

HANDGRIP STRENGTH IN OLDER ADULTS PRACTITIONERS OF PILATES EXERCISE METHOD: A COMPARISON BASED ON SOCIODEMOGRAPHIC, HEALTH, AND EXERCISE VARIABLES

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Abstract: This study compared handgrip strength in older adult practitioners of the Pilates Method based on sociodemographic, health, and exercise variables. It is an cross-sectional study conducted with 71 subjects of both genders. A sociodemographic questionnaire was used to characterize the older participants. Handgrip strength was assessed using a digital manual dynamometer. Data were analyzed using the Kolmogorov-Smirnov test, measures of skewness and kurtosis, bootstrap procedures, independent Student's t-test, one-way ANOVA, and Tukey's post-hoc test. A significance level of $p < 0.05$ was adopted. The older adult participants showed a mean handgrip strength of 26.53 kg. Male participants ($p < 0.001$), those aged 60-69 years ($p = 0.003$), and retirees ($p = 0.017$) exhibited higher handgrip strength. No significant difference ($p > 0.05$) in handgrip strength was found among older adults based on variables related to health conditions and Pilates practice. Sociodemographic factors such as gender, age group, and retirement status may influence handgrip strength in older adult practitioners of the Pilates Method.

Key words: aging; exercise; strength

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FORÇA DE PREENSÃO MANUAL EM PESSOAS IDOSAS PRATICANTES DE EXERCÍCIOS DO MÉTODO PILATES: UMA COMPARAÇÃO BASEADA NAS VARIÁVEIS SOCIODEMOGRÁFICAS, DE SAÚDE E DA PRÁTICA DE EXERCÍCIO

Resumo: Este estudo comparou a força de preensão manual de pessoas idosas praticantes de exercícios do Método Pilates com base em variáveis sociodemográficas, de saúde e exercício. Trata-se de um estudo transversal realizado com 71 sujeitos de ambos os sexos. Para a caracterização dos idosos, foi utilizado um questionário sociodemográfico. A força de preensão manual foi avaliada utilizando um dinamômetro manual digital. Os dados foram analisados pelo teste Kolmogorov-Smirnov, medidas de assimetria e curtose, procedimentos de bootstrap, teste t de Student independente, ANOVA de um fator e teste post-hoc de Tukey. Foi adotado nível de significância de $p < 0,05$. Os participantes idosos apresentaram média de 26,53 kg de força de preensão manual. Participantes do sexo masculino ($p < 0,001$), na faixa etária de 60-69 anos ($p = 0,003$) aposentados ($p = 0,017$), apresentaram maior força de preensão manual. Não foi encontrada diferença significativa ($p > 0,05$) na força de preensão entre as pessoas idosas com base em variáveis relacionadas às condições de saúde e à prática de Pilates. Fatores sociodemográficos como sexo, faixa etária e status de aposentadoria, podem ser intervenientes na força de preensão manual de pessoas idosas praticantes de exercícios do Método Pilates.

Palavras-chave: envelhecimento; exercício; força

Introduction

The aging of the population is a global phenomenon that has raised increasing concerns regarding the health and well-being of older adults¹. With the increase in life expectancy, there is an urgent need to promote effective strategies to maintain physical functionality and quality of life in this age group². Among the physical exercise approaches aimed at older adults, the Pilates Method has gained prominence due to its potential benefits in improving muscle strength, flexibility, and posture and promoting balance and coordination³.

With its focus on muscle strength and flexibility, the Pilates Method holds promise in influencing handgrip strength in older adults^{4,5}. Handgrip strength, a crucial indicator of physical functionality in older adults, is linked to various health outcomes, including functional capacity, risk of falls, and mortality^{6,7}. Therefore, understanding the factors that influence handgrip strength in older adult Pilates practitioners is relevant and offers hope for optimizing the benefits of this exercise modality and promoting health in this population.

Age, sex, socioeconomic status, and education have been extensively studied as determinants of handgrip strength in older adults^{8,9}. Health factors such as chronic diseases, nutritional status, and mental health can also influence handgrip strength in older adults^{10,11}. However, the role of the Pilates Method practice in handgrip strength among older adults and its interaction with other variables have not been fully elucidated. Therefore, this study compares handgrip strength in older adult practitioners of the Pilates Method based on sociodemographic, health, and exercise variables.

