











## Correlation between the GDLAM functional fitness test scores and the Katz functional scale of physically independent older people

### Correlação entre os scores dos testes de aptidão funcional GDLAM e escala funcional de Katz de idosos fisicamente independentes

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#### ABSTRACT

**Aim:** To evaluate the level of agreement via correlational analysis between an objective (GDLAM) and a subjective (Katz scale) measure of functional capacity in physically independent older adult males and females. **Methods:** One hundred physically independent subjects  $\geq 60$  years participated in the study. The following parameters were investigated: body composition (height, body weight, body mass index, and hip and waist circumference), objectively measured functional capacity via the GDLAM test (walking 10m, rising from a sitting position, rising from the prone position and standing up, get up of a chair and move around the house), and the Katz functional scale (subjective perception of six items for daily activities, namely: bathing, dressing, toileting, transferring, continence, and feeding). **Results:** Correlational results between the objective (GDLAM) and subjective (Katz) assessments showed a high degree of agreement between the scores within the full sample ( $r = -0.6636$ ), as well as among females ( $r = -0.8662$ ) and males ( $r = -0.8380$ ), all  $p \leq 0.001$ . **Conclusion:** The two physical aptitude tests showed satisfactory levels of agreement and correlation and presented good practical application. This suggests interchangeability of the tests.

**Keywords:** elderly people; functional test; functional fitness; aging.

#### RESUMO

**Objetivo:** O objetivo deste estudo foi avaliar a correlação entre os testes de aptidão funcional desenvolvido pelo Grupo de Desenvolvimento Latino-Americano para a Maturidade (GDLAM) e a escala de aptidão funcional de Katz em idosos fisicamente independentes. **Métodos:** Cem idosos com idade  $\geq 60$  anos participaram do estudo. Os seguintes parâmetros foram investigados: composição corporal (estatura, massa corporal, perímetria), funcionalidade objetiva por meio da aplicação do teste objetivo GDLAM (andar 10m, levantar-se a partir de uma posição sentada, subida da posição prona e levantar-se da cadeira e deslocar-se pela casa) e escala funcional subjetiva de Katz (percepção do idoso seis itens para atividades diárias, como, banhar-se, vestir-se, utilizar o banheiro ou ato de ir ao banheiro para excreções, higiene pessoal, arrumar a roupa, transferência, avaliada no desempenho de sair da cama e se sentar em uma cadeira e vice-versa, continência, referente a autocontrole de eliminação de urina e fezes e alimentação, ato de dirigir a comida à boca). **Resultados:** A comparação dos resultados de concordância entre os testes de aptidão física objetivo (GDLAM) e subjetivo (Katz) apresentaram alto grau de concordância entre os scores, tanto na avaliação geral ( $r = 0,6636$ ) quanto nos grupos feminino ( $r = 0,8662$ ) quanto masculino ( $r = 0,8380$ ). **Conclusão:** Os dois testes de aptidão física se correlacionaram moderadamente e apresentam boa aplicação prática. Isto sugere a intermutabilidade dos testes.

**Palavras-chave:** envelhecimento; exercício físico; atividades diárias; saúde.

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## Introduction

In developing countries, the prevalence of elderly people has been increasing rapidly [1]. In Brazil, the number of elderly people increased from 3 million in 1960 to 20 million in 2008, with prospects for an even greater increase for next years [2]. Associated with aging, physical inactivity is considered an important risk factor for diseases in general, and, in addition to social and environmental aspects, it can lead to progressive loss of functional capacity, which is often accompanied by reductions in the ability to perform activities of daily living [3-6]. The practice of physical activity is considered an effective non-pharmacological method to reduce physical disability, in addition to decreasing the risk of several chronic diseases [4,5,7-12] recognized as disabling in advanced clinical stages [5,13-16].

In view of all the positive factors of physical activity and negative factors of aging, there are countless tests that allow the assessment of the functional capacity of the elderly, of which the objective and subjective tests stand out. Regardless, both seek to obtain data related to general physical condition, showing the individual's independence. The objective tests for the elderly consist of exercises that represent everyday tasks; however, there are also tools that assess certain physical valences in an individualized manner, facilitating the identification of specific functional impairment [17].

Objectively, the protocol for assessing functional fitness in the elderly developed by the Latin American Development Group for Maturity (GDLAM) has been used frequently in the literature [18-20]. This protocol aims to investigate changes resulting from the pathological or physiological aging processes, in the presence or absence of acute or chronic strategies and/or interventions [18,20], aiming to assess the ability of the elderly to perform activities of daily living (ADL). Among subjective tests, the Katz scale of functionality has become a frequently explored method in the literature and has conclusive validity to functional aspects [21-25]. With the instrument proposed by Katz (1963), known as the functional capacity scale, the objective is to evaluate, through the perception of the elderly, six items for daily activities, such as bathing, dressing, toileting, transferring, continence, and feeding.

