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ORIGINAL ARTICLE

Glittre ADL test in eutrophic, overweight and obese elderly

Teste de AVD-Glittre em idosas eutróficas, com sobrepeso e obesidade

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Abstract

The Glittre ADL-test (TGlittre) has been designed and validated to measure functional capacity during daily living activities in patients with chronic obstructive pulmonary disease (COPD) but is now used in several other situations. The aim of this study was to evaluate the applicability of TGlittre in a sample of overweight and obese eutrophic elderly. This was an experimental and cross-sectional study, which included 21 elderly women, allocated by BMI, in eutrophic (n = 8), overweight (n = 6) and obese (n = 7) groups. They were assessed for functional capacity (TGlittre and 6MWT), quality of life (QOL) with the questionnaire World Health Organization Quality of Life for Older People (WHOQOL-OLD) and handgrip strength (HGS). TGlittre correlated with age (p = 0.0040) and with 6MWT (p = 0.0086), but no statistical difference was found in TGlittre's performance time and the distance covered in 6MWT between groups. TGlittre did not correlate with HGS (p = 0.1493) and WHOQOL-Old (p = 0.0905). The data obtained in the present study corroborate that TGlittre is used as a functional measurement variable in the elderly population.
Keywords: aged, obesity, exercise intolerance.

Resumo

O teste de AVD-Glittre (TGlittre) foi elaborado e validado para mensuração da capacidade funcional durante realização de atividades de vida diária, em pacientes com doença pulmonar obstrutiva crônica (DPOC), porém vem sendo utilizado em diversas outras populações. O objetivo do estudo foi averiguar a aplicabilidade através do TGlittre em uma amostra de indivíduos idosos eutróficos, com sobrepeso e obesidade. Trata-se de um estudo experimental e transversal, no qual foram avaliadas 21 idosas, alocadas por IMC, nos grupos eutrófico (n = 8), sobrepeso (n = 6) e obeso (n = 7). Foram avaliados entre os grupos a capacidade funcional (TGlittre e TC6min), qualidade de vida (QV) através do questionário World Health Organization Quality of Life - Old Group (WHOQOL-OLD) e força de preensão manual (FPM). O TGlittre apresentou correlação com a idade dos participantes (p = 0,0040) e com o TC6min (p = 0,0086), entretanto não foi encontrada diferença estatística no tempo de execução do TGlittre e na distância percorrida no

TC6min entre os grupos. O TGlittre não se correlacionou com a FPM (p = 0,1493) e com o WHOQOL-Old (p = 0,0905). Os dados obtidos no presente estudo corroboram para que o TGlittre seja utilizado como uma variável de medida funcional na população idosa.
Palavras-chave: idoso, obesidade, tolerância ao exercício.

Introduction

The elderly population is directly affected by aging, which induce adaptations in the neuromuscular system, cardiorespiratory and metabolic changes [1]. Often these changes culminate in body weight gain, and obesity has been linked to impaired functional capacity and reduced activities of daily living (ADLs) performance, which consequently is one of the causes of physical inactivity and sedentary lifestyle, especially in the elderly [2,3]. Thus, there is a constant concern regarding obesity as a public health problem, as approximately 2.8 million people worldwide die annually due to their comorbidities [4].

For the clinical assessment of the functional status of an individual, functional tests that are already validated and reliable are constantly performed, including the sit-to-stand test and the six-minute walking test (6MWT) [5,6]. Handgrip strength (HGS) is another reliable clinical method for estimating the overall strength status and functional performance of the elderly, being closely related to ADLs [7]. Studies show that HGS correlates moderately with performance in specific tasks and can be a good predictor for functional capacity [8].

The Glittre ADL-test (TGlittre) is a submaximal test that includes the function of the upper limbs in performing ADLs to assess functional capacity, designed initially for patients with chronic obstructive pulmonary disease (COPD) [9]. Studies show that TGlittre is a useful and applicable tool both in adults and children, as well as in individuals with COPD, heart failure, heart disease, in obese adults and after bariatric surgery [10–14].

