical tests. Subsequently, those who could not walk without assistance or who needed a walker, who were unable to complete all tests, who had been diagnosed with dementia, Parkinson’s disease, or Alzheimer’s diseases, and those who were critically ill were excluded from the sample. After applying the exclusion criteria, the final sample comprised 36 and 86 participants from LTCIs and the community, respectively.

Anthropometric variables

To measure body mass, individuals stood on a digital scale (BE3, Britannia®, São Paulo, Brazil) with a resolution of 0.1 kg, wearing as few clothes as possible, staying immobile until the value was stable on the display. Height was assessed with a measuring tape, with participants standing erect and arms relaxed, after deep inhalation. The body mass index (BMI) was determined using the following equation: body mass (kg)/height (m²).

Gait speed test

The gait speed test was performed over a 4-meter stretch, at usual speed. Slowness was adjusted according to sex and height. For men, the cut-off points for frailty were 7s and 6s for those with height ≤ 173 cm and those taller than 173 cm, respectively. For women, the cut-off points were 7s and 6s for those with height ≤ 159 cm and > 159 cm, respectively.
Sit to stand test
For this test a chair with a height of 45 centimeters was used. After the familiarization, the participants stood up and sat in the chair 5 times with their arms folded on their shoulders, where the test execution time was calculated.

Handgrip strength
After participants became familiar with the hydraulic dynamometer (Jamar, Preston-Patterson, USA), they remained seated, with their shoulders in neutral position, elbows flexed at 90°, and fists in neutral position. They were instructed to perform a maximum isometric contraction. Three attempts were made with alternate limbs, with a 60-second interval between attempts. The highest achieved reading was recorded for subsequent analyses. No verbal encouragement was offered during the test. The cut-off points for frailty were those proposed by Fried et al.1

QuickScreen Clinical Falls Risk Assessment
The QuickScreen Clinical Falls Risk Assessment (QuickScreen),19 was used to evaluate risk of falls. This instrument assesses the following eight factors related to falls: number of falls in the last 12 months, regular use of four or more medications, use of any psychotropic medications, vision, peripheral sensation, balance, time reaction, and lower-limb strength. The result indicates the probability of falling in the next 12 months, which can be classified into four possible levels of risk (7, 13, 27, or 49%). Detailed procedures have been described elsewhere.19

Lipidogram and blood pressure
Blood samples were obtained through a venous puncture. Serum triglycerides (TGs), high-density lipoprotein (HDL-c), total cholesterol (TC), and glucose levels were analyzed by enzyme-based colorimetric methods using commercially available kits (Advia 2400, SIEMENS Healthcare Diagnostics Inc., Tarrytown, USA). The Friedewald equation was used to yield low-density lipoprotein (LDL-c) and very low-density lipoprotein (VLDL-c) estimates.20

The reference values used to deem the participants as healthy were total cholesterol level ≤ 150 mg/dL, triglycerides level ≤ 200 mg/dL, HDL level ≥ 40 mg/dL, and LDL level ≤ 160 mg/dL.

Systolic (SBP) and diastolic blood pressure (DBP) were measured on the left arm using an automatic device (BPA10, Microlife, São Paulo, Brazil).

Figure 1 Flow-chart of selection of participants for the study.
Frailty syndrome in older adults

Identification of Frailty

Frailty was identified based on criteria described by Fried et al.9 Briefly, this assessment is based on the presence of at least three of the following criteria:

• poor grip strength;
• slow gait speed;
• unintentional weight loss;
• exhaustion;
• physical inactivity.

Moreover, other volunteers were stratified into two groups, non-frail and pre-frail. Specifically, participants who did not meet any of the aforementioned criteria were classified as non-frail, while those who met one or two criteria were classified as pre-frail. Loss of more than 4.5 kg or 10% of the body weight over the last year was considered as weight reduction. Exhaustion was identified when there was self-reported fatigue. Slowness was determined by walking speed during a walking speed test. Muscle weakness was defined based on the handgrip strength test. Low level of physical activity indicated exercising less than twice a week.