Although both instruments have the same objective of assessing aspects of functionality, there are no reports in the literature on the association between their results. Being the investigation of different domains considered decisive for geriatric characterization and/or evaluation, the objective of this study was to evaluate the correlation between the tests of aptitude of the functional capacity developed by the GDLAM and the scale Katz of functional fitness in physically independent elderly.

## Methods

### *Sample*

Participated in the present study, 100 physically independent older adults, in the region of greater Vitória (ES, Brazil),  $\geq 60$  years, recruited through advertisement in social media networks. All subjects were informed of the objective and the voluntary nature of the study and signed an informed consent form. This research is in the process of approval by the Ethics and Research Committee of the Federal University of Espírito Santo (n<sup>o</sup>: 3.781.742-, CAAE: 23557519.5.0000.5542- 2019).

The following exclusion criteria were adopted: recent hospitalization, symptomatic cardiorespiratory disease, hypertension or uncontrolled metabolic syndrome, severe kidney or liver disease, cognitive impairment or progressive and debilitating health conditions, obesity with the inability to perform physical activity, recent bone fractures, or any other contraindications to perform physical exercise.

### **Parameters evaluated**

#### *Body composition*

Height was measured using a Cardiomed stadiometer (WCS model) with an accuracy of 0.1 cm, and for body mass (BM) a Filizola scale (Personal Line Model 150) was used with an accuracy of 0.1 kg. The body mass index (BMI) was calculated according to the formula:  $BMI = \text{weight}/\text{height}^2$ . Thus, the following parameters were evaluated: BM, BMI, waist and hip circumference, and waist-to-hip ratio (WHR).

### **Functional fitness assessment**

#### *GDLAM Protocol*

Functional aptitude was assessed considering the scores and procedure proposed by the protocol according to Dantas & Vale [18] which consists of performing the following tests: walking 10 meters (W10m), standing up from a seated position (SSP), getting up from the prone position (GUPP), get up from the chair and move around the house (GUCMH). All GDLAM tests are scored based in time to perform each test, recorded in seconds. All tests were performed in the order described above, in a single day, using a 3-minute interval between them to allow a good recovery. According to Dantas & Vale [18], the General GDLAM Index was evaluated considering the following equation:  $IG = [(C10m + LPS + LPDV) \times 2] + LCLC / 3$ .

#### *Katz scale of functional fitness*

The Katz scale of functionality has become a subjective method widely explored in the literature and has conclusive validity to assess aspects of physical function [21]. The Katz scale proposes to assess, through the elderly's perception, six items related to ADL. More specifically, it assesses one's ability to bathe, dress, use the toilet,

transfer (e.g., get out of bed and sit in a chair and vice versa); continence (i.e., self-control over urination and defecation), and feed (i.e., direct food to the mouth). Each activity above is matched by three filling alternatives, the first consisting of “without help”, means that the subject can perform the activity without assistance, with “partial help”, in which the subject can only perform the activity if he/she receives some assistance and with “total help”, in which the subject is completely unable to perform the activity independently. The questionnaire is completed in the order described with scores ranging from 0 to 6 points, where 0 indicates total independence for the performance of activities and 6, dependence (total or partial) in carrying out all the proposed activities. The intermediate score indicates total or partial dependence on any of the activities and must be assessed individually.

### *Statistical analyses*

The Kolmogorov-Smirnov test was applied to analyze normality. We determined differences between males and females using an independent samples t-test. Pearson’s linear correlation was used to analyze the correlation between the GDLAM and Katz scores. Data are presented as means  $\pm$  standard deviation, and all analyzes were performed using SPSS (IBM version 22.0). A two-tailed significant level was set at  $p < 0.05$ .

## **Results**

Table I shows the anthropometric and functional parameters of the general analyzes, also identifying the male and female groups. Significant differences ( $p < 0.05$ ) were found between males and females only in body mass, height and WHR values. In the three analyzes, the subjects were classified as overweight, and only the male group presented WHR values above the cutoff rate, with greater probabilities of cardiovascular events.

The performance of the C10m, RSP and RPP functionality tests were classified as weak in all analyzes, however, for the general and female group analyzes the GUCMH test performance was classified as good, while the males were classified as very good. Significant differences ( $p < 0.05$ ) were found between males and females in the tests LPS and LCLC as shown in Table II.

Regarding the GDLAM functionality index, in the full sample (general analysis) was classified as “weak”, and so were females, while males were classified as “regular”. Therefore, significant differences were found between males and females in both functional scores as shown in table II. The prevalence of the functionality categories of both the GDLAM protocol and the Katz scale are showed at Figure 1.

Table I - Anthropometrics parameters of study participants

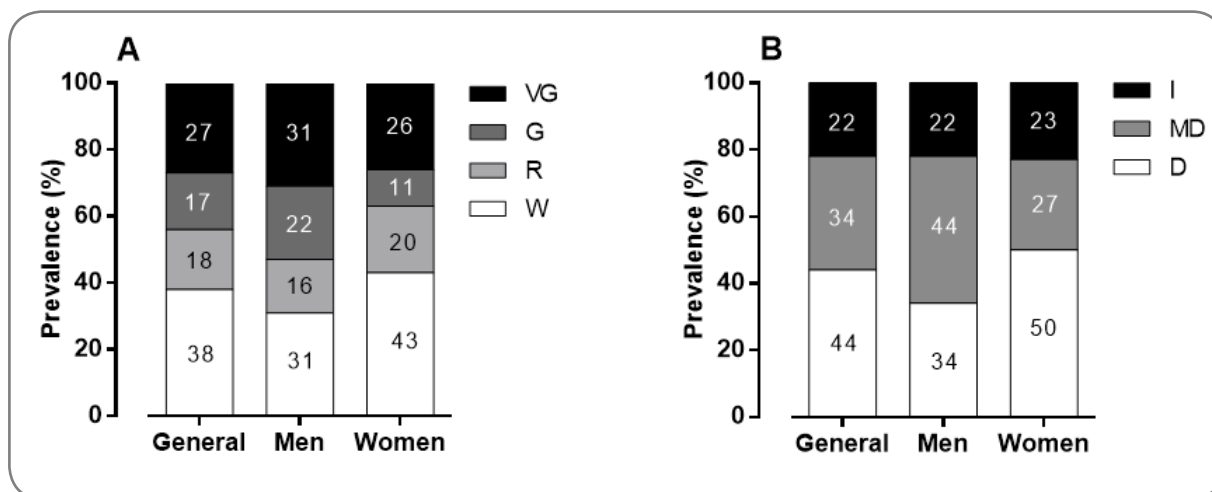
Parameters	General			Men			Females		
	Mean ± SD	95% IC	CV	Mean ± SD	95% IC	CV	Mean ± SD	95% IC	CV
Body mass (kg)	70.95 ± 10.51	68.55-73.35	14.81%	75.19 ± 1.69*	71.74 - 78.64	12.73%	67.87 ± 1.53	64.78 - 70.97	14.99%
Height (m)	1.642 ± 0.09	1.62-1.66	5.64%	1.696 ± 0.01*	1.66 - 1.72	5.00%	1.602 ± 0.011	1.57 - 1.62	4.80%
BMI (kg/m <sup>2</sup> )	26.49 ± 4.55	25.45-27.53	17.20%	26.27 ± 0.68	24.86 - 27.67	14.84%	26.65 ± 0.75	25.13 - 28.18	18.83%
WC (cm)	93.05 ± 9.37	90.91-95.2	10.08%	93.5 ± 1.82	89.77 - 97.23	11.05%	92.73 ± 1.31	90.07 - 95.38	9.41%
HC (cm)	93.74 ± 8.65	91.76-95.72	9.24%	92.25 ± 1.94	88.28 - 96.22	11.95%	94.82 ± 0.95	92.89 - 96.75	6.70%
WHR	0.99 ± 0.05	0.98-1.00	5.21%	1.015 ± 0.01*	0.99 - 1.03	4.64%	0.97 ± 0.01	0.96 - 0.99	5.10%

Values expressed as mean ± standard deviation (SD), 95% CI (confidence interval) and CV (coefficient of variation). BMI (body mass index), (WC) waist circumference, HC (hip circumference), WHR (WC/HC ratio). \*p <0.05 vs females

Table II - Functional fitness parameters of elderly people

Parameters	General			Men			Female		
	Mean ± SD	95% IC	CV	Mean ± SD	95% IC	CV	Mean ± SD	95% IC	CV
<b>GDLAM</b>									
W10m (sec)	9.06 ± 4.34	8.07 - 10.06	47.92 %	8.25 ± 0.68	6.85 - 9.64	46.91 %	9.66 ± 0.69	8.26 - 11.07	47.74 %
RSP (sec)	10.51 ± 4.44	9.49 - 11.53	42.30 %	9.23 ± 0.46*	8.27 - 10.19	28.73 %	11.44 ± 0.78	9.85 - 13.03	45.67 %
RPP (sec)	6.21 ± 4.13	5.26 - 7.15	66.55 %	5.44 ± 0.80	3.79 - 7.08	84.00 %	6.77 ± 0.56	5.63 - 7.91	55.22 %
GUCMH (sec)	35.09 ± 11.01	32.57 - 37.6	31.39 %	30.83 ± 0.86*	29.07 - 32.59	15.83 %	38.18 ± 1.97	34.2 - 42.16	34.27 %
<b>Functional score</b>									
GDLAM index	28.27 ± 8.73	26.28 - 30.27	30.89 %	25.56 ± 5.68*	23.51 - 27.61	22.23 %	30.24 ± 10.01	27.2 - 33.29	33.11 %
Katz index	3.07 ± 1.65	2.70 - 3.45	53.77 %	3.25 ± 1.50*	2.70 - 3.79	46.24 %	2.95 ± 1.76	2.41 - 3.49	59.73 %
<b>GDLAM classification</b>									
Weak	37.24 ± 6.63	34.72 - 39.76	17.82 %	31.92 ± 3.66	29.29 - 34.54	11.49 %	40.04 ± 6.14	37.08 - 43.00	15.34 %
Regular	27.36 ± 0.99	26.78 - 27.93	3.63 %	27.78 ± 0.72	26.87 - 28.68	2.62 %	27.13 ± 1.08	26.29 - 27.96	3.99 %
Good	23.63 ± 1.05	23.00 - 24.27	4.45 %	23.77 ± 0.88	22.95 - 24.58	3.72 %	23.48 ± 1.29	22.12 - 24.83	5.50 %
Very good	18.92 ± 2.14	17.92 - 19.92	11.33 %	19.35 ± 1.99	17.92 - 20.77	10.28 %	18.5 ± 2.31	16.84 - 20.15	12.50 %
<b>Katz classification</b>									
Very dependent	1.48 ± 0.50	1.30 - 1.66	34.18 %	1.54 ± 0.52	1.19 - 1.89	33.79 %	1.45 ± 0.50	1.22 - 1.68	35.04 %
Moderate dependence	3.53 ± 0.50	3.33 - 3.74	14.37 %	3.57 ± 0.51	3.27 - 3.86	14.38 %	3.50 ± 0.52	3.16 - 3.83	14.92 %
Independent	5.47 ± 0.51	5.20 - 5.73	9.40 %	5.28 ± 0.48	4.83 - 5.73	9.23 %	5.60 ± 0.51	5.23 - 5.96	9.22 %

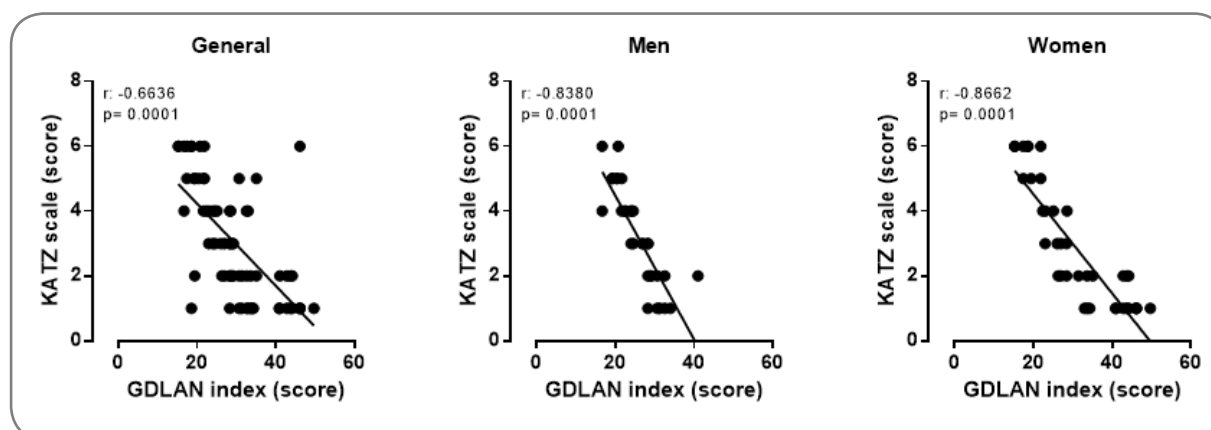
Values expressed as mean ± standard deviation (SD), IC (confidence interval) and CV (coefficient of variation). W10m (10 meters walk), RSP (standing up from seated position), RPP (getting up from the prone position), GUCMH (get up from the chair and move around the house). p <0.05 vs females



