



Handgrip strength predicts physical and psychological domains of quality of life, but not social and environmental domains

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ABSTRACT

OBJECTIVE

This study investigated the association between handgrip strength with quality of life in different domains of quality of life.

METHODS

This is a cross-sectional study. Participants underwent a semi-structured interview to record age, sex, marital status, ethnicity, family income). Also, individuals performed the handgrip strength test.

RESULTS

Two hundred individuals were evaluated. Overall, the sample comprised individuals of both sexes (79% female) aged 52±17 years. High strength group showed high values of quality of life in physical (71.5 vs. 64.1 a.u.; 95%CI 2.0 to 12.6; P=0.0066) and psychological domain in comparison with low strength group (72.0 vs. 67.4 a.u.; 95%CI -0.1 to 9.3; P=0.0214). No between-group differences were observed for quality of life in the social and environmental domains (both P>0.05). Significant positive associations were found between handgrip strength and quality of life in physical and psychological domain (R=0.27, P<0.0001 and R=0.17, P=0.0117, respectively). No significant association between handgrip strength and quality of life in social and environment was observed. Adjusted linear regression model showed a positive association between handgrip strength and quality of life in physical (B=0.74; 95%CI 0.37 to 1.11; P<0.001), and psychological (B=0.38; 95%CI 0.06 to 0.71; P=0.022) domain. In contrast, handgrip strength did not show to be an independent predictor of quality of life in social and environment domains (both P>0.05).

CONCLUSION

These findings reveal handgrip strength is a significant and independent predictor of quality of life in physical and psychological domains, but not in social and environmental domains.

DESCRIPTORS

Quality of life, General health status, Strength.

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INTRODUCTION

Quality of life is a holistic and multidimensional measure that considers a wide range of physical, psychological, social, and environmental factors that impact an individual's well-being and life satisfaction¹. Quality of life is a fundamental concept in fields such as healthcare, psychology, and social sciences, and it can be assessed and evaluated using a variety of tools and indicators.

The WHOQOL-BREF (World Health Organization Quality of Life - Brief Version) is a concise, easier and widely used instrument for assessing the quality of life in both clinical and research settings². It includes 26 items and covers four main domains of quality of life: *i*) physical Health [it assesses an individual's physical well-being, including questions about pain, energy, mobility, sleep, and activities of daily living]; *ii*) psychological health [it evaluates an individual's mental and emotional well-being, including questions about self-esteem, body image, negative feelings, positive feelings, and thinking, learning, memory, and concentration]; *iii*) social relationships [it measures an individual's social interactions and relationships, including questions about personal relationships, social support, and sexual activity] and; *iv*) environment [it covers an individual's perception of their environment, including questions about financial resources, information, safety, accessibility to health care and social services, pollution, noise, and transportation]. Since good quality-of-life scores should be desired throughout life and it can be measured, to identifying predictive measures to quality of life may be useful for health professionals in clinical and non-clinical settings.

Handgrip strength is a simple, direct, easy handling, low-cost measurement commonly utilized in the clinical setting as an indicator of the general health status in individuals across a wide age range³. The handgrip strength has shown to be related with distinct health outcomes such as age-related muscle loss (sarcopenia)⁴, mental disorders⁵⁻⁸, nutrition status^{9,10}, chronic diseases such as diabetes¹¹ and, cardiovascular disease¹² and, all-cause, cancer, and cardiovascular mortality^{13,14}. In this scenario, it is reasonable to assume that handgrip strength may also be associated with quality-of-life scores, especially in specific domains like physical and psychological domains. In contrast, handgrip strength may not be related to social and environmental domains of the quality of life since these domains are related to an individual's social interactions and relationships and their perception of the environment around. Although previous studies support the association between handgrip strength and quality of life in physical and mental domains, the results are unclear regarding other domains^{15,17} and, thus studies still are required. Therefore, this study aimed to investigate the association between handgrip strength with quality of life in different domains of quality of life.

METHODS

Study design and participants

This is a cross-sectional study conducted in the University Santo Amaro (Sao Paulo, Brazil) between August 2023 and September 2023. Participants were recruited through social media and were invited to attend the university for assessments. Inclusion criteria were: *(i)* individuals aged over 17 years. Exclusion criteria were: *(i)* cognitive deficit that precluded the patient from reading and signing the informed consent form; *(ii)* people with disabilities; *(iii)* cancer in the past 5 years; *(iv)* inability to perform the physical tests; *(v)* prior diagnosis of muscle degenerative disease (e.g., myopathies, amyotrophic lateral sclerosis).

