ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 12, Issue, 05, pp. 56034-56042, May, 2022
https://doi.org/10.37118/ijdr.24445.05.2022

RESEARCH ARTICLE OPEN ACCESS

PREVALENCE OF LOW HANDGRIP STRENGTH IN LATIN AMERICAN OLDER ADULTS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Maria Luiza Amorim Sena Pereira*[1,2], Marlus Henrique Queiroz Pereira[1,2], Marcos Pereira-Santos[3], Marcia Mara Corrêa[4] and Elizabete Regina Araújo de Oliveira[1]

[1]Postgraduate Program in Collective Heath, Federal University of Espírito Santo, Vitória, Espírito Santo, Brazil. [2]Center of Biological and Health Science, Federal University of the Western of Bahia, Barreiras, Bahia, Brazil. [3]Collective Health Institute, Federal University of Bahia, Salvador, Bahia, Brazil. [4]Federal Universityof Espírito Santo, Vitória, Espírito Santo, Brazil

ARTICLE INFO

Article History:
Received 19th February, 2022
Received in revised form
06th March, 2022
Accepted 20th April, 2022
Published online 27th May, 2022

Key Words:
Hand Strength; Aged; Latin America; Meta-Analysis; Muscle Strength; Muscle Strength Dynamometer.

Corresponding author:
Maria Luiza Amorim Sena Pereira

ABSTRACT

Objective: This systematic review and meta-analysis aims to estimate the prevalence of low handgrip strength (HGS) among community-dwelling older adults in Latin America. ***Methods***: PubMed, Lilacs, Embase, and Scielo were searched. Two researchers independently selected the studies, extracted data, and performed a risk of bias analysis. The prevalence of low HGS was estimated using a random-effects meta-analytic model. Subgroup analysis was also performed. ***Results***: The summary measure (53 records) of the prevalence of low HGS was 33.0% (95%CI: 29.0-36.0%). Cuba presented the highest estimated prevalence, and Colombia the lowest. The prevalence of low HGS was higher in older females than males. The summary measure did not seem to be influenced by less robust studies and those with smaller sample sizes. ***Conclusion***: The pooled prevalence of low HGS was expressive, with variability among countries. The increasing older adult population in Latin America reinforces the need to measure low HGS when evaluating older adults as a global indicator of health and functionality.

Citation**: **Maria Luiza Amorim Sena Pereira, Marlus Henrique Queiroz Pereira, Marcos Pereira-Santos, Marcia Mara Corrêa, Elizabete Regina Araújo de Oliveira" Prevalence of low handgrip strength in latin american older adults: a systematic review and meta-analysis*", International Journal of Development Research,* 12, (05), 56034-56042.

INTRODUCTION

The growth of the older adult population globally has heterogeneous individual repercussions (Chan *et al.,* 2016). Increased longevity may be associated with compromised functionality that causes a decrease in quality of life (Amaral *et al.,* 2020). Among the changes that occur in the aging process, the changes observed in the skeletal musculature cause decreased muscle strength, contributing to mobility impairment and a greater chance of hospitalization (McLean and Kiel, 2015).In addition, they increase the risk of falls, premature mortality, and institutionalization (Tieland *et al.,* 2018). Muscle strength, which reaches its peak around 30 years old, is lost by about 15% every decade from about 50 years oldonwards. This loss becomes more pronounced over time and can reach about 30% per decade after 70 years in males and females ("Exercise and Physical Activity for Older Adults," 1999). This decrease in muscle strength is linked to adverse health outcomes, is used as a criterion for the evaluation of geriatric syndromes, and is an important part of the frailty and sarcopenia phenotype (Cruz-Jentoft *et al.,* 2010; Fried *et al.,* 2001). The muscles of the upper limbs are most commonly investigated of the muscle groups (Bohannon and Magasi, 2015).The frequent measurement of handgrip strength (HGS) is based on aspects such as simplicity of measurement, low relative cost, and evidence that grip strength can reflect general muscular strength (Bohannon, 2015).Thus, the measurement of HGS can be used as a screening tool for health problems in older adults and informing decision making with the aim to reduce morbidity and mortality. Considering that the measure of strength has a relationship with indicators of social inequalities and demographic conditions (Sternäng *et al.,* 2015), increased longevity in countries that have more unfavorable social indicators, such as Latin American (LA) countries, raises the probability of having a population with a higher risk of change in frailty indicators (Cesari *et al.,* 2016). It is important to review the prevalence ofmuscle weakness (dynapenia) (Manini and Clark, 2012), using the HGS in LA countries as this population experiences a context (historical, social, political, economic, and health) different from that presented in other parts of the world, especially North America and Europe, where more

studies have been conducted. From the perspective of chronic diseases and disabilities, older Latin Americans have been reported to have a higher prevalence than older adults in developed countries (Cesari *et al.,* 2016). Therefore, the different social panoramas observed in these nations can influence the functionality of individuals and the aging process, leaving them more or less vulnerable. Considering that data on the prevalence of low HGS is vital for the planning of health strategies for the older adult population (Diz *et al.,* 2017), and the repercussions that the LAcontext has on the health and quality of life of older adults, this study aims to estimate the prevalence of low HGSamong community-dwelling older adultsin LA countries through a systematic review and meta-analysis.

METHODS

This study is a systematic review with a meta-analysis oforiginal scientific publications that identified the prevalence of low HGSin older adults in LA countries, regardless of whether HGS was the primary outcome of the study. The review protocol is registered in the International prospective register of systematic reviews(number: CRD42020201671) (Booth *et al.,* 2012),and the recommendations proposed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework(Appendix A) were followed for the preparation of the manuscript(Moher *et al.,* 2009). Articles from journals indexed in theMedline via PubMed, Lilacs, Embase, and Scielo databases were searchedfrom inception to May 2020. The search strategy was conducted using the descriptors related to “aged”, “elderly”, “older people”, “older adult”, “hand strength”, "grip strength", "handgrip", in English, Spanish, and Portuguese, as these are thepredominant languages used in studies conducted in LA countries (Appendix B). The primary search strategy was developed after testing in the first database and progressively adapted for the others, respecting the specificities of each database. At this stage, there was no restriction as to the location of the study, which was identified in each manuscript in the later stages. The search and selection of articles were performed by two independent researchers (MLASP; MHQP) with the aid of the Zotero® reference management software. Disagreements between the researchers were resolved by consensus.

In addition to the database searches, a reverse/manual search was performed, in which the references of eligible articles were checked and, after verifying the criteria, new studies were included in the review. The review included: 1. observational studies of cross-sectionalor prospective design with baseline data; 2. studies in which the measurement of HGS was made at least once using a hand dynamometer and that reported the frequency/proportion of individuals with low HGS; 3. conducted with older adults (60 years or more), regardless of sex; 4. Conducted in the community; and 5. conducted in LAcountries. Thus, the study sites were identified, considering the countries that are part of LA *strictosensu*(countries with Romance languages in America): Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay, and Venezuela(Aleixo, 1984; Cardoso and Fishlow, 1992). Studies were excluded if they: 1. did not report the frequency/proportion of low HGS; 2. includedonly children, adolescents, adults, and pregnant females;3. those with a specific population: such as patients who present a predeterminеddisease (parkinsonism, Alzheimer's, history of stroke); group of athletes (boxers, swimmers, climbers); individuals undergoing special training (war training, military, paratroopers); undergoing rehabilitation; older adult residents in a long stay institution or hospitalized; 4. studies conducted in countries outside LAor that did not report the location of the study; 5. literature reviews, intervention studies, qualitative studies, ecological studies, case reports, and experimental studies, as well as dissertations, theses, official documents, and abstracts; and 6. duplicate articles. Articles from the same sample, with overlapping participants, sub-samples, or repeated samples, were analyzed and compared to include only the one with the largest number of participants or the one with the largest amount of data. After the selected articles were read in full, the information collected was entered into a database by two independent researchers (MLASP; MHQP), and disagreements were resolved by consensus. The following variables were included: main author, year of publication, place of study, study design/methodology, number of people investigated (total and by sex, when available), HGS measurement protocol (position, side of measurement, number of tests), equipment used, cut-off points applied, prevalence of low strength (absolute and relative) according to the cut-off point defined in the study (total and by sex, when available). To assess the methodological quality (risk of bias) of the included studies, we used the Joanna Briggs Institute Prevalence Critical Appraisal Tool(Munn *et al.,* 2014).We applied the checklist that considers ten methodological aspects: representativeness of the sample, recruitment of participants, sample size, sample description, analysis with sufficient coverage, objective and standardized criteria for defining the condition, reliable measurement, appropriate statistical analysis, identification of confounding factors, and identification of subpopulations. A coded response was attributed for each item analyzed, being: yes (1), no (0), and uncertain (?). A total quality score was calculated for each study from the sum of the criteria. Quality scoring was performed independently by two researchers (MHQP and MLASP), and disagreements were resolved after discussion. Data were initially described using descriptive statistics. Proportions were calculated from the sample size and number of low HGSevents from each included study, and overall prevalence rates were reported as percentages. The estimated summary measure was the prevalence of low HGSin LAolder adults. The prevalences estimated in each of the studies were combined through a meta-analytic model. I^2 statistics and Cochran's Q test were used to assess heterogeneity between studies, low heterogeneity was considered when the$I^2$was<50% and moderate and high heterogeneity if $I^2 \geq 50\%$. Combined effects were estimated with fixed-effects models when $I^2 < 50\%$ and when $I^2 \geq 50\%$ random-effects models were used(Higgins and Green, 2011).Confidence intervals for the results of the individual studies were calculated using the Coppler-Pearson method. Results were presented as the prevalence with 95% confidence intervals. Publication bias was not assessed as conventional funnel plots used to assess the potential risk of bias in meta-analyses are inaccurate for meta-analyses with proportion studies (Hunter *et al.,* 2014). To explore heterogeneity, a subgroup analysis was performed to investigate aspects that could influence the estimation of the pooled prevalence of low HGS, includingcountry, sex, sample size,and risk of bias score. All analyses were performed in Stata 14 software (Stata Corp, College Station, TX). The results of the meta-analysis were presented using a Forest plot.

RESULTS

A total of 7455 papers were identified in the primary search, and 2119 duplicates were excluded. Of the remaining (5336), 5050 articles were excluded after screening by title and abstract. In the next step, among the 286 potentially eligible papers, which were read in full, 227 were excluded for not meeting the eligibility criteria. A further 19 articles were excluded for having overlapping or repeated samples. A reverse/manual search identified 50 new articles that were read in full, and of these, ten met the criteria and were included in the study. In total, 50 original articles were identified as eligible, with data from 53 sample units (Figure 1). One of the papers presented results from five countries (Alvarado *et al.,* 2008),four of which were eligible for this review and extracted separately. Table1presents all 53 records (50 original articles) included in the review,carried out from 2005 to 2020,totaling 43,930 individuals, with a mean age ranging from 62 to 85years. Considering the studies that reported thesex of participants, 61.7% of the participants were female. The studies were conducted in the following LA countries: 66.0% (35 studies) in Brazil;7.5% (fourstudies) in Chile;3.8% (two studies) in Colombia;3.8% (twostudies) in Cuba;1.9% (onestudy) in Ecuador;13.2% (sevenstudies) in Mexico;and 3.8% (two studies) in Peru.The prevalence of low HG Samong the included studies ranged from 4.3% to 70.8% (Table 1).

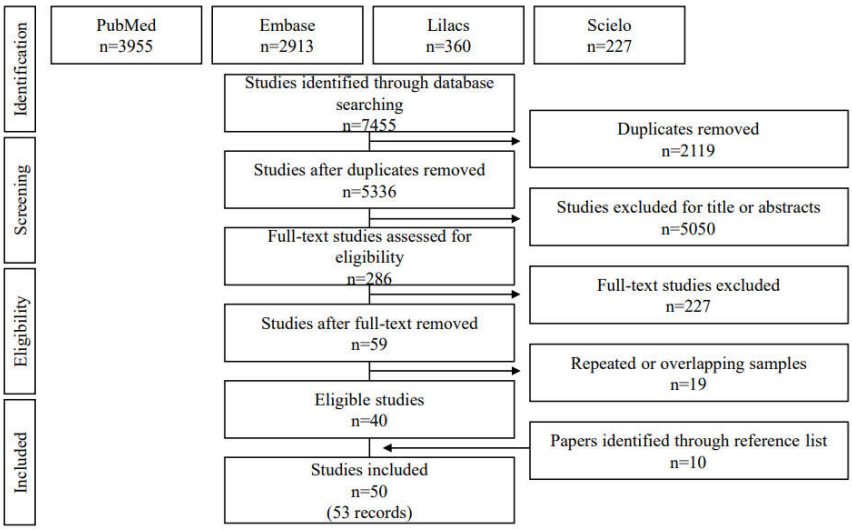

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram of literature search and screening process

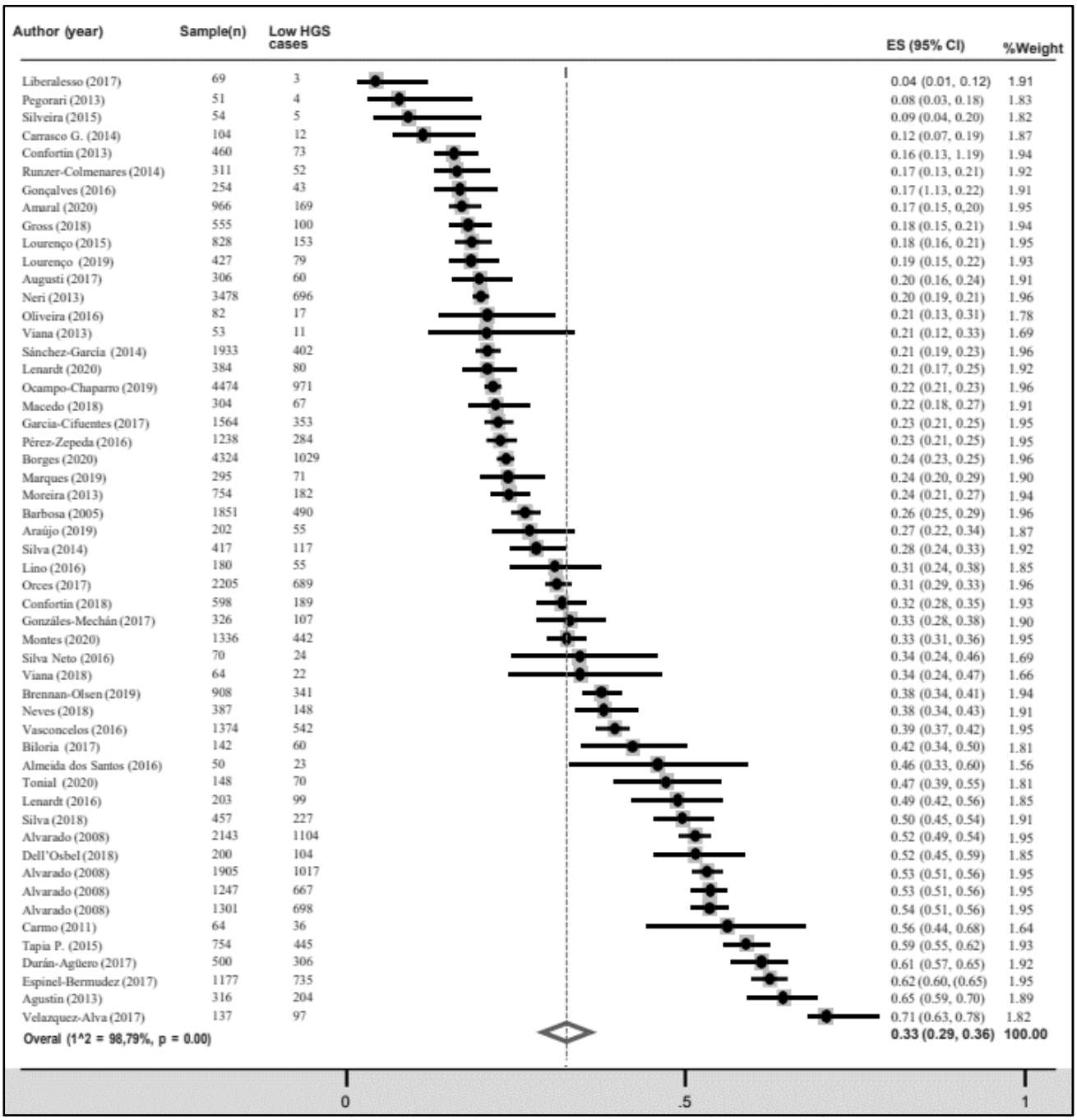

Figure 2. Forest plot of the 53 included studies that reported the prevalence of low Handgrip strength among older adults in Latin America

The methodological quality of the included studies was assessed according to the Joanna Briggs Institute Prevalence Critical Appraisal Tool (Appendix C), and a mean score of 8.2 points was observed, ranging fromthreeto tenamong the studies (Table 1). The best evaluated item was the use of an appropriate statistical analysis (item eight) since 100% of the studies scored in this question; followed by item four (detailed description of the environment and participants) and six (use of objective criteria for measurement of the condition), both were met by 94.3% (n= 50) of the studies.

The item with the lowest performance was participant recruitment (item two), met by 58.4% (n= 31) of the studies. Of the studies included, 22.6% (n=12) had a score equal or lower than six points. A meta-analysis of the 53 studies that reported the prevalence of low HGSamong older adults in LA countries was conducted using a random-effects model (Figure 2). The summary measure of the prevalence of low HGSwas 33.0% (95%CI: 29.0-36.0%). The analysis by subgroup suggests that there is a large variation between the estimated proportions in these countries (Table 2).

Table 1. General characteristics of the articles included (n=53)in the systematic review and meta-analysis of the prevalence of low Handgrip strength in Latin America older adults.Barreiras, BA, Brazil, 2020.

Author(year)	Country	Study	Sample (n)	Age (mean)	Prevalenceoflow HGS*(%)	Riskof bias score
(Barbosa et al., 2005)	Brazil	SABE†	1851	74.2	26.8	9
(Alvarado et al., 2008)	Brazil	SABE	2143	-	51.5	10
(Carmo et al., 2011)	Brazil	-	64	-	56.3	6
(Confortin et al., 2013)	Brazil	Saúde-AC	460	-	15.9	8
(Moreira and Lourenço, 2013)	Brazil	FIBRA‡	754	76.6	24.1	8
(Neri et al., 2013)	Brazil	FIBRA	3478	-	20.5	9
(Pegorari et al., 2013)	Brazil	-	51	73.0	7.8	6
(Viana et al., 2013)	Brazil	-	53	76.7	20.8	6
(Silva and Menezes, 2014)	Brazil	-	417	71.5	28.1	8
(Silveira et al., 2015)	Brazil	-	54	72.9	9.3	5
(Vasconcelos et al., 2016)	Brazil	FIBRA	1374	73.4	39.4	9
(Gonçalves et al., 2016)	Brazil	-	254	62.0	16.9	10
(Lenardt et al., 2016)	Brazil	"Efeitos da fragilidade e qualidade de vida relacionada à saúde de idosos da comunidade"	203	-	48.8	9
(Lino et al., 2016)	Brazil	-	180	73.1	30.9	7
(Oliveira et al., 2016)	Brazil	-	82	-	20.7	6
(Almeida dos Santos et al., 2016)	Brazil	-	50	73.9	46.0	7
(Silva Neto et al., 2016)	Brazil	-	70	65.6	34.2	10
(Augusti et al., 2017)	Brazil	-	306	72.6	19.6	8
(Biloria et al., 2017)	Brazil	-	142	67.3	42.2	8
(Liberalesso et al., 2017)	Brazil	-	69	85.0	4.3	5
(Confortin et al., 2018)	Brazil	EpiFloripa§	598	-	31.6	10
(Dell'Osbel and Zanotti, 2018)	Brazil	-	200	71.5	52.0	3
(Gross et al., 2018)	Brazil	"Saúde do idoso na atenção primária"	555	71.1	18.0	10
(Macedo et al., 2018)	Brazil	-	304	70.6	22.0	5
(Neves et al., 2018)	Brazil	FIBRA	387	-	38.2	9
(Silva et al., 2018)	Brazil	ELSIA‖Project - Alcobaça	457	70.2	49.7	10
(Viana et al., 2018)	Brazil	-	64	69.3	34.4	6
(Araujo et al., 2019)	Brazil	"Projeto Longevidade"	202	85.0	27.2	9
(Lourenço et al., 2019)	Brazil	FIBRA	427	74.4	18.5	10
(Marques et al., 2019)	Brazil	-	295	70.6	24.1	9
(Montes et al., 2020)	Brazil	HOW ARE YOU?¶	1336	-	33.2	10
(Amaral et al., 2020)	Brazil	EDOC-I**	966	-	17.3	10
(Borges et al., 2020)	Brazil	ELSI††-Brazil	4324	62.1	23.8	10
(Lenardt et al., 2020)	Brazil	-	384	70.7	20.8	7
(Tonial et al., 2020)	Brazil	-	148	73.6	47.3	8
(Alvarado et al., 2008)	Chile	SABE	1301	-	52.9	10
(Carrasco G et al., 2014)	Chile	-	104	72.2	11.5	7
(Tapia P et al., 2015)	Chile	-	754	73.0	59.0	8
(Durán Agüero et al., 2017)	Chile	-	500	-	61.3	6
(Garcia-Cifuentes et al., 2017)	Colombia	SABE	1564	71.2	22.6	9
(Ocampo-Chaparro et al., 2019)	Colombia	SABE	4474	69.3	21.7	10
(Alvarado et al., 2008)	Cuba	SABE	1905	-	53.3	10
(Agustín et al., 2013)	Cuba	-	316	-	64.5	5
(Orces, 2017)	Ecuador	SABE	2205	-	31.2	10
(Alvarado et al., 2008)	Mexico	SABE	1247	-	53.4	10
(Sánchez-García et al., 2014)	Mexico	SADEM‡‡	1933	-	20.8	9
(Lourenço et al., 2015)	Mexico	CC§§	828	76.3	18.5	10
(Velazquez-Alva et al., 2017)	Mexico	-	137	73.8	70.8	6
(Pérez-Zepeda et al., 2016)	Mexico	MHAS‖‖	1238	69.2	22.9	9
(Espinel-Bermúdez et al., 2017)	Mexico	COSFOMA¶¶	1177	68.4	62.4	9
(Brennan-Olsen et al., 2019)	Mexico	WHO-SAGE***	908	-	37.5	10
(Runzer-Colmenares et al., 2014)	Peru	-	311	76.1	16.7	7
(Gonzáles-Mechán et al., 2017)	Peru	-	326	-	32.8	8

*HGS: Hand Grip Strength; †SABE: "SaludBienestar y Envejecimiento" (Spanish for Health, Well-being and Aging); ‡FIBRA: Frailty of Brazilian Elderly Study; §EpiFloripa: health conditions of older adults in Florianópolis; ‖ELSIA:Longitudinall Study of the Elderly Health of Alcobaça; ¶"HOW ARE YOU?": Masters Consortium for Valuation of Elderly Care; **EDOC-I:Study of Chronic Diseases; ††ELSI: Brazilian Longitudinal Study of Aging; ‡‡SADEM: Study on Aging and Dementia in Mexico; §§CC: The Coyoacan Cohort; ‖‖MHAS: Mexican Health and Aging Study; ¶¶COSFOMA: Cohort of Obesity, Sarcopenia and Frailty of Older Mexican Adults; ***WHO-SAGE: World Health Organization (WHO) Study on global AGEing

Table 2. Prevalence of low Handgrip strength among Latin America older adults, categorized by subgroups. Barreiras, BA, Brazil, 2020

Characteristics	Numberofstudies (n)	Prevalence (%)	95% CI*	I^2†(%)
Country				
Brazil	35	29.0	25.0-33.0	97.52
Chile	4	47.0	31.0-62.0	98.51
Colombia	2	22.0	21.0-23.0	-
Cuba	2	55.0	53.0-57.0	-
Ecuador	1	31.0	29.0-33.0	-
Mexico	7	41.0	27.0-55.0	99.46
Peru	2	23.0	20.0-26.0	-
Sex				
Male	24	29.0	23.0-36.0	97.99
Female	28	39.0	32.0-45.0	98.76
Sample size				
0 - 100	9	25.0	14.0-36.0	92.87
100 - 500	22	34.0	27.0-41.0	97.73
> 500	22	34.0	29.0-39.0	99.34
Risk of bias score				
0 - 6	12	35.0	20.0-50.0	98.38
7 – 9	24	31.0	26.0-36.0	98.41
10	17	33.0	27.0-40.0	99.22

*CI: Confidence Interval; †I^2 index

The country that showed the smallest difference in relation to the pooled prevalence was Ecuador (-2%). The results obtained in this study also suggest that Colombia has the lowest prevalence of low HGS (22.0%, 95%CI 21.0-23.0%), while in Cuba, the highest value was observed (55.0%, 95%CI 53.0-57.0%) (Table 2). Regarding sex (Table 2), considering the studies that presented the necessary data for the analysis, the prevalence estimate increased by 6% when only femaleswere included and decreased by 4% with males. Studies with samples greater than 500 individuals showed prevalence similar to the pooled estimate (34.0%, 95%CI 28.0-39.0%),as well as studies with higher scores in the assessment of risk of bias (33.0%, 95%CI 27.0-40.0%) (Table 2).

DISCUSSION

This study estimated the prevalence of low HGS among community-dwelling older adults in LA countries using a systematic review and meta-analysis. It was considered that LA, due to its socioeconomic characteristics, may affect the health and quality of life of older adults differently from other regions. The estimated prevalence of low HGSamong older adults aged 60 years or older in LA was 33.0% (95% CI 29.0-36.0%). Estimates of the prevalence of low HGS among countries may vary. In studies that have performed this assessment in developed regions of the world, no trend was observed, with the prevalence ranging from 22.5% in European countries (Bertoni *et al.,* 2018), to 25.1% in Korea (Noh and Park, 2020),and 44% in the United States (Duchowny *et al.,* 2018).In LA countries, which are considered developing countries, estimates of the prevalence also differ, as seen in the present study, with 16.7% in Peru (Runzer-Colmenares *et al.,* 2014), 23.8% in Brazil(Borges *et al.,* 2020), and 31.2% in Ecuador (Orces, 2017), reaching higher values, such as the one observed in Mexico, of 62.4% (Espinel-Bermúdez *et al.,* 2017). Thus, it is challenging to compare between countries that are both developed and developing. These differences in the estimated prevalence of low HGS between studies may be related to several factors, ranging from socioeconomic and environmental aspects to operational issues of measurement execution and proper classification. Studies that have their primary outcome as the prevalence of low HGSare not easily identified in the literature. This scarcity may be related, among other aspects, to the absence of consensus on the methods used for strength measurement, as well as to the different cut-off points used in the studies(Alexandre *et al.,* 2019; Borges *et al.,* 2020). In addition, as strength measurement is more widely used as a criterion to identify sarcopenia (Cruz-Jentoft *et al.,* 2019), and fragility syndrome (Fried *et al.,* 2001), from the joint analysis with other indicators, its isolated use is less frequent. Nevertheless, the importance of measuring HGS among older adults is justified by the positive association that the measurement has with overall muscle strength (Bohannon, 2015; Porto *et al.,* 2019). Consequently, although low HGSis not directly related to the performance of functional activities, such as walking, the measured values can be lower among older adults who report having physical limitations, and therefore, it is a useful indicator for the general evaluation of health in the older adults(Bohannon, 2019; Forrest *et al.,* 2018). The use of the HGS measurement is relevant in the multidimensional evaluation of older adults, and a systematic review with meta-analysis that evaluated the predictive value of HGS as a marker of vulnerability and mortality among the older adults reported the predictive validity of this indicator for the decline in mobility and functional status as well as increased mortality (Rijk *et al.,* 2016). Low HGS may also correlate with intensified depressive symptoms in older adults (Zasadzka *et al.,* 2021), and with global cognition (Kobayashi-Cuya *et al.,* 2018). An important variable associated with HGS that can contribute to the divergence between the results obtained betweenstudies is the age of the participating individuals (Dodds *et al.,* 2014; Vianna *et al.,* 2007).

Thus, the prevalence of low HGSamong older adults from different nations is influenced by the chronological milestones established by the World Health Organization to classifyindividuals as older adults. The cut-off points in developed and developing countries are those aged 65 years or more and 60 years or more, respectively. Although comparisons are usually made between countries, the association that age has with this measure can influence the results (Albrecht *et al.,* 2021; Riviati *et al.,* 2017).Therefore, it may be preferable to group countries that classify older adults using the same criterion to make more robust comparisons. In addition, other characteristics between different world regions must be considered in the evaluation of strength since they differ significantly from one another, and the use of normative data standardized internationally is questionable (Werle *et al.,* 2009).A meta-analysis that evaluated the global variation of the measurement of HGS highlighted that the strength averages are substantially lower in the developing regions of the world (Dodds *et al.,* 2016),including LA, compared to the developed regions.In the present meta-analysis, studies from seven LA countries with different socioeconomic panoramas were identified. Among the studies, there was a predominance of those conducted in upper-middle incomecountries (Brazil, Colombia, Cuba, Ecuador, Mexico, and Peru) and only one country with high income (Chile) according to the World Bank classification included("World Bank Country and Lending Groups – World Bank Data Help Desk," n.d.).No studies were found on low and lower-middle income countries. This observation may indicate that local income is a variable that can contribute to geographical inequality in research on HGS. Most of the included studies were conducted in Brazil (n=35), where an overall

prevalence of 29.0% (95% CI 25.0-33.0%) was identified. Systematic reviews and meta-analyses that evaluate HGS (Dodds *et al.,* 2016; Siriwardhana *et al.,* 2018),as a primary outcome or not, present the same trend, identifying a concentration of Brazilian studies among those conducted in LA. The densification of studies in the area may reflect the progressive increase in the number of older adults in that country and the consequent social needs of this population (Silva, 2016). A subgroup analysis allowed us to observe how the studied variable behaves in each country included in the identified studies. We observed that the country with the highest estimated prevalence of low HGSwas Cuba (55.0%; 95%CI 53.0-57.0%). Higher values in the prevalence of low strength among Cuban older adults may be related to the growing population of older adults in the country, with the current proportion of older adults being approximately 20% (Espiñeira, 2020).This growing aging populationalso contributes to the increase in the proportion of longevous individuals, leading to changes in the country's age structure(Díaz-Briquets, 2016).Thus, longevity may be associated with lower HGS(Riviati *et al.,* 2017; Werle *et al.,* 2009).On the other hand, the country that presented the lowest estimated prevalence of low HGS was Colombia (22.0%; 95% CI 21.0-23.0%), a country that has a more moderately aging population compared to Cuba(Caribe, 2018),with the population of older adults representing 10.8% of the total population in 2015(Flórez *et al.,* 2019). The summary measure of low HGS in this study probably suffered little influence from studies with smaller sample sizes, considering that those with a larger number of participants (500 or more) showed an estimate close to the pooled prevalence (34.0%; 95%CI 29.0-39.0%). Similarly, the studies that obtained 100% adequacy regarding methodological aspects (ten points) showed a prevalence estimate of low HGS (33.0%; 95%CI 27.0-40.0%), very similar to the pooled prevalence. In the analysis of low HGSby sex, the prevalence was 39.0% (95%CI 32.0-45.0%) among females and 29.0% (95%CI 23.0-36.0%) among males.

In general, studies have shown the lowest mean HGS among older adultfemalesin LA (Lenardt *et al.,* 2016; Lourenço *et al.,* 2015; Montes *et al.,* 2020; Ocampo-Chaparro *et al.,* 2019; Orces, 2017),and other regions of the world(Abe *et al.,* 2016; Chung *et al.,* 2016; Dodds *et al.,* 2016; Noh and Park, 2020). Low HGS was more prevalent among females even when lower cut-off points were used for this group and might be related to females having lower overall muscle reserve than males(Alexandre *et al.,* 2008).In addition, hormonal changes related to the decrease in muscle mass occur differently in males and females, being slower in males(Kirchengast and Huber, 2009). Femalesalso seem to perform physical activity at a lower intensity than males (Aadahl *et al.,* 2011), which may impact on the lower levels of strength. Despite these considerations, the prevalence estimate observed only among males included fewer studies and therefore requires caution. It is also noteworthy that the data shown in the present study reflect a panorama prior to the pandemic of COVID-19, whose repercussion on the elderly population has been significant (Sepúlveda-Loyola *et al.,* 2020). A meta-analysis performed with data from 2020 showed considerable variation in the prevalence of comorbidities as well as mortality from COVID-19 depending on the geographic region in which the country is located(Thakur *et al.,* 2021). The highest mortality rates were observed in studies with LA patients, mainly older adults aged 65 years and older(Thakur *et al.,* 2021).In addition to the effects of the pandemic on mortality among older adults, social isolation has been found to contribute to decreased levels of physical activity, reduced muscle contractions and may have consequences in increasing the prevalence of geriatric syndromes already mentioned, such as sarcopenia and frailty(Arazi and Eghbali, 2018; Sepúlveda-Loyola *et al.,* 2020).Thus, further investigations regarding HGS in this group, considering the repercussions of the COVID-19 pandemic, as well as the population dynamics experienced by LA countries in recent decades, need to be conducted (Alvarez *et al.,* 2020).

This study had limitations.We identified articles with an evaluation of the prevalence of HGS in a reduced number of LA countries (seven countries). Brazil and Mexico presented the largest number of articles, while only a few studies were included for the other countries. In addition, since not all studies presented data according to sex, the analysis by sex needed to be performed with fewer records. We also observed a significant variation between the prevalence estimated between countries, and a possible explanation for this variation, in addition to local socioeconomic and health issues and the number of articles included in each country, is the great variability of cut-off points used as criteria for the classification of low HGS. In addition, there is a wide variety of measurement methods recommended by different research groