DOI: 10.1590/1809-2950/17021426042019

ORIGINAL RESEARCH

Handgrip strength and functional performance in middle-aged and older women with rheumatoid arthritis

Força de preensão palmar e desempenho funcional em mulheres de meia-idade e idosas com artrite reumatoide

Fuerza de prensión manual y rendimiento funcional en mujeres de mediana edad y ancianas con artritis reumatoide

Karla Gonçalves Diogo[1], Giane Amorim Ribeiro-Samora[2], Adriana Maria Kakehasi[3], Lygia Paccini Lustosa[4]

ABSTRACT | The handgrip strength in women with rheumatoid arthritis may be compromised, considering the presence of deformities and functional restrictions imposed by the disease. There is insufficient information on the difference in handgrip strength and functionality among middle-aged and older women with rheumatoid arthritis. The aim was to compare handgrip strength, functional capacity and fatigue among middle-aged and older women with rheumatoid arthritis and to verify the association of these variables in the different age groups. Women with rheumatoid arthritis, older than 45 years, with independent gait, were divided into groups of middle-aged (45-59 years) and older women (60 years and over). Handgrip strength (Jamar® dynamometer), functional capacity (gait speed) and fatigue (Functional Assessment of Chronic Illness Therapy) were measured. Statistical comparisons were made between groups by the independent Student's t-test and the association between variables in each group by Pearson's correlation test. The significance level considered was 5%. There was a significant difference in handgrip strength between groups (p=0.01). In the adult group, there was an association between functional capacity and fatigue (r=0.53, p=0.01) and in the elderly women group, there was an association between handgrip strength and gait speed (r=0.51, p=0.02). The results showed that the older women were in better muscle conditions. Parameters indicated as markers of functional and muscle performance in elderly women were shown to be associated, confirming the use of these markers in this specific condition.

Keywords | Arthritis, Rheumatoid; Middle Aged; Aged; Muscle Strength; Gait.

RESUMO | A força de preensão palmar em mulheres com artrite reumatoide pode estar comprometida devido à presença de deformidades e restrições funcionais impostas pela doença. Existem poucas informações na literatura sobre a diferença de força de preensão e funcionalidade em mulheres adultas e idosas com artrite reumatoide. O objetivo foi comparar a força de preensão palmar, capacidade funcional, e fadiga entre mulheres adultas (meia idade) e idosas com artrite reumatoide e verificar a associação destas variáveis nas duas faixas etárias. Participaram mulheres com artrite reumatoide, acima de 45 anos, com marcha independente, divididas em grupo de adultas (45 a 59 anos) e idosas (60 anos e mais). Foram mensuradas a força de preensão palmar (dinamômetro Jamar®), capacidade funcional (velocidade de marcha) e fadiga (*Functional Assessment of Chronic Illness Therapy*); feitas comparações entre grupos de idade pelo teste t-Student independente,

[1]Universidade Federal de Minas Gerais (UFMG) – Belo Horizonte (MG), Brazil. E-mail: fisio.karlagoncalves@gmail.com. Orcid: 0000-0002-4838-7019
[2]Universidade Federal de Minas Gerais (UFMG) – Belo Horizonte (MG), Brazil. E-mail: gribeirosamora@gmail.com. Orcid: 0000-0001-5102-369X
[3]Universidade Federal de Minas Gerais (UFMG) – Belo Horizonte (MG), Brazil. E-mail: amkakehasi@gmail.com. Orcid: 0000-0001-9411-7493
[4]Universidade Federal de Minhas Gerais (UFMG) – Belo Horizonte (MG), Brazil. E-mail: lygiapl@ufmg.br. Orcid: 0000-0002-0919-1320