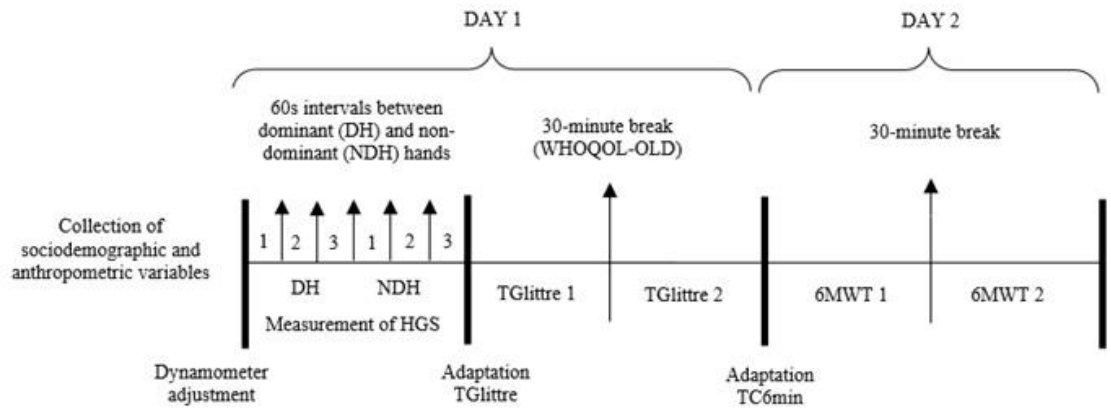
So far, TGlittre has not been performed in an elderly eutrophic population, with overweight and obesity. Thus, the objective of the present study was to assess the functional capacity with TGlittre in a sample of eutrophic, overweight and obese elderly women, and to investigate the correlation with the 6MWT, HGS, and QOL.

Methods

This is a cross-sectional study, in which included elderly women (aged between 60 to 85 years), with controlled systemic arterial hypertension (SAH), who were sedentary (individuals who perform less than 30 minutes of moderate physical activity daily during most days of the week), who completed the proposed assessments and who signed the informed consent form. The volunteers were recruited from August 2017 to April 2018, in groups of elderly people from a city in the countryside of Rio Grande do Sul, Brazil. The study was approved by the Human Research Ethics Committee, of the Lutheran University of Brazil, campus Canoas/RS, protocol number 3.452.176.

Women were excluded when they had physical disabilities (amputations of upper and lower limbs, blindness), trauma-orthopedic injuries (bone fractures or muscle injuries in the last 6 months), cognitive impairments, neurological disorders (Alzheimer's, Parkinson's, vestibular disorders and dementia), use of walking aids and orthoses, gait changes and limb discrepancy. As shown in the diagram in figure 1, the chronological order of data collection can be observed.

First, a previous assessment was carried out to collect sociodemographic and anthropometric data [gender, age, ethnicity, hand dominance/preference, body weight, height and body mass index (BMI)] and then the TGlittre was performed. On the second day, within the same week, the 6MWT was performed both functional tests were performed twice, with a 30-minute rest interval between assessments, and the best result between the two measures was used, due to possible learning effect. During the interval between the two TGlittre, a QOL questionnaire was applied, specifically for the elderly population (WHOQOL-Old) [15].



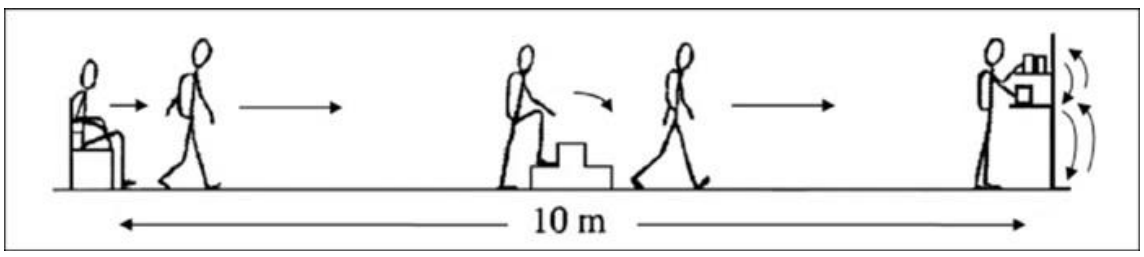
HGS = Hand Grip Strength; DH = dominant hand; NDH = non-dominant hand; WHOQOL-Old = World Health Organization Quality of Life for Older People.

Figure 1 - *Study Protocol.*

For the assessment of the HGS, a digital dynamometer was used (apparatus brand - Camry®, model EH 101-37, with a maximum capacity of 90 kg and a scale of 1 g). The patient was positioned sitting in a chair with an upright spine, maintaining a degree of knee flexion at 90, shoulder in adduction and neutral rotation, elbow flexed at 90°, forearm and wrist in neutral position, arm kept suspended in the air with the hand positioned on the dynamometer, the hand was supported by the evaluator. For all subjects, the dynamometer handle was individually adjusted, according to the size of the hands it was considered the highest measurement among the three measures in the dominant hand (DH) or in the non-hand dominant (NDH). There was a rest period of 60 seconds between measurements, with alternating measurements between DH and NDH. The participants performed a warm-up in the form of a submaximal grip while the procedure was explained. The volunteers performed the grip during expiration, without performing Valsalva maneuver, in addition to being verbally stimulated during the test [6,16].

Glittre-ADL test (TGlittre)

The circuit was designed according to the standard protocol, its representation is shown in figure 2. For the test, a chair, a staircase and an adjustable shelf with surfaces at the shoulder and waist height were used. The individuals carried a backpack (weight 2.5 kg) and followed a circuit with the following activities: from the sitting position, the individual walked on a 10-meter-long flat aisle, interposed in half by a staircase with two steps up and two steps down (17 cm high x 27 cm wide). After completing the second half, the patient moved three 1 kg-objects from a shelf at shoulder height to another at waist height and then to the floor. From there, they returned with the objects from the floor to the waist-high shelf and finally to the top shelf. After that, the participant went through the circuit again, crossing the steps, until reaching the starting point (chair). The participant sat down and immediately started the next lap. If the subject wanted to take a pause, the pause duration would be timed and added to the time to complete the test. The individuals were instructed to complete five laps as fast as possible. Heart rate (HR), peripheral oxygen saturation (SpO2) and dyspnea and leg fatigue assessed by the BORG scale were monitored at each lap. No verbal stimulus was made during the test [9].



Source: Skumlien S *et al.* [9].

Figure 2 - *Representation for the performance of TGlittre (Standard Protocol).*

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Six-Minute Walking Test (6MWT)

The 6MWT was performed according to the guidelines of the American Thoracic Society [17]. For its realization it was necessary a flat surface of 30 meters, being demarcated in every meter. The individuals were instructed to walk as far as possible and they receive standardized verbal encouragement. HR, SpO2 and the dyspnea and leg fatigue (Borg scale) were measured at the beginning, in the 2nd and 4th minutes and at the end of the test. For analysis, the longest distance covered was considered [10].

Quality of Life for Older Persons (WHOQOL-OLD)

The quality of life was measured with a specific and validated questionnaire, called the World Health Organization Quality of Life for Older People (WHOQOL-OLD). This evaluation tool consists of 24 questions and its answers follow the Likert ordinal scale of 5 points (from 1 to 5). They are divided into six domains: sensory functioning, autonomy, past, present, and future activities, social participation, death and dying and intimacy [15].

Statistical analysis

Data are expressed as means ± SD for each variable and group. The Shapiro-Wilk test was performed to assess the normality of all variables. One-way ANOVA, followed by the Student Newman-Keuls post hoc test was used to compare parametric data between groups. The Kruskal-Wallis test, followed by Dunn's post hoc multiple comparison test, was used to compare nonparametric data between groups. Pearson and Spearman's correlation test was used to investigate the relationships between parametric and nonparametric data. A value of $P < 0.05$ was considered statistically significant. GraphPad Prism 5 (Graph-Pad Software, San Diego, CA, USA) was used in data analysis and graph creation.

Results

21 elderly women were included, aged between 62 and 79 years. Among 37 individuals, 13 did not meet the inclusion criteria and 3 did not complete the proposed assessment, so they were excluded. According to the BMI criteria proposed by the World Health Organization (WHO), following the classification for the general population, considering the BMI: 18.5 kg/m² as underweight; eutrophy, BMI between 18.5 kg/m² and 24.9 kg/m²; overweight, BMI between 25 kg/m² and 29.9 kg/m²; class I obesity, BMI between 30 kg/m² and 34.9 kg/m²; class II obesity, BMI between 35 kg/m² and 39.9 kg/m² (18). From these classifications, the elderly women were divided into three groups: eutrophic (n = 8), overweight (n = 6) and obese (n = 7). Table I presents the characteristics of the patients and groups.

Table I - *Sociodemographic and functional characteristics of the participants.*

Variables	Eutrophic (n=8)	Overweight (n=6)	Obese (n=7)	p value	Overall sample (n=21)
Age (years)	67.88±4.94	70.50±5.857	69.00±6.83	0.7151	69± 5.683
Height (m)	1.598±0.05	1.575±0.038	1.560±0.053	0.3252	1.578±0.048
Weight (Kg)	57.13±6.109	68.75±4.45∗	76.60±7.64∗†	< 0.0001	66.938±10.38
BMI (kg/m2)	22.39±2.325	27.70±1.46∗	30.89±1.44∗†	< 0.0001	26.74±4.11
DH				0.4261	
Right	7 (87.5%)	6 (100%)	7 (100%)		20 (95.24%)
Left	1 (12.5%)	0 (0%)	0 (0%)		1 (4.76%)
TGlittre 1 (min)	3.66±0.71	3.62±0.40	4.24±0.66		3.84±0.66
TGlittre 2 (min)	3.29±0.56	3.47±0.33	3.52±0.505		3.42±0.48
6MWT 1 (m)	398.2±39.46	435.6±58.26	370.16±82.01		399.54±64.06
6MWT 2 (m)	413.46±33.62	446.82±56.10	402.08±76.99		419.2±57.49
6MWT pred (m)	483.93±24.63	434.39±38.11	421.93±39.61		449.11±43.07
6MWT pred (%)	85.43±136.50	102.85±147.16	95.49±194.37		93.34±133.48

m = meters; kg = kilograms; min = minutes; pred (%) = percentage of predicted; DH = dominant hand. Values presented with means ± SD. Statistical analysis: one-way ANOVA followed by Newman-Keuls post hoc test. Symbols represent the comparison between groups by post hoc analysis: † P <0.05 compared to the Eutrophic group, and † P <0.05 compared to the overweight group.

Hand grip strength (HGS)

There was no difference in HGS between the eutrophic groups: 23.06 ± 3.198 kg; overweight: 25.25 ± 3.936 kg; obese: 22.31 ± 3.696 kg; p = 0.3331.

Glittre-ADL test (TGlittre)

Table II indicates the TGlittre values in eutrophic, overweight, obesity and general test values. There was no significant difference between groups.

Table II - *TGlittre (minutes) in eutrophic elderly women, overweight and obese.*

	Eutrophic (n=8)	**Overweight (n=6)**	**Obese (n=7)**	**TGLITRE general (n=21)**	**p value**
Mean ± SD	3.289±0.5635	3.452±0.3326	3.519±0.5059	3.412±0.4755	0.2478
Standard error	0.1992	0.1358	0.1912	0.1038	
Median	3.145	3.355	3.500	3.300	
25% percentile	2.993	3.270	3.120	3.125	
75% percentile	3.838	3.585	3.570	3.540	
95%CI	[2.818; 3.760]	[3.103; 3.801]	[3.051; 3.986]	[3.195; 3.628]	
Minimum	2.530	3.180	3.100	2.530	
Maximum	4.210	4.110	4.580	4.580	

Statistical analysis (p-value): Kruskal-Wallis Test between eutrophic elderly women, overweight and obese.

Six-Minute Walking Test (6MWT)

There was no significant difference between groups in the 6MWT (eutrophic: 414.9 ± 34.44 m; overweight: 449.7 ± 51.90 m; obese: 402.1 ± 77 m; p = 0.3206).

Quality of Life (QOL)

Figure 3A shows the WHOQOL-old values in eutrophic elderly women, with overweight and obesity. Obese elderly women had a lower QOL score when compared to the euthrophic group (77.29 ± 2.928 vs. 86.13 ± 6.854; p <0.05). There were no significant differences between overweight and other groups. Figure 3B shows the QOL values in each domain of the WHOQOL-Old questionnaire. Despite a trend of significance in domain 2 (p = 0.0668), no significant differences were observed between groups in each domain.

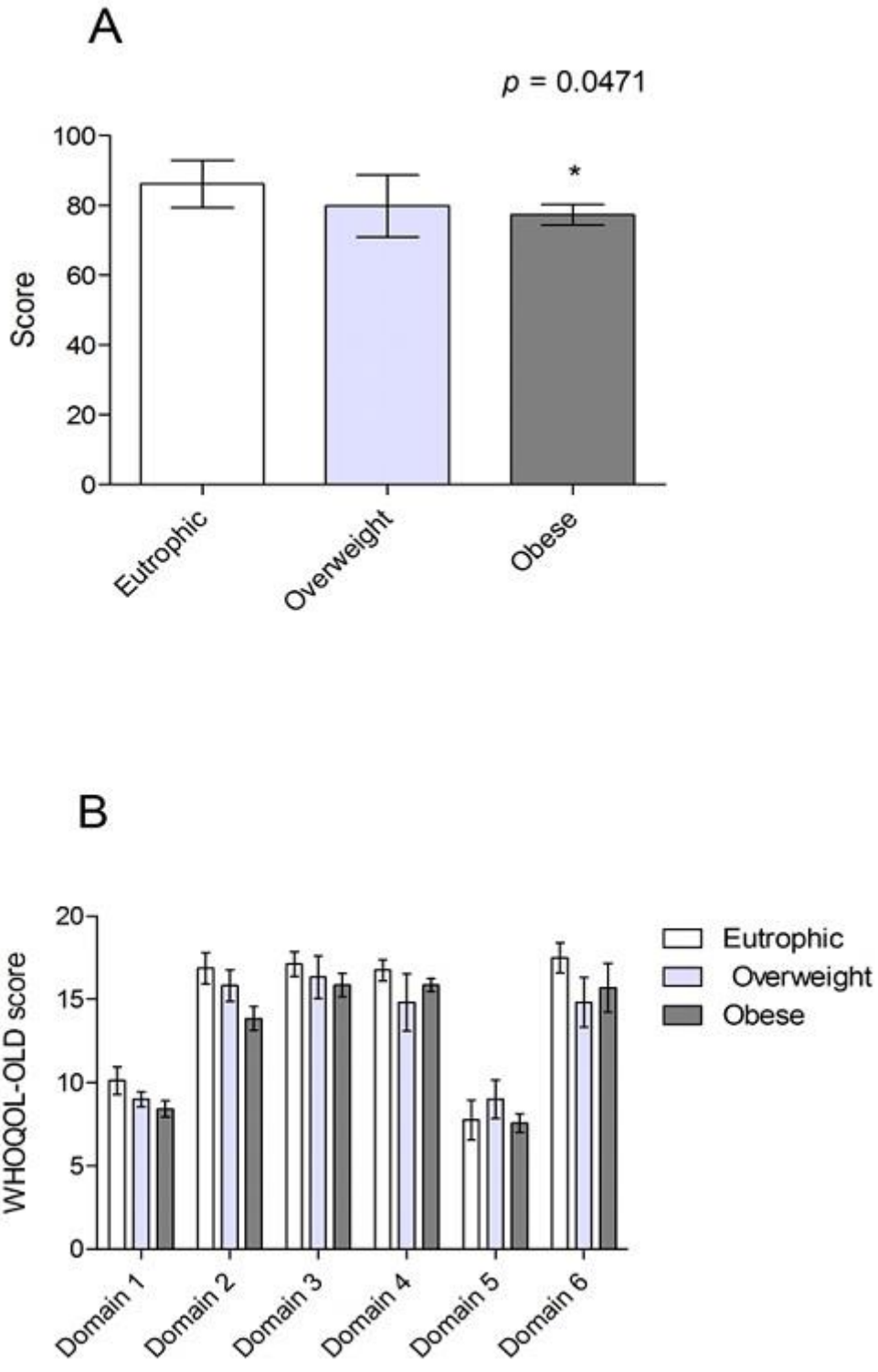

Figure 3 - *WHOQOL-old values in eutrophic elderly women, with overweight and obesity.*

Correlation between TGlittre and 6MWT, quality of life, hand grip strength and age

TGlittre showed a significant correlation with the 6MWT (Spearman r = -0.5582; p = 0.0086; figure 4A) and age (Spearman r = 0.6005; p = 0.0040; figure 4C). The 6MWT was significantly correlated with HGS (Pearson r = 0.6431; p = 0.0017; figure 4D). TGlittre did not correlate with QOL (WHOQOL-Old) (Spearman r = -0.3787; p = 0.0905; figure 4B). Table III

summarizes all the correlations carried out in this study. Figure 4 highlights the correlation between TGlittre and 6MWT; TGlittre and QOL; TGlittre and age; 6MWT and HGS.

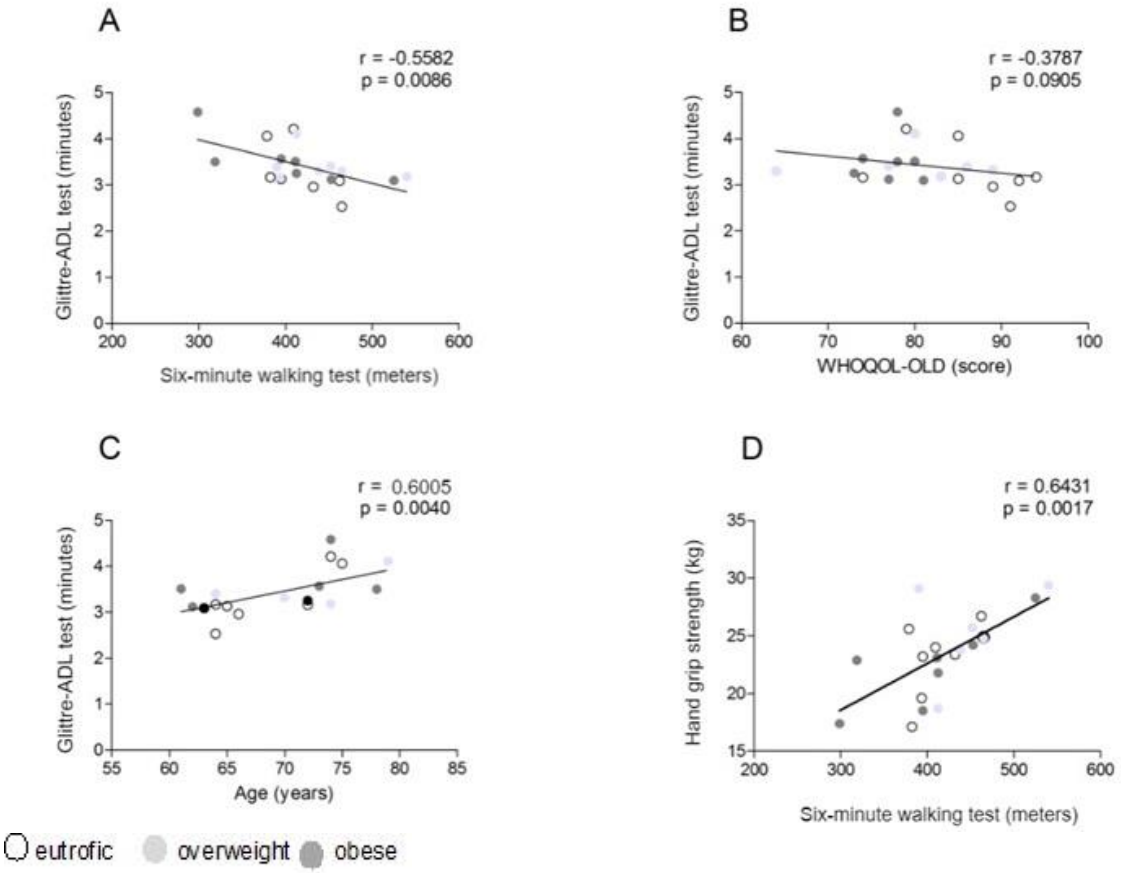

Figure 4 - *Correlations between TGlittre with 6MWT, QOL, age and HGS.*

Table III - *Correlations between TGlittre with quality of life, 6MWT and anthropometric variables.*

Correlation	n	R	P value
TGlittre x 6MWT(m)	21	-0.5582	0.0086 a
TGlittre x HGS (Kg)	21	-0.3260	0.1493 a
TGlittre x WHOQOL-Old	21	-0.3787	0.0905 a
TGlittre x WHOQOL-Old (Domain 1)	21	0.2268	0.3228 a
TGlittre x WHOQOL-Old (Domain 2)	21	-0.3608	0.1081 b
TGlittre x WHOQOL-Old (Domain 3)	21	-0.2329	0.3096 b
TGlittre x WHOQOL-Old (Domain 4)	21	-0.2874	0.2064 a
TGlittre x WHOQOL-Old (Domain 5)	21	-0.05514	0.8124 b
TGlittre x WHOQOL-Old (Domain 6)	21	-0.06891	0.7666 a
TGlittre x Age (years)	21	0.6005	0.0040 a
TGlittre x Height (m)	21	-0.1508	0.5141 a
TGlittre x Weight (Kg)	21	0.3793	0.0899 a
TGlittre x BMI (kg/m^2)	21	0.3469	0.1234 a
6MWT x HGS (kg)	21	0.6431	0.0017 b
6MWT x WHOQOL-Old	21	0.07046	0.7615 b
HGS x WHOQOL-Old	21	0.1544	0.5041 b

a = Spearman's correlation; b = Pearson's correlation; TGlittre = Glittre-ADL test; 6MWT = 6-minute walking test; HGS = hand grip strength; WHOQOL-Old = World Health Organization Quality of Life for Older People; BMI = body mass index.

Discussion

The present study investigated the functional capacity assessed with TGlittre in a sample of eutrophic elderly, overweight and obesity classes I and II. To our knowledge, this is the first study to propose the application of TGlittre for the elderly population with this profile, as well as to verify its executability. The TGlittre correlated with the age of the participants and with the 6MWT, however, there was no significant difference in the time of execution of the TGlittre and in the distance covered in the 6MWT between the groups. TGlittre did not correlate with HGS and WHOQOL-Old when the QOL of life was compared between groups, the obese group had a lower score.

In a recent study, TGlittre was valid and reproducible to assess functional capacity in a group of obese individuals (n = 21), aged 44 ± 9 years and with BMI of 44 ± 6 kg/m2 [12]. In the present study, no significant difference was found between the three groups, having as possible cause the sample size, the difference in age (69.0 ± 6.83 years) and BMI (30.89 ± 1.43 kg/m^2). As for TGlittre and its correlation with age (r = 0.6005; p = 0.0040), it is observed that the older the age, possibly the lower its performance on the test. A recent study carried out with a group of elderly people with COPD, corroborates our findings, as the time spent on TGlittre was also associated with age (r = 0.66, p = 0.03) [10].

One study found a moderate to the high correlation of TGlittre with 10m walking tests with and without a load in obese patients and post-bariatric surgery [12]. Other studies, including COPD patients, support these findings, identifying an association between the time of TGlittre performance and the distance covered in the 6MWT [9,10]. In the present study, a moderate correlation was observed between TGlittre and the 6MWT (r = -0.5582, p = 0.0086), showing that TGlittre is an indicator of functional performance in elderly women, since demonstrating a certain equivalence with the 6MWT, considered the gold standard submaximal test so far.

HGS was evaluated for possible correlations with TGlittre, due to studies presenting it as a good predictor for performance in motor tasks in frail elderly people in functional tests, such as in the 10-meter walk test at maximum speed (C10) and Timed Up & Go Test (TUG) [8]. There were no significant differences between the experimental groups in the HGS nor in the correlation with the TGlittre (r = -0.3260; p = 0.1493). However, we found a correlation between the HGS and the 6MWT. In previous studies, a significant and positive correlation of HGS with the distance covered in the 6MWT has been shown, especially in patients with COPD. In healthy elderly people, HGS was identified as a determinant of the total distance covered in the 6MWT [18,19].

Regarding QOL, a recent research showed that the obese group had a lower score in all aspects of the SF-36 questionnaire (physical and mental domains) when compared to the post-bariatric and control group [20]. Another study also using SF-36, found a considerable impairment in the QOL of obese individuals [21]. A similar aspect was found in the present study since the obese elderly women presented a lower score in the WHOQOL-Old compared to the eutrophic subgroup (77.29 ± 2.928 vs. 86.13 ± 6.854; p < 0.05). Despite its proximity, TGlittre did not correlate between the WHOQOL-Old domains, perhaps revealing that TGlittre is not an indicator for QOL in this population. Still, further studies, with larger sample, are needed to confirm that.

This study has some limitations. The first is the reduced sample size, considering that there was a sample calculation that predicted at least 11 participants in each group. It was difficult to include individuals using the established criteria, as most of the elderly population has several associated comorbidities. In this context, reduced samples can generate low statistical power for associations (type II error). The second limitation was the exclusivity of women in the population studied, the absence of males prevented a more global analysis for the exposure of the results.

Conclusion

No difference was found between eutrophic, overweight and with obesity grade I and II elderly women in functional capacity assessed by the TGlittre. However, relevant associations were observed between variables, such as the correlation of TGlittre with age and 6MWT. Still, we suggested that new studies be carried out with a larger sample number to validate TGlittre in this population. The data obtained in the present study corroborate that TGlittre is used as a functional measurement variable, as well as the 6MWT, for possible interventions in the elderly population.

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