Statistical analysis

After analyzing the preliminary data, it was determined that, with an alpha of 0.05 and a power of 0.80 for a two-tailed test, and assuming unequal groups, a sample of at least 30 and 75 participants including aging adults living in LTCIs and in the community, respectively, would be required to detect a significant difference. The final sample consisted of 122 subjects, 36 participants from LTCIs and 86 from the community. The quantitative difference observed in tables 1 and 2 is due to the exclusion of volunteers for that analysis, due to the absence of data.

The Kolmogorov–Smirnov test was used to verify the data distribution. Descriptive statistics were presented as means and standard deviations, unless otherwise noted. Independent comparisons were conducted using the Student’s t-test and one-way analysis of variance (ANOVA) with Sidak correction.

This study included the analysis of the prevalence rate for possible dichotomous variables potentially considered as a cause, and FS status as the outcome. Scores on the STS, GS, HGS, and QuickScreen were stratified into tertiles. Additionally, the predictive capacity was verified by the area under the ROC curve (AUC) and by the 95% confidence interval (95%CI). For an indicator to present a significant discriminatory ability, the AUC should be between 1.00 and 0.50. Further, it should be confirmed by the 95%CI of the ROC curve, which should have a lower limit (LL-CI) < 0.50 to be considered as a significant predictor of FS.

The ROC curve was generated by plotting sensitivity on the y-axis as a function of 1-specificity on the x-axis. Sensitivity refers to the percentage of individuals who presented the outcome (FS in the present study) and who were correctly diagnosed through the indicator (i.e., true positive). On the other hand, specificity describes the percentage of individuals who did not present the outcome and were correctly diagnosed by the indicator (i.e., true negative).

A multiple regression analysis was conducted, in which an initial model was generated using the stepwise method. Subsequently, the non-significant variables were removed. The analysis generated three models and the analysis of the Bayesian and Akaike information criteria (BIC and AIC, respectively) were used to define the model with greater explanatory power.

STATA™ version 9.1, SPSS 22.0, and R 3.4.2 were used in the analyses.

This study considered the ethical care related to respect for the rights of individuals and ensured anonymity of the participants in compliance with the Declaration of Helsinki and the aging adults signed an Informed Consent Form.

RESULTS

Table 1 shows the sample characteristics with mean and standard deviation for anthropometric, functional, and lipid profile variables by sex.

Table 1 Sample characteristics.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male (n = 31)</th>
<th>Female (n = 86)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>74.6 ± 9.1</td>
<td>71.5 ± 6.8</td>
</tr>
<tr>
<td>Body mass (Kg)</td>
<td>71.0 ± 8.7*</td>
<td>64.1 ± 11.4</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.64 ± 0.1*</td>
<td>1.50 ± 0.1</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.6 ± 4.7</td>
<td>26.8 ± 4.5</td>
</tr>
<tr>
<td>Number of medications consumed</td>
<td>3.9 ± 3.1</td>
<td>2.9 ± 2.3</td>
</tr>
<tr>
<td>STS (sec)</td>
<td>21.2 ± 11.0*</td>
<td>13.5 ± 5.2</td>
</tr>
<tr>
<td>Gait speed (m/s)</td>
<td>0.42 ± 0.5*</td>
<td>0.67 ± 0.2</td>
</tr>
<tr>
<td>HGS (kgf)</td>
<td>196 ± 10.4</td>
<td>191 ± 6.8</td>
</tr>
<tr>
<td>Cholesterol (mg.dL⁻¹)</td>
<td>160.9 ± 45.1</td>
<td>165.8 ± 32.4</td>
</tr>
<tr>
<td>HDL (mg.dL⁻¹)</td>
<td>35.1 ± 9.4</td>
<td>36.5 ± 13.4</td>
</tr>
<tr>
<td>Triglycerides (mg.dL⁻¹)</td>
<td>171.1 ± 124.9</td>
<td>193.7 ± 89.3</td>
</tr>
<tr>
<td>LDL (mg.dL⁻¹)</td>
<td>100.5 ± 28.9</td>
<td>93.8 ± 28.1</td>
</tr>
</tbody>
</table>

BMI: body mass index; STS: sit-to-stand test; HDL: high-density-lipoprotein; LDL: low-density-lipoprotein; HGS: handgrip strength; *statistically significant difference at p < 0.05.
As evident from Table 1, male participants presented higher values on weight and height, as well as worse performance on the STS and GS tests as compared to female participants.

Table 2 presents the mean and standard deviation for anthropometric, functional, and biochemical variables by FS classification. Aging adults classified as frail were older and heavier; consumed more medications; exhibited worse performance on the HGS, STS, and GS tests; and had higher HDL values as compared to pre-frail and non-frail participants (higher p-value).

Table 3 presents the mean and standard deviation values for anthropometric, functional, and biochemical variables by place of residence.

As seen in Table 3, participants living in LTCIs were older; had higher medication consumption, total cholesterol, HDL, and LDL levels; and worse performance on the HGS, STS, and GS tests as compared to community-dwelling participants.

Table 4 presents the prevalence ratio values and the AUC for anthropometric, functional, and biochemical variables.

As seen in Table 4, aging adults living in LTCIs were 1.9 times more likely to present FS, while those with a risk of falls above 27% were 1.83 times more likely to present FS. The older adults classified in the upper GS and STS tertiles were protected against frailty, with 56 and 59% less chance of FS, respectively. Additionally, the AUC analysis showed that the STS and GS tests may be significant predictors of frailty.

**Table 2** Anthropometric, functional, and biochemical variables according to the frailty syndrome classification.

<table>
<thead>
<tr>
<th></th>
<th>Non-frail (n = 40)</th>
<th>Pre-frail (n = 34)</th>
<th>Frail (n = 41)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>70.6 ± 6.6</td>
<td>71.2 ± 5.9</td>
<td>75.02 ± 8.9*</td>
</tr>
<tr>
<td>Body mass (Kg)</td>
<td>63.4 ± 8.1</td>
<td>64.7 ± 11.1</td>
<td>69.5 ± 12.9*</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.58 ± 0.1</td>
<td>1.5 ± 0.1</td>
<td>1.6 ± 0.1</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.5 ± 3.1</td>
<td>26.7 ± 4.3</td>
<td>27.9 ± 5.5</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>125.9 ± 16.8</td>
<td>127.5 ± 17.5</td>
<td>124.7 ± 22.3</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>77.2 ± 10.3</td>
<td>72.5 ± 8.2</td>
<td>76.7 ± 13.4</td>
</tr>
<tr>
<td>Amount of drugs</td>
<td>2.5 ± 1.9</td>
<td>2.35 ± 1.6</td>
<td>4.7 ± 3.1*</td>
</tr>
<tr>
<td>STS (sec)</td>
<td>11.4 ± 3.0</td>
<td>12.6 ± 3.5</td>
<td>22.1 ± 9.6*</td>
</tr>
<tr>
<td>Gait speed (m/s)</td>
<td>0.83 ± 0.03</td>
<td>0.67 ± 0.1</td>
<td>0.38 ± 0.3*</td>
</tr>
<tr>
<td>HGS (kgf)</td>
<td>25.7 ± 6.0</td>
<td>18.4 ± 5.4</td>
<td>13.6 ± 5.7*</td>
</tr>
<tr>
<td>Cholesterol (mg.dL⁻¹)</td>
<td>155 ± 28.1</td>
<td>161.3 ± 32.1</td>
<td>174.1 ± 43.7</td>
</tr>
<tr>
<td>HDL (mg.dL⁻¹)</td>
<td>31.9 ± 9.2</td>
<td>34.5 ± 13.5</td>
<td>41.4 ± 12.2*</td>
</tr>
<tr>
<td>Triglycerides (mg.dL⁻¹)</td>
<td>188.4 ± 106.5</td>
<td>196.2 ± 74.8</td>
<td>181.1 ± 114.8</td>
</tr>
<tr>
<td>LDL (mg.dL⁻¹)</td>
<td>89.9 ± 25.8</td>
<td>90.9 ± 26.3</td>
<td>102.5 ± 30.7</td>
</tr>
</tbody>
</table>

BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; STS: sit-to-stand test; HDL: high-density-lipoprotein; LDL: low-density-lipoprotein; HGS: handgrip strength; *statistically significant difference at p < 0.05.

**Table 3** Anthropometric, functional, and biochemical variables according to place of residence.

<table>
<thead>
<tr>
<th></th>
<th>Community (n = 86)</th>
<th>LTCI (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>71.2 ± 7.3</td>
<td>75.3 ± 7.6*</td>
</tr>
<tr>
<td>Body mass (Kg)</td>
<td>64.8 ± 10.7</td>
<td>68.9 ± 11.8</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.5 ± 0.1</td>
<td>1.6 ± 0.1</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.4 ± 4.2</td>
<td>27.8 ± 5.1</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>127.6 ± 18.1</td>
<td>121.0 ± 20.3</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>76.1 ± 10.1</td>
<td>74.9 ± 13.7</td>
</tr>
<tr>
<td>Amount of drugs</td>
<td>2.3 ± 1.7</td>
<td>5.2 ± 3.2*</td>
</tr>
<tr>
<td>STS (sec)</td>
<td>12.3 ± 3.5</td>
<td>24.4 ± 9.9*</td>
</tr>
<tr>
<td>Gait speed (m/s)</td>
<td>0.71 ± 0.2</td>
<td>0.36 ± 0.1*</td>
</tr>
<tr>
<td>HGS (kgf)</td>
<td>21.6 ± 7.3</td>
<td>12.5 ± 5.0*</td>
</tr>
<tr>
<td>Cholesterol (mg.dL⁻¹)</td>
<td>156.6 ± 30.5</td>
<td>183.6 ± 42.4*</td>
</tr>
<tr>
<td>HDL (mg.dL⁻¹)</td>
<td>32.7 ± 11.1</td>
<td>44.5 ± 11.3*</td>
</tr>
<tr>
<td>Triglycerides (mg.dL⁻¹)</td>
<td>189.4 ± 89.5</td>
<td>181.8 ± 125.9</td>
</tr>
<tr>
<td>LDL (mg.dL⁻¹)</td>
<td>90.3 ± 26.0</td>
<td>107.8 ± 30.0*</td>
</tr>
</tbody>
</table>

LTCI: long-term care institution; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; STS: sit-to-stand test; HDL: high-density-lipoprotein; LDL: low-density-lipoprotein; HGS: handgrip strength; *statistically significant difference at p < 0.05.
Gait Speed Mathematical Model
\[- GS = 0.02 \times \text{Age} - 0.03 \times \text{HGS} - 1.05 \times \text{Non-frail} \quad (1)\]

Sit-to-stand Mathematical Model
\[- \text{STS} = 0.33 \times \text{QuickScreen} - 0.12 \times \text{HGS} \quad (2)\]

For the GS mathematical model, it was observed that, after 60 years of age, each 1-year increment in age led to slower gait speed by 0.02 seconds per meter. Further, the increase of 1 kg/F on the HGS test improved gait speed by 0.03 seconds per meter, while being classified as non-frail increased gait speed by 1.05 seconds per meter.

As for the STS mathematical model, it was observed that a 1% increase in the risk of falls according to the QuickScreen results with worse performance on the STS test led to an increase in the time required to perform the 5 movements by 0.33 seconds. In addition, an increase in the HGS score by 1 kg/F improved the performance speed of the 5 sit-to-stand movements by 0.12 seconds.

**DISCUSSION**

The main results of the study showed that aging adults living in LTCIs and those with a risk of falls greater than 27% were 1.9 and 1.83 times more likely to have FS, respectively. In contrast, those in the best performance tertile for the GS and STS tests were protected against FS, with 56 and 59% less chances of being classified as frail, respectively. Other previous studies have presented similar results, describing the relationship between FS and LTCIs residence, increased risk of falls, and low functional capacity. It is important to understand that the literature presents several approaches regarding the definition of frailty, so that depending on the type of approach used, these prevalence values could change significantly.

Among the variables tested, only GS and STS scores emerged as significant predictors of FS. Although they are simple tests, both variables presented good discriminatory capacity for FS. Another important result was the mathematical model that explained GS and STS performance. Specifically, age, HGS performance, and frailty status explained GS performance, while fall risk and HGS performance explained STS performance. As for GS, the final model showed that each year the aging adults’ gait speed reduced by 0.02 seconds per meter walked. This finding seems obvious because older age is associated with approximately 1% mass muscle loss per year from the 30s, and these losses tend to accelerate since the 70s. Further, the aging process is known to affect contractile and neuromuscular capacity. However, the maintenance of muscle strength seems to act in the opposite direction, since an increase of 1 kg/F in the HGS score improved GS by 0.03 seconds per meter. Nevertheless, the most decisive factor was the absence of an FS diagnosis, since the non-frail status was a determinant for the older adults’ faster GS, by 1.05 seconds per meter as compared to frail aging adults.

The magnitude of this result reinforces prior findings related to FS since it is characterized by a decrease in the homeostatic reserve and reduction of the body’s ability to endure and perform activities, leading to a cumulative, vicious cycle of decline in multiple physiological systems. Frailty decreases functional capacity by affecting the strength necessary to perform everyday activities such as walking, rising from a chair, and maintaining balance. It is also insidiously related to a higher incidence of falls and disability, as well as to hospitalization and mortality.

As for the final model to explain lower limb strength (based on STS test scores), each 1% increase in the risk of falls led to an increase of 0.33 seconds in the total time required to complete the 5 sit-to-stand movements, while every 1 kg/F increase in the HGS score improved this time by 0.12 seconds. These findings reinforce the concept of this vicious cycle, since there seems to be a cyclical relationship among frailty, functional capacity, balance, falls, disability, and hospitalization. However, the starting point of this cycle may not be fixed and it may not necessarily occur in the order described here.
Other studies corroborate our findings, presenting age as an aggravating factor for functional decline and increased risk of frailty. Additionally, low functional capacity, represented by poor performance in the GS and STS tests, greatly increases the risk of falls and vulnerability, besides being a clinical indicator of frailty. In this sense, a study on the association between frailty and quality of life of older adults according to their frailty status, considering functional abilities such as GS and STS performance, level of physical activity, HGS performance, and exhaustion showed that the non-frail group presented better indexes of functionality and quality of life compared to the pre-frail and frail groups. Another study in 1,327 older adults, suggests that higher age and worse GS performance were associated with a greater risk of FS. Also, a GS score lower than 0.8 m/s was suggested as a cutoff point at which the prevalence of FS is most noticeable. These findings corroborate those observed in the present study.

According to Medina-Mirapeix et al., in addition to functional capacity, participants classified as frail presented worse clinical outcomes, such as a higher incidence of comorbidities, as compared to non-frail ones. In this sense, the complementary data obtained in the present study demonstrate that older adults classified as frail tended to consume more medications compared to those classified as non-frail and pre-frail, although the former presented higher HDL values and higher age. Our study also found that the older people living in LTCIs tend to take more medications; had lower muscle strength and GS performance; and had higher levels of total cholesterol, triglycerides, and LDL compared to community-dwelling older adults, although they also presented higher HDL values and higher age. Thus, there seems to be a similarity between frail older adults and those living in LTCIs, suggesting that both characteristics may be associated with low levels of physical fitness and functional capacity. These results were corroborated by Kim et al., who found that loss of mobility and functionality potentially aggravates and/or triggers a series of complications beyond frailty. Supporting this idea, Silva et al. stated that the average daily time exposed to sedentary behavior could predict fragility in older adults.

Nutritional status seems to be an important factor associated with frailty, especially when a status of physical inactivity, poor diet and smoking accumulates. However, in the present study, nutritional status according to BMI showed no significant difference between frailty states.

A limitation of the present study is that the sample was recruited by convenience sampling, excluding those in mobility aids and/or wheelchairs, which could have increased the sample number of frail participants, although it comprised a representative sample of the older population. With reference to applicability of the tools used in this study, the GS and STS tests were able to predict FS. Additionally, we highlight that these tests are simple, involve low costs, and are easy to administer by any healthcare professional. However, we suggest further studies to evaluate the relationship between functional capacity and frailty in the elderly population, especially through longitudinal studies that could help identify possible cause-and-effect explanations.

CONCLUSION

We conclude that GS and STS may be significant predictors of FS and that older adults living in LTCIs and those at higher fall risk were more likely to have FS. Additionally, GS performance was explained by age, HGS performance, and frailty status, while STS performance was explained by fall risk and HGS performance.

ACKNOWLEDGMENTS

The authors would like to thank the individuals who participated in the study and the study group on exercise physiology and health.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

REFERENCES

Frailty syndrome in older adults


© 2019 Sociedade Brasileira de Geriatria e Gerontologia
This is an open access article distributed under the terms of the Creative Commons license.