Corresponding address: Lygia Paccini Lustosa – Av. Antônio Carlos, 6627, Pampulha – Belo Horizonte (MG), Brazil – Zip Code: 31270-901 – E-mail: lygiapl@ufmg.br –
Finance source: Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and the Coordenção de Aperfeiçoamento de Pessoal de Nível Superior (Capes) – Conflict of interest: nothing to declare – Presentation: 21/06/2018 – Accepted for publication: 12/08/2019 – Approved by the Research Ethics Committee: Opinion No. 52645416.5.0000.5149 (Universidade Federal de Minas Gerais)

e associação entre as variáveis, em cada grupo, pelo teste de correlação de Pearson. Foi verificado nível de significância de 5% e a força de preensão palmar foi maior no grupo de idosas (p=0,01). No grupo de adultas, houve associação entre capacidade funcional e fadiga (r=0,53; p=0,01) e no grupo de idosas, houve associação entre força de preensão palmar e velocidade de marcha (r=0,51; p=0,02). Os resultados demonstraram que as idosas estavam em melhores condições musculares. Parâmetros indicados, como marcadores de desempenho funcional e muscular em idosas demonstraram estar associados, confirmando o uso destes marcadores nesta condição específica.

Descritores | Artrite Reumatoide; Pessoa de Meia-Idade; Idoso; Força Muscular; Marcha.

RESUMEN | La fuerza de prensión manual en mujeres con artritis reumatoide puede verse comprometida debido a la presencia de deformidades y restricciones funcionales impuestas por la enfermedad. Hay poca información en la literatura sobre la diferencia en la fuerza de agarre y la funcionalidad en mujeres adultas y mayores con artritis reumatoide. El objetivo fue comparar la fuerza de la empuñadura, la capacidad funcional y la fatiga entre mujeres adultas (de mediana edad) y ancianas con artritis reumatoide y verificar la asociación de estas variables en ambos grupos de edad. Participaron mujeres con artritis reumatoide, mayores de 45 años, con marcha independiente, divididas en grupos de adultos (45 a 59 años) y ancianos (60 años y más). Se midieron la fuerza de agarre de la mano (dinamómetro Jamar®), la capacidad funcional (velocidad de marcha) y la fatiga (Evaluación funcional de la terapia de enfermedades crónicas). Se realizaron comparaciones entre grupos de edad mediante la prueba t de Student independiente, y la asociación entre las variables en cada grupo mediante la prueba de correlación de Pearson. Nivel de significancia del 5%. La fuerza de agarre fue mayor en el grupo de ancianos (p=0.01). En el grupo de adultos, hubo una asociación entre la capacidad funcional y la fatiga (r=0.53; p=0.01), y en el grupo de ancianos, hubo una asociación entre la fuerza de prensión y la velocidad de la marcha (r=0.51; p=0.02). Los resultados mostraron que las mujeres mayores estaban en mejor condición muscular. Los parámetros indicados como marcadores de rendimiento funcional y muscular en mujeres de edad avanzada se asociaron, lo que confirma el uso de estos marcadores en esta condición específica.

Palabras clave | Artritis Reumatoide; Persona de Mediana Edad; Anciano; Fuerza Muscular; Marcha.

INTRODUCTION

Rheumatoid arthritis (RA) is an autoimmune, systemic, and inflammatory disease that causes deformities and leads to death[1]. The occurrence of this disease is approximately 1% in the general population, beginning between the ages of 30 and 50 years in both sexes, with predominance in women[2]. The RA presence in middle-aged adults can cause progressive damage that, over time, will impact on their independence, compromising the performance of simple and complex daily life tasks[3]. In this case, it can be assumed that with aging, people affected by RA may present worse muscular and functional conditions.

Since the beginning of the disease, RA carriers report joint pain, morning stiffness — which last more than one hour — sometimes followed by edema[4]. The joints with the greatest involvement are the proximal interphalangeal, metacarpophalangeal and wrists[5,6]. Hand deformities, loss in bone and muscle strength, associated with pain, cause difficulties to perform work activities, personal care and housekeeping[5-7]. Furthermore, recurrent inflammation damages the muscle fibers, tends to decrease muscle strength, compromises joints, causes pain and deformity in the feet, leading to reduction in gait speed and increasing the risk of falls[8]. Also, in response to deformation and pain, indicators show that the handgrip strength of patients with RA is different from the strength of healthy people, using the same health parameters[9]. Furthermore, it is known that muscle strength can influence the functionality and impairment of aging.