Participants underwent a semi-structured interview to re-

cord sociodemographic characteristic (i.e., age, sex, marital status, ethnicity, family income). Also, individuals performed the handgrip strength test in dominant arm.

This study was approved by the local Ethics Committee (Ethics Committee Approval Number: CAAE - 69886123.8.0000.0081; approval numbers: 6.231.001). All participants provided written informed consent before entering the study. This manuscript was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)¹⁸.

World Health Organization Quality of Life questionnaire (WHOQOL-bref)

Quality of life was assessed using the WHOQOL-bref¹⁹. This questionnaire consists of 26 questions, the first of which refers to quality of life in general, the second to satisfaction with one's own health and the rest are divided into the physical, psychological, social and environment domains. This instrument was validated for the Portuguese language²⁰ and it has been used for both healthy and chronic diseases populations²¹⁻²³.

Handgrip Strength

Handgrip strength was assessed in the dominant side using a hand dynamometer (TKK 5101; Takei, Tokyo, JP). Participants were in the standing position with their shoulder adducted and neutrally rotated, posed their elbow extended at 180° as well as the forearm and wrist in a neutral position. Then, participants were instructed to grip the dynamometer with maximum strength in response to a voice command. Three attempts were performed with a 1 min rest after each one. The maximal grip strength was recorded and utilized for analysis.

For analysis, the participants were ranked according to handgrip strength scores and stratified into low handgrip strength or high handgrip strength group based on median values.

Statistical analyses

Data are presented as absolute (n) and relative (%) frequency, means \pm standard deviation (SD). Data normality was determined via Shapiro-Wilk test and visually checked with histograms. Independent *t*-tests were performed to test possible between-group differences (High Strength vs. Low Strength) for all dependent variables (Quality of life - Physical Domain; Psychological Domain; Social Domain; Environment Domain). Pearson product-moment linear correlation was used to check the level of association between handgrip strength and quality of life for each domain.

Crude and adjusted linear regression models were utilized for verify possible associations between handgrip strength and quality of life for each domain. Linear regression models was adjusted by age (< 60 and ≥ 60 years old), ethnicity [white, black and pardo], sex [male or female], family income [$< US\$ 267.85$, $US\$ 267.85$ to $US\$ 535.70$, $US\$ 535.70$ to $US\$ 863.55$ and $> US\$ 863.55$], and obesity ($BMI < 30$ or $BMI \geq 30$). Beta coefficients were calculated along their corresponding 95% confidence intervals (95%CI). Significance level was set at $P \leq 0.05$. All analyses were performed in the statistical environment R (version 3.5.3; R Core Team 2020).

RESULTS

Two hundred individuals were evaluated. Overall, the sample comprised individuals of both sexes (79% female) aged 52 ± 17 years. Frequency of ethnicity of individuals white, black or pardo (term used in Brazilian Portuguese, meaning "mixed ethnicity," according to the Brazilian Institute of Geography and Statistics) were 70%, 28%, and 2%, respectively. Forty percent of the

participants showed obesity (i.e., IMC > 30 kg/m²). Table 1 details demographic and clinical characteristics of the individuals.

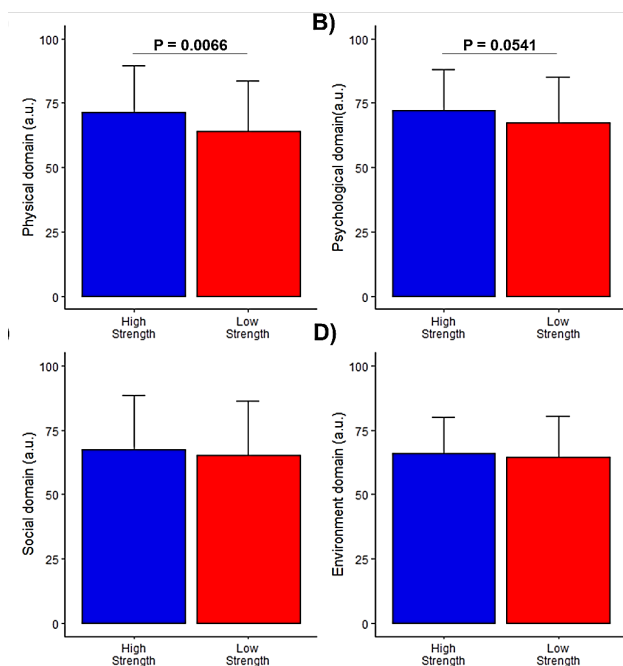
Table 1. Characteristics of the participants.

Outcomes	n = 200
Age, n (%)	
< 60 years old	145 (72%)
≥ 60 years old	55 (28%)
Sex, n (%)	
Female	158 (79%)
Male	42 (21%)
Marital status, n (%)	
Single	60 (30%)
Married	92 (46%)
Divorced	23 (12%)
Widowed	25 (12%)
Ethnicity, n (%)	
White	139 (70%)
Black	55 (28%)
Pardo	6 (2%)
Income^a, n (%)	
< US\$ 267.85	84 (42%)
US\$ 267.85 to US\$ 535.70	87 (44%)
>US\$ 535.70 to US\$ 863.55	14 (7.0%)
> US\$ 863.55	3 (1.0%)
Chose not to report	12 (6.0%)
Obesity, n (%)	
IMC < 30 kg/m ²	79 (40%)
IMC ≥ 30 kg/m ²	121 (60%)
Handgrip strength, mean (SD)	27 (10)

n = number of subjects; a = Pardo is the exact term used in Brazilian Portuguese, meaning “mixed ethnicity,” according to the Brazilian Institute of Geography and Statistics; IMC = Body Mass Index.

High strength group showed high values of quality of life in physical (71.5 vs. 64.1 a.u.; 95%CI 2.0 to 12.6; P = 0.0066) and psychological domains in comparison with low strength group (72.0 vs. 67.4 a.u.; 95%CI -0.1 to 9.3; P = 0.0214). There was not between-group differences observed for quality of life in the social and environmental domains (both P > 0.05). The Figure 1 details quality of life in each domain for high and low strength group.

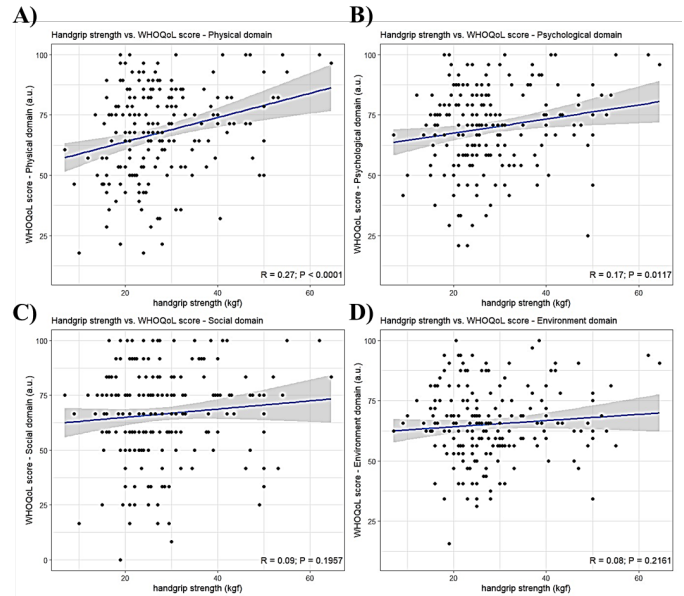
Figure 1. Quality of life for physical (Panel A), psychological (Panel B), social (Panel C) and environment (Panel D) domains in according with handgrip strength levels.



Associations between handgrip strength and quality of life in each domain are shown in Figure 2. Significant positive associations were found between handgrip strength and quality of life

in physical and psychological domain (R = 0.27, P < 0.0001 and R = 0.17, P = 0.0117, respectively) even after adjusted by co-founders. No significant association between handgrip strength and quality of life in social and environment was observed.

Figure 2. Scatter plot and Pearson's correlation coefficient for quality of life in each domain (physical domain [Panel A], psychological [Panel B], social [Panel C] and environment [Panel D] domains and handgrip strength levels.



Adjusted linear regression model showed a positive association between handgrip strength and quality of life in physical (B = 0.74; 95%CI 0.37 to 1.11; P < 0.001), and psychological (B = 0.38; 95%CI 0.06 to 0.71; P = 0.022) domain (Table 2). In contrast, handgrip strength did not show to be an independent predictor of quality of life in social and environment domains (both P > 0.05).

Table 2. Linear regression analyses of the association between handgrip strength and quality of life scores for each domain.

Outcome	Unadjusted model			Adjusted model ^a		
	B	95%CI	P value	B	95%CI	P value
Physical Domain (a.u.)	0.50	0.25 - 0.76	<0.001	0.74	0.37 - 1.11	<0.001
Psychological Domain (a.u.)	0.29	0.07 - 0.52	<0.001	0.38	0.06 - 0.71	0.022
Social Domain (a.u.)	0.19	-0.10 - 0.47	0.196	0.20	-0.22 - 0.62	0.343
Environment Domain (a.u.)	0.13	-0.08 - 0.33	0.216	0.12	-0.17 - 0.40	0.422

a = Linear regression model was adjusted by age (< 60 and ≥ 60 years old), ethnicity (white, black and pardo), sex (male or female), family income (< US\$ 267.85, US\$ 267.85 to US\$ 535.70, US\$ 535.70 to US\$ 863.55 and > US\$ 863.55) and, obesity (BMI < 30 or BMI ≥ 30).

DISCUSSION

The aim of this study was to investigate the associations between handgrip strength with quality of life in different domains. Our main findings were: *i*) individuals with high handgrip strength display higher quality of life in physical and psychological domains than those with low values of handgrip strength; *ii*) handgrip strength showed to be significantly associated with quality of life in physical and psychological domains and *iii*) adjusted linear regression models revealed that handgrip strength is a significant and independent predictor of quality of life in physical and psychological domains, but not for social and environment domains. These results are in line with our a priori hypothesis that handgrip strength is related to the quality of life in specific domains.

Handgrip strength is widely recognized as an indicator of overall muscle strength, and it is associated with a variety of clinically relevant health outcomes³ such as functionality, hospital length of stay and mortality in distinct populations²⁴⁻²⁶. In

this scenario, it reasonable to assume that handgrip strength may be a predictive measure of quality of life. However, it is noteworthy that quality of life consists of a multidimensional measure that considers a wide range of factors (i.e., physical, psychological, social, and environment) that impact an individual's well-being and life satisfaction¹ and, thus may imply different levels of association with handgrip strength.

Previous studies that investigated the association between handgrip strength and quality of life have shown controversial results¹⁵⁻¹⁷. While previous studies¹⁵⁻¹⁷ have consistently demonstrated that grip strength is an independent predictor of quality of life in physical domain (i.e., physical functioning), the association between handgrip strength and mental, social and environmental domains of quality of life is not consensual. For instance, Sayers et al.¹⁷ did not observe that handgrip strength is a significant and independent predictor of role emotional and social functioning domains of quality of life. In another study, authors demonstrated that handgrip strength is a predictive measure of environment domain of quality of life, but not for psychic and social domains¹⁶. These controversial results may be discussed in different perspectives such as different questionnaires utilized to assess quality of life (European Quality of Life Scale-Five Dimensions [EQ-5D] vs. 36-Item Short Form Health Survey questionnaire [SF-36]) and different characteristics sample (e.g., age, ethnicity and income).

In the current study, we observed that individuals with high handgrip strength show higher scores of quality of life in physical and psychological domains. Also, the adjusted linear regression model revealed that handgrip strength is a significant predictor of quality of life in physical and psychological domains. These findings are in consonance with previous studies indicating that handgrip strength is associated with physical (i.e., disability)²⁶ and mental parameters (i.e., anxiety and depression)⁵⁻⁸. Taken together, these results reinforce the handgrip strength as an important predictive measure of health outcomes.

Regarding the association between handgrip strength with social relationships and environmental domains of the quality of life, we observe neither statistically significant difference in these specific domains of quality of life when participants were stratified by handgrip strength (high handgrip strength group vs. low handgrip strength group) nor significant associations between handgrip strength and quality of life in social relationships and environmental domains. These findings may be explained, at least partially, due to the social relationships and environmental domains refers to an individual's social interactions and relationships and their perception of the environment around², respectively, which are unlikely influenced by handgrip levels.

This study is not free of limitations. First, this cross-sectional design does not allow causative inferences, and reversal causality (e.g., low handgrip strength as a consequence of worse quality of life) cannot be ruled out. Second, this is a small cohort and, thus our findings are limited to individuals with similar characteristics to those reported herein. Third, the use of questionnaire to assess quality of life is prone to recall bias.

In conclusion, handgrip strength is associated with quality of life in physical and psychological domains. Additionally, handgrip strength was shown to be an independent predictor of quality of life in physical and psychological domains, but not in social relationships and environmental domains. These findings reinforce handgrip strength as an important risk factor for health outcomes.

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