Panel A: classification considering the criteria of GDLAM index as very good (VG), good (G), regular (R) and weak (W). Panel B: classification considering the Katz scale criteria as independent (I), moderately dependent (MD) and dependent (D)

**Figure 1** - Prevalence of classifications of functional fitness

The correlation results between the GDLAM tests and the Katz scale are shown in Figure 2. Significant correlations were found in the three analyzes, full sample ( $r = -0.6636$ ;  $p < 0.0001$ ), males ( $r = -0.8380$ ;  $p < 0.0001$ ) and females ( $r = -0.8662$ ;  $p < 0.0001$ ).



**Figure 2** - Correlations between the Katz scale and the GDLAM index to general sample, males and females

## Discussion

The result of the present study demonstrated that both assessment protocols have correlation and agreement between them, given that both demonstrated significant correlations in all analyzes ( $r = -0.6636$ ;  $r = -0.8380$ ;  $r = -0.8662$ ). The present findings corroborate the hypothesis that both protocols have applicability in fields of activity and validity in the results.

It is no longer new that life expectancy is increasing and population aging is present in all countries, especially in developing countries [26]. In this perspective, countless interventions have been applied aiming at promoting successful aging [27,28], many of which targeting well-being and functionality. Thus, initiatives ai-

med at promoting independence are important to help maintain basic and instrumental ADL at a satisfactory level.

The assessment of functional independence is important for numerous outcomes, such as the progression of physical training, monitoring of independence in performing daily activities, risk of chronic disease and overall mortality [29], and dependency [30]. According to Ramos et al. [31], elderly people with a high dependency index have a higher risk of mortality, and maintaining physical independence is a preventive factor [31]. In addition, the progressive loss of functionality can have repercussions in several other aspects of life, covering the social, psychological, and biological domains [32].

This way, the assessment of functional capacity becomes relevant to a broad approach, both in the prevention and in the treatment of illnesses that can affect overall health in older adults. Thus, tests that aim at the objective assessment of independence are frequently used in the literature [18,19,33], however the application is surrounded by barriers in their administration, especially when performed in large populations. As such, the use of questionnaires and scales, like the ones in the current study, allows feasible and practical assessment of functional capacity in large groups of people.

The GDLAM protocol has been used in several studies as a functional outcome measure [18-20]. Of these, many proposed to investigate the effects of different types of exercise programs on functional capacity in older adults. Interventions such as water-based aerobic training [19,35-37], resistance training [38-40], walking [41], and multimodal exercises [33,42]. Regardless of the investigated modality, the duration of the exercise protocol, as well as the level of functionality of the subjects submitted to the exercise programs, measurable significant improvement in functional fitness were detected using the GDLAM protocol.

The Katz protocol was developed in the 1970s and is still used today to assess functionality in the elderly, but over the decades, some versions have been modified and adapted from the original test, as shown by Duarte et al. [21]. Regardless, Lino et al. [43] presented a cross-cultural adaptation of the Katz scale to the Portuguese language, showing fidelity both in the back-translation and in the functionality of its application [43].

Although many studies show the validity of using the GDLAM and Katz [18,19,33] protocols to assess physical independence, little has been investigated regarding the agreement between these assessment methods. To our knowledge, there are no studies available in the literature that investigated the agreement between the instruments investigated in this research. Thus, considering the moderate correlation presented in this study for the general population ( $r = -0.6636$ ), and high correlation for females ( $r = -0.86620$ ) and males ( $r = -0.8380$ ), these tests allows us greater versatility the use of both instruments according to the need of the evaluator and the prerogative of use.

## Conclusion

In conclusion, the functional independence assessed by the GDLAM protocols and the Katz functional fitness scale in physically independent older adults presented a considerably high level of agreement and correlation, thus allowing interchangeability between these instruments.

### Conflict of interest

The authors declare that they have no conflict of interest.

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### Authors' contributions

**Conception and design of the research:** Araujo GVM, Rica RL, Bocalini DS. **Data collection:** Araujo GVM, Barbosa WA, Gomes MCSS. **Data analysis and interpretation:** Rica RL, Alonso AC, Lima-Leopoldo AP. **Statistical analysis:** Rica RL, Alonso AC, Lima-Leopoldo AP, Bocalini DS. **Writing of the manuscript:** Araújo GVM, Rica RL, Alonso AC, Bocalini DS. **Critical review of the manuscript for important intellectual content:** Lima-Leopoldo AP, Silva-Grigoletto ME, Cadore E, Bocalini DS.

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