Fatigue is presented as a secondary response to RA, reported by 88% to 98% of patients and associated with depressive symptoms, anxiety, and loss of life satisfaction[10,11]. Fatigue is considered as one of the agents that decrease functional capacity and muscle strength, causing indisposition, constant tiredness, inefficiency for habitual and work tasks, insomnia, irritability, and exhaustion[1,10,12]. Unlike tiredness, fatigue is reported as accentuated and difficult to control — which can last for minutes or days. This sensation worsens in the presence of pain in situations of stress in the home, family or work environment[1,10,12].

Regarding the pathogenesis and the clinical of the RA, there is the assumption that the greater the time of disease occurrence, the greater the functional impairments, especially when aging[13]. Moreover, aspects such as muscle strength, functional capacity, fatigue, deformities, increased dependence, among others, could

impact more those affected by RA[14]. This would be related not only with pathophysiological aspects of the disease, but also with the changes inherent to aging[14], which would contribute to increase the number of disabilities. Thus, it is believed that exploring the differences of these parameters (muscle strength, functional capacity and fatigue) among people affected by the disease, in different age groups, can contribute to enhance the knowledge in this area. Furthermore, these parameters have been indicated as markers of adverse health outcomes in older adults.

Therefore, this study aimed to compare the handgrip strength, functional capacity and fatigue among middle aged and older women with rheumatoid arthritis, in addition to verify the association of these variables in each of the two age groups.

METHODOLOGY

This is a cross-sectional study, which is an excerpt from the project "*Confiabilidade entre as medidas de força de preensão palmar em idosos com artrite reumatoide*" (free translation — Reliability among the measures of handgrip strength in older adults patients with rheumatoid arthritis), with a non-probabilistic sample. All participants signed an informed consent form. All procedures were performed by a single researcher previously trained.

The inclusion criteria were: women diagnosed with rheumatoid arthritis; and be 45 years or more. There was no distinction between race and/or social class. Those who presented any of the following characteristics were excluded: pain that incapacitated the performance of the tests; neurological diseases and/or sequelae; fractures of the upper and/or lower limbs in past year; dependent gait; suggestive score of cognitive alterations, according to schooling, detected in the mini mental state examination[15].

All the patients answered to a questionnaire with socio-clinic-demographic information and, subsequently, to the Functional Assessment of Chronic Illness Therapy (FACIT-F version 4), which contains questions to track the subjective perception of fatigue in people with chronic diseases, such as arthritis[1,16], and has a translated version for Brazilian Portuguese[16]. FACIT-F encompasses: physiological fatigue, which is related to muscle strength and endurance; objective fatigue, which is related to functional performance; and self-perceived fatigue, which is associated with subjective perception in relation to symptoms and sensations felt by the influence of emotional and mental condition[17]. Thus, the questionnaire includes domains of physical, social/family, emotional, functional and additional concerns[1,16]. Each statement of the subscale enables the participant to choose between 0 and 4, allowing a final result of 160 points in maximum. The closer to this total, lower is the perception and influence of fatigue symptoms on the participant's quality of life. On the other hand, a score closer to zero indicates strong symptoms of fatigue and, consequently, worse quality of life[1,16]. In this study, were used the sum of all the subscales results.

To measure the handgrip strength, the Jamar® hydraulic hand dynamometer was used with the handle in the second position. The positioning protocol of the participant during the test is recommended by the American Society of Hand Therapists[18,19]. The participant received guidance about the test and performed the highest handgrip strength after the "Go ahead" command, maintaining the maximum isometric contraction for six seconds. During the test, the verbal stimulus such as: "you can do it…" and clapping were constant. Three measurements were performed, with the dominant hand, with an one-minute interval between each[20].

Functional capacity was assessed by the walk test in the distance of four meters. In this case, the participant was instructed to walk at her usual speed, for a course of eight meters, not being considered neither the two initial meters for acceleration nor the final two meters for deceleration. This measurement was performed twice, the time was timed and the mean of the two measurements was used for analysis in meters/seconds (m/s)[21,22].

Statistical analysis

The sample size was calculated using the G*Power 3.1.9.2 program with the significance level parameters α=0.05, non-directional, 95% confidence interval, mean effect size=0.5 and power=0.80. The result demonstrated the need of 16 participants for each group. Considering the possibility of sample loss, a quota 20% higher than the required number was recruited. The descriptive analysis of the sample was presented in mean, percentage and standard deviation. Data distribution was verified by the Shapiro-Wilk test. Comparisons between groups were conducted using the independent Student's t-test and the chi-square test. The association between variables was analyzed using Pearson's correlation test[23].

According to Fleiss, correlations below 0.30 are considered weak, between 0.30 and 0.60 are considered moderate and above 0.60 are considered good[24]. A 5% significance level was adopted.

RESULTS

A total of 41 women participated in this study, divided between two groups, according to age: the group of middle aged women (MAW) (n=21), aged between 45 and 59 years old and the group of older women (OW) (n=20) age equal or higher than 60 years. The socio-clinic-demographic characteristics are shown in Table 1.

Table 2 shows the results of the comparing between the variables studied for MAW and OW, demonstrating statistical difference only for the handgrip strength (p=0.01), indicating that the older women were in better muscle conditions. Other comparisons were not significant (p>0.05).

The correlations are shown in Table 3 and 4. In MAW, the better the functional capacity the lower the fatigue. On the other hand, in the OW, the better the handgrip strength the better the functional capacity. Other comparisons were not significant (p>0.05).

Table 1. Socio-clinic-demographic characteristics of the participants and the differences between groups

Variable	MAW (n=21)	OW (n=20)	p-value
Age, mean (SD)	54.5 (4)	67.1 (6.6)	0.01*
Race			
White, n (%)	6 (28.6)	5 (25)	
Brown skin, n (%)	12 (57.1)	9 (45)	0.86
Others, n (%)	3 (16.3)	6 (30)	
Marital status			
Married, n (%)	13 (61.9)	11 (55)	
Single, n (%)	3 (14.3)	5 (25)	0.11
Others, n (%)	5 (23.8)	4 (20)	
Schooling			
Elementary School, n (%)	8 (38.1)	10 (50)	
Middle School, n (%)	7 (33.3)	3 (15)	0.17
Others, n (%)	6 (28.6)	7 (35)	
Smoker			
Yes, n (%)	5 (23.8)	2 (10)	0.47
Former smoker, n (%)	2 (9.5)	3 (15)	
Lives with			
Husband/partner, n (%)	11 (52.4)	8 (38.1)	0.54
Children or Stepchildren, n (%)	1 (4.8)	5 (23.8)	0.04*
Grandchildren and relatives, n (%)	9 (42.9)	8 (38.1)	0.34
Other diseases, mean (SD)	2.4 (1.4)	3.9 (1)	0.01*
Presence of pain, n yes (%)	17 (81)	17 (85)	0.89
Self-perceived health/general well-being			
Poor, n (%)	1 (4.8)	1 (5)	
More or less, n (%)	12 (57.1)	12 (60)	0.98
Good, n (%)	8 (38.1)	7 (35)	
Welfare			
Poor, n (%)	4 (19)	2 (10)	
More or less, n (%)	10 (47.6)	8 (40)	0.62
Good, n (%)	7 (33.3)	10 (50)	
General Satisfaction			
Poor, n (%)	3 (14.3)	0 (0)	
More or less, n (%)	11 (52.4)	9 (45)	0.14
Good, n (%)	7 (33.3)	11 (55)	

(continues)

Table 1. Continuation

Variable	MAW (n=21)	OW (n=20)	p-value
General satisfaction with life			
Poor, n (%)	2 (9.5)	0 (0)	
More or less, n (%)	12 (57.1)	7 (35)	0.07
Good, n (%)	7 (33.3)	13 (65)	
Time of diagnosis, years (SD)	12.2 (8)	16.2 (12.5)	0.30
Medicine in use, number (SD)	6.1 (2.7)	7.5 (2.5)	0.09

SD: standard deviation; *significantly difference.

Table 2. Comparison of the measures of handgrip strength, functional capacity and fatigue among middle-aged and older women

Variable	MAW (n=21) Mean (SD)	OW (n=20) Mean (SD)	p-value	95% Confidence Interval
HGS	9.87 (7.32)	16.29 (6.64)	0.01*	−10.85-−1.99
GS	1 (0.26)	1 (0.27)	0.92	−0.18-0.16
FACIT-F	103.80 (22.60)	105.42 (21)	0.81	−15.42-12.18

HGS: handgrip strength; GS: gait speed; FACIT-F: Functional Assessment of Chronic Illness Therapy-Fatigue; *significantly difference; SD: standard deviation.

Table 3. Association of handgrip strength measures with functional capacity and muscle fatigue in middle-aged (MAW) and older women (OW) with rheumatoid arthritis

MAW (n=21)			OW (n=20)		
Variable	GS r (p)	FACIT-F r (p)	Variable	GS r (p)	FACIT-F r (p)
HGS	0.33 (0.13)	0.23 (0.30)	HGS	0.51 (0.02)*	0.31 (0.18)

HGS: handgrip strength; GS: gait speed; FACIT-4: Functional Assessment of Chronic Illness Therapy-Fatigue; *significantly difference; SD: standard deviation.

Table 4. Association of functional capacity and muscle fatigue measures in middle-aged (MAW) and older (OW) women with rheumatoid arthritis

MAW (n=21)		OW (n=20)	
Variable	FACIT-F r (p)	Variable	FACIT-F r (p)
GS	0.53 (0.01)*	GS	0.07 (0.75)

HGS: handgrip strength; GS: gait speed; FACIT-F: Functional Assessment of Chronic Illness Therapy-Fatigue; *significantly difference; SD: standard deviation.

DISCUSSION

This study aimed to compare the handgrip strength, functional capacity, and fatigue among middle-aged and older women with rheumatoid arthritis, in addition to verifying the association of these variables in each of the two age groups. The results showed that the handgrip strength was higher, statistically significant, in older women and, in this group, was correlated with functional capacity (r=0.51; p=0.02). In middle-aged women there was a correlation between functional capacity and fatigue (r=0.53; p=0.01).

Studies have evidenced that the handgrip strength is a predictor of health problems in older people and this measure corresponds to a decrease in global muscle strength[25,26]. In this case, the reference values recommended in the literature, for older people, have helped in the identification of some clinical conditions. Thus, values lower than 20 kgf have been considered determinants to health impairment during aging[25,26]. However, in RA it is assumed that the hand deformities interfere in the mechanics of the grip, suggesting that this value may not be the best reference for populations with these deformities. Thus, although both groups studied here present values below the cutoff point of a healthy population of the same age, older women were shown with greater handgrip strength, statistically different, than middle-aged women. This result proved to be contrary to the literature, as it was expected a loss of gradual and global muscle strength with the aging process[25,26]. In this case, one can think about the repercussions of RA and its deformities, mainly indicating to the possibility

of adapting to them over the years. On the other hand, although the results showed no statistically significant difference between the groups, regarding the development time of the disease, it can be inferred that older women would be more adapted to deformities, generating higher torque at the time of the handgrip strength test[17].

Regarding the fatigue, it is known that it is related with quality of life, since the symptoms and unpleasant sensations reported by RA patients exert influence on strength and endurance of the muscle as well as in functional performance, causing reduction in activities and participation[1,17]. As we used all the FACIT subscales in this study, it was not possible to demonstrate differences between the groups and, consequently, to determine which domain would be compromising the muscle strength.

This study identified that middle-aged and older women were similar in gait speed. Moreover, it showed an association between handgrip strength and functional capacity in older women, confirmed in the literature[21]. Thus, it was verified that even in the presence of RA, considering the time of diagnosis, use of polypharmacy and comorbidities, resulting from the disease, the older women were in good functional condition, despite the joint constraints. On the other hand, it is known that the measure of handgrip strength and gait speed are health markers for the older people, which may indicate the presence of silent conditions[3,17,18,21]. The association demonstrated here reinforces its importance and indicates the need for monitoring these conditions in clinical practice.

In middle-aged women there was an opposite correlation between functional capacity and fatigue. Some authors have pointed out that the presence of fatigue in people with rheumatoid arthritis has an interaction with physical, psychological and environmental factors[11]. Thus, factors such as pain, physical inactivity and depression can interact and determine fatigue[11]. On the other hand, according to the results showed, a good functional capacity suggests to minimize fatigue manifestation and should also be considered in the daily practice of the health professional.

Some limitations of this study must be considered. One of them refers to the type of deformity in the hands, that could influence the measurements of handgrip strength. Similarly, the level of physical activity of the participants, for practicing physical activity regularly can be determinant to a better functional capacity, especially in older people. It is noteworthy that the time of disease activity, as well as the type of specific medicine used, should be better explored in future studies, since they may have an influence on the muscle quality and functional capacity of people affected by rheumatoid arthritis.

Finally, it can be said that the results obtained presented clinical relevance, for they indicated to a compromise of the handgrip strength in women with RA, with possible repercussions on functional capacity, which should be assessed in a systematic manner at clinical practice.

CONCLUSION

The results of this study showed that older women with rheumatoid arthritis presented better handgrip strength. The association of muscle and functional parameters in this age group indicates to the use of these markers in the presence of rheumatoid arthritis. On the other hand, the functional capacity for middle-aged women acts as a fatigue indicator.

REFERENCES

1. Bianchi WA, Elias FR, Pinheiro GRC, Gayer CRM, Carneiro C, Grynzpan R, et al. Análise da associação da fadiga com variáveis clínicas e psicológicas em uma série de 371 pacientes brasileiros com artrite reumatoide. Rev Bras Reumatol. 2014;54(3):200-7. doi: 10.1016/j.rbr.2013.11.001
2. Wasserman AM. Diagnosis and management of rheumatoid arthritis. Am Fam Physician. 2001;84(11):1245-52.
3. Camara FM, Gerez AG, Miranda MLJ, Velardi M. Capacidade funcional do idoso: formas de avaliação e tendências. Acta Fisiatr. 2008;15(4):249-56.
4. Mota LMH, Cruz BA, Brenol CV, Pereira IA, Rezende-Fronza LS, Bertolo MB, et al. Diretrizes para o diagnóstico da artrite reunatoide. Rev Bras Reumatol. 2013;53(2):141-57. doi: 10.1590/S0482-50042013000200003
5. Aletaha D, Neogi T, Silman AJ, Funovits J, Felson DT, Bingham CO, et al. Rheumatoid arthritis classification criteria: An American College of Rheumatology/European League Against Rheumatism collaborative initiative. Arthritis Rheum. 2010;62(9):2569-81. doi: 10.1136/ard.2010.138461
6. Norton S, Sacker A, Dixey J, Done J, Williams P, Young A. Trajectories of functional limitation in early rheumatoid arthritis and their association with mortality. Rheumatol (Oxford). 2013;52(11):2016-24. doi: 10.1093/rheumatology/ket253
7. Corbacho MI, Dapueto JJ. Avaliação da capacidade funcional e da qualidade de vida de pacientes com artrite reumatoide. Rev Bras Reumatol. 2010;50(1):31-43. doi: 10.1590/S0482-50042010000100004
8. Marques WV, Cruz VA, Rego J, Silva NA. The impact of comorbidities on the physical function in patients with rheumatoid arthritis. Rev Bras Reumatol. 2016;56(1):14-21. doi: 10.1016/j.rbr.2015.01.009

9. Caporrino FA, Faloppa F, Santos JBG, Réssio C, Soares FHC, Nakachima LR, et al. Estudo populacional da força de preensão palmar com dinamômetro Jamar. Rev Bras Ortop. 1998;33(2):150-4.

10. Nicklin J, Cramp F, Kirwan J, Greenwood R, Urban M, Hewlett S. Measuring fatigue in rheumatoid arthritis: a cross-sectional study to evaluate the Bristol Rheumatoid Arthritis Fatigue Multi-Dimensional questionnaire, visual analog scales, and numerical rating scales. Arthritis Care Res (Hoboken). 2010;62(11):1559-68. doi: 10.1002/acr.20282

11. Nikolaus S, Bode C, Taal E, van de Laar MFJ. Fatigue and factors related to fatigue in rheumatoid arthritis: a systematic review. Arthritis Care Res (Hoboken). 2013;65(7):1128-46. doi: 10.1002/acr.21949

12. Pollard LC, Choy EH, Gonzalez J, Khoshaba B, Scott DL. Fatigue in rheumatoid arthritis reflects pain, not disease activity. Rheumatology (Oxford). 2006;45(7):885-9. doi: 10.1093/rheumatology/kel021

13. Mota LMH, Laurindo IMM, Santos Neto LL. Características demográficas e clínicas de uma coorte de pacientes com artrite reumatoide inicial. Rev Bras Reumatol. 2010;55(3):235-40. doi: 10.1590/S0482-50042010000300004

14. Roma I, Almeida ML, Mansano NDS, Viani GA, Assis MR, Barbosa PMK. Quality of life in adults and elderly patients with rheumatoid arthritis. Rev Bras Reumatol. 2014;54(4):279-86. doi: 10.1016/j.rbr.2014.03.025

15. Bertolucci PH, Brucki SM, Campacci SR, Juliano Y. O mini-exame do estado mental em uma população geral: impacto da escolaridade. Arq Neuropsiquiatr. 1994;52(1):1-7. doi: 10.1590/S0004-282X1994000100001

16. Webster K, Cella D, Yost K. The Functional Assessment of Chronic Illness Therapy (FACIT) Measurement System: properties, applications, and interpretation. Health Qual Life Outcomes. 2003;1:79. doi: 10.1186/1477-7525-1-79

17. Silva JP, Pereira DS, Coelho FM, Lustosa LP, Dias JMD, Pereira LSM. Fatores clínicos, funcionais e inflamatórios associados à fadiga muscular e à fadiga autopercebida em idosas da comunidade. Rev Bras Fisioter. 2011;15(3):241-8. doi: 10.1590/S1413-35552011000300011

18. Hogrel JY. Grip strength measured by high precision dynamometry in healthy subjects from 5 to 80 years. BMC Musculoskelet Disord. 2015;16(1):139. doi: 10.1186/s12891-015-0612-4

19. Figueiredo LM, Sampaio RF, Mancini MC, Silva FCM, Souza MAP. Teste de força de preensão utilizando o dinamômetro Jamar. Acta Fisiatr. 2007;14(2):104-10. doi: 10.5935/0104-7795.20070002

20. Shiratori AP, Iop R, Gomes NJB, Domenech SC, Gevaerd S. Protocolos de avaliação da força de preensão manual em indivíduos com artrite reumatoide : uma revisão sistemática. Rev Bras Reumatol. 2014;54(2):140-7. doi: 10.1016/j.rbr.2014.03.009

21. Bez JPO, Neri AL. Velocidade da marcha, força de preensão e saúde percebida em idosos: dados da rede FIBRA Campinas, São Paulo, Brasil. Cienc Saude Coletiva. 2014;19(8):3343-53. doi: 10.1590/1413-81232014198.09592013

22. Novaes RD, Miranda AS, Dourado VZ. Velocidade usual da marcha em brasileiros de meia idade e idosos. Rev Bras Fisioter. 2011;15(2):117-22. doi: 10.1590/S1413-35552011000200006

23. Portney LG, Watkins MP. Foudations of clinical research. 3rd ed. Philadelphia: FA Davis Company; 2015.

24. Fleiss RL. The design and analysis of clinical experiments. New York: John Wiley & Sons; 1986.

25. Iop RR, Shiratori AP, Ferreira L, Borges Júnior NG, Domenech SC, Gevaerd MS. Capacidade de produção de força de preensão isométrica máxima em mulheres com artrite reumatoide : um estudo piloto. Fisioter Pesqui. 2015;22(1):11-6. doi: 10.590/1809-2950/12371922012015

26. Masuko K. Rheumatoid cachexia revisited: a metabolic co-morbidity in rheumatoid arthritis. Front Nutr. 2014;(24):1-6. doi: 10.3389/fnut.2014.00020