Methods and Materials

This is an observational and cross-sectional study, approved by the Ethics Committee on Research with Human Beings of the Metropolitan University Center of Maringá (Unifamma), through opinion number 2.305.312, built by the Reporting of Observational Studies in Epidemiology (STROBE).

The sample, intentionally and conveniently selected, consisted of 71 older adults of both sexes, practitioners of Pilates Method exercises, in seven clinics/gyms/studios in Maringá, Paraná. Older adults using walking aids (cane, walker, among others) and wheelchair users were excluded from the research; older adults with visual, auditory, and cognitive impairments disabling them from taking the test and completing the questionnaires were also excluded.

For the characterization of older adults, a sociodemographic questionnaire was used,

with questions regarding age, sex, race, education, smoking, retirement, self-perception of health, occupational status, income in the minimum wage, marital status, number of medications used, presence of diseases, history of falls in the last six months, time of practice, and weekly frequency of Pilates Method exercise practice.

Handgrip strength was evaluated using a digital manual dynamometer, adopting the unit of measurement in kilograms (kg). The older adult remained seated in a chair with the arm of the dominant limb adducted and in neutral rotation, with the elbow flexed at 90° and forearm and wrist in neutral rotation. The grip was self-adjusted, according to the older adult's report of greater comfort, and after observing the correct position of the device, whose rod was positioned between the second phalanges of the fingers (index, middle, and ring). At the evaluator's voice command, the older adult exerted maximum force to bring the two rods of the device closer together. Three measurements were collected with a one-minute rest interval between them, using the highest value obtained¹². The measurement methodology was based on the instructions described in the manufacturer's manual.

For the classification of muscle strength, we adopted the cutoff points proposed by the European Working Group on Sarcopenia in Older People (EWGSOP)¹³, which considers values <27 kg for men and <16 kg for women as indicative of low muscle strength. These cutoffs are widely used in geriatric and gerontological research, providing a standardized reference that accounts for sex differences but does not stratify results by age group¹³.

A detailed search was conducted to identify establishments offering Pilates apparatus exercises, including studios, clinics, and gyms. Seven locations were selected. Researchers contacted these establishments to explain the objectives and methodology of the study. All seven locations agreed, and visits were scheduled for the days and times when older adults would be present.

During these visits, researchers informed older adults about the procedures and details of the research. Those who agreed to participate signed the Informed Consent Form. Data collection lasted an average of 20 minutes per person between July and October 2023.

The data analysis was conducted using SPSS 25.0 software, employing descriptive and inferential statistical approaches. Frequency and percentage were used as descriptive measures for categorical variables. For numerical variables, data normality was assessed using the Kolmogorov-Smirnov test and measures of skewness and kurtosis. Additionally, bootstrapping procedures (1000 re-samplings; 95% BCa confidence interval) were performed to enhance result reliability, correct for potential deviations from normality in the sample distribution and

differences in group sizes, and to provide a 95% confidence interval for the means¹⁴. Mean and standard deviation were used as measures of central tendency and dispersion.

To compare handgrip strength among older adult participants based on sociodemographic, health, and Pilates practice profiles, independent Student's t-test (for two groups) and One-Way ANOVA followed by Tukey's post-hoc test (for more than two groups) were employed. A significance level of $p < 0.05$ was adopted.

Results

The research included 71 older adult Pilates practitioners, comprising 57 females and 14 males, aged between 60 and 93 years ($M = 71.52$; $SD = 7.68$). The data from Table 1 reveal a predominance of older adults under 80 years old (81.7%), living with a partner (54.9%), having completed high school or higher education (70.4%), of Caucasian ethnicity (78.9%), retired (84.5%), not currently employed (60.6%), and having a monthly income of more than three minimum wages (62.0%).

Table 1 – Sociodemographic Profile of Older Adults Pilates Practitioners Participating in the Study.

VARIABLES	<i>f</i>	%
Gender		
Female	57	80.3
Male	14	19.7
Age Group		
60 to 69 years	32	45.1
70 to 79 years	26	36.6
80 years or older	13	18.3
Marital Status		
With partner	39	54.9
Without partner	32	45.1
Education		
Did not study	2	2.8
Incomplete elementary education	11	15.5
Complete elementary education	8	11.3
Complete high school	15	21.1
Complete higher education	35	49.3
Race/Ethnicity		
White	56	78.9
Black/Brown	4	5.6
Other	11	15.5
Monthly income		
1 to 2 MW	7	9.8
2.1 to 3 MW	20	28.2

More than 3 MW	44	62.0
Retirement		
Yes	60	84.5
No	11	15.5
Occupational Status		
Employed	28	39.4
Not employed	43	60.6

MW: minimum wages.

According to the results from Table 2, the majority of older adults participants reported perceiving themselves to be in good health (67.6%), using between one and three medications regularly (95.4%), having some chronic non-communicable disease (53.5%), practicing Pilates for more than one year (73.2%), engaging in Pilates sessions two or more times per week (95.8%), and not engaging in any other form of exercise (59.2%).

Table 2 – Health and Pilates Practice Profile of Older Adults Participants in the Study.

VARIABLES	<i>f</i>	%
Health Perception		
Good	48	67.6
Fair	23	32.4
Medication use		
None	7	9.9
1 to 3	39	54.9
More than 3	25	35.2
Presence of NCDs		
No	33	46.5
Yes	38	53.5
Time practicing Pilates		
Less than one year	19	26.8
1.1 to 4 years	28	39.4
More than four years	24	33.8
Weekly frequency of Pilates practice		
1 time	10	14.1
Two times or more	61	95.8
Practice of other exercise		
Yes	29	40.8
No	42	59.2

NCDs: Non-Communicable Diseases.

Handgrip strength among older women ranged from 15.1 kgF to 50.9 kgF, with a mean of 24.4 ± 5.3 kgF. Only three participants presented values below the cutoff point, indicating low muscle strength. Among older men, values ranged from 15.1 kgF to 51.6 kgF, with a mean of 26.8 ± 8.1 kgF. In this group, 45 participants (68.2%) presented low muscle strength.

When comparing handgrip strength among older adult Pilates practitioners based on

sociodemographic profile (Table 3), significant differences were found in handgrip strength based on sex ($p < 0.001$), age group ($p = 0.003$), and retirement status ($p = 0.017$). Specifically, male older adult participants ($M = 38.84$; $SD = 8.51$) exhibited greater handgrip strength than females ($M = 23.51$; $SD = 3.73$). Additionally, older adult participants aged 60-69 ($M = 29.59$; $SD = 8.80$) demonstrated greater handgrip strength than those aged 80 ($M = 21.30$; $SD = 3.95$). Retired older adult participants ($M = 27.13$; $SD = 8.33$) showed higher handgrip strength than non-retired older adults ($M = 23.29$; $SD = 3.62$).

Table 3 - Compares handgrip strength among older adults Pilates practitioners participating in the research based on sociodemographic profile.

GROUPS	Handgrip strength	p-value
	M (SD)	
Gender		
Female	23.51 (3.73)	<0.001*
Male	38.84 (8.51)	
Age Range		
60 to 69 years	29.59 (8.80) ^a	0.003*
70 to 79 years	25.39 (6.59)	
80 years or more	21.30 (3.95)	
Marital Status		
With partner	28.11 (8.78)	0.055
Without partner	24.61 (6.27)	
Monthly Income		
1 to 2 MW	21.48 (3.02)	0.193
2.1 to 3 MW	26.56 (7.63)	
More MW	27.32 (8.34)	
Retirement		
Yes	27.13 (8.33)	0.017*
No	23.29 (3.62)	
Occupational Status		
Works	27.02 (7.11)	0.679
Does not work	26.21 (8.43)	

* Significant difference ($p < 0.05$) - Independent Student's t-test for two groups; One-Way ANOVA for more than two groups between a) 60 to 69 years and 80 years or more. MW: minimum wages. SD: Standard deviation. M: mean.

No significant difference ($p > 0.05$) was found in handgrip strength among older adult participants based on variables related to health conditions and Pilates practice.

Discussion

The main findings of this study indicate that older adult practitioners of Pilates exercises have acceptable handgrip strength. Male participants, younger older adults, and retirees showed

higher handgrip strength than their counterparts. Furthermore, no significant difference was found in handgrip strength among older adults based on variables related to health conditions and Pilates practice.

The finding that older adult individuals have acceptable handgrip strength can be attributed to the fact that Pilates is a form of resistance exercise focusing on strengthening various muscle groups, including those in the hands. By performing specific Pilates exercises, often involving equipment such as the Reformer and mat exercises¹⁵, older adults can gradually strengthen their hand muscles, improving handgrip strength.

Additionally, Pilates is known to promote better posture and body alignment. As many Pilates exercises emphasize movement control and spinal stabilization¹⁶, practitioners are encouraged to engage their hand muscles throughout the workout. This emphasis on proper technique and muscle activation may increase handgrip strength among older adults who consistently engage in movements challenging hand muscles.

We found that males exhibit superior handgrip strength compared to females. Firstly, their history of physical activities may play a significant role^{17,18}. Many men tend to engage in occupations or hobbies that require physical strength, which can result in a more robust muscle foundation. When these men adopt the Pilates Method later in life, they already possess a solid base of muscle strength, enabling them to progress more quickly and achieve more significant gains in handgrip strength¹⁹.

Furthermore, men generally have a biomechanical advantage over women due to their muscle composition and bone density^{20,21}. Therefore, by performing specific Pilates exercises to strengthen these areas, males may experience a more noticeable increase in handgrip strength.

Another important finding is that younger older adults have greater handgrip strength compared to older ones. Younger older adults typically have a history of more active and consistent physical activity participation than their older counterparts. This results in a stronger and more resilient muscle foundation, giving them an initial advantage when starting the Pilates Method. Consequently, they may progress more quickly and gain more substantial handgrip strength gains.

Additionally, younger older adults tend to experience less muscular and joint degeneration compared to older individuals^{22,23}. With aging, there is commonly a decrease in muscle mass and bone density and an increased susceptibility to joint issues²⁴. However, younger older adults may be in earlier stages of these processes due to their younger age. As a

result, they may have relatively better muscular and joint capacity to respond to Pilates Method training, leading to greater handgrip strength.

Retired older adults exhibited greater handgrip strength compared to non-retired ones. Time availability could be a critical factor in this observation. Retirees generally have more free time than non-retired individuals, who may be occupied with work and family responsibilities^{25,26}. This increased time availability allows retirees to consistently dedicate themselves to the Pilates Method, potentially resulting in more regular and prolonged practice and increasing handgrip strength.

After retirement, many individuals focus more on maintaining health and well-being²⁷. Pilates is often chosen as an exercise form due to its physical and mental health benefits, including muscle strengthening, improved posture, and stress reduction^{28,29}. Retirees in Pilates may be more motivated to commit to their health and physical fitness, dedicating consistent time and effort to the exercise program. This dedication can result in more significant gains in handgrip strength than non-retired individuals, who may have less time or energy for regular exercise.

Finally, we found no significant difference in handgrip strength among older adults concerning health conditions and Pilates practice variables. Several factors can explain this. Firstly, the study sample is relatively homogeneous regarding health and Pilates practice, which may reduce variation in results, making it challenging to identify significant differences between groups. Additionally, the health conditions of the study's older adult participants are relatively mild or similar across groups, which could also contribute to the lack of significant differences in handgrip strength. More severe health conditions typically have a more pronounced impact on muscle strength³⁰.

This study has some significant limitations to consider. Firstly, the sample does not fully represent the diversity of the older population who practice the Pilates exercise method in the municipality. This may limit the generalization of the results. Additionally, the study's cross-sectional design prevents the analysis of causality between Pilates practice and handgrip strength over time. Another potential limitation includes reliance on self-reported sociodemographic, health, and exercise practice variables, which could introduce biases related to memory or interpretation of participants' responses. These considerations are essential for critically interpreting this study's findings and guiding future research.

Conclusion

The results indicated an overall acceptable level of handgrip strength among older adults. Significant differences in handgrip strength were observed based on sociodemographic factors such as sex, age group, and retirement status. Specifically, older male adults showed greater handgrip strength than females, and individuals aged 60-69 demonstrated greater strength than those aged 80 years or older. Moreover, retired participants exhibited higher handgrip strength compared to non-retired individuals. Interestingly, no significant differences in handgrip strength were found based on variables related to health conditions and Pilates practice among older adult participants.

These findings suggest that Pilates exercises may be an effective intervention for improving handgrip strength in older adults, especially among retirees with more physical exercise time. This underscores the importance of promoting regular Pilates practice as part of a healthy and active lifestyle for older adults, thereby supporting functional independence and quality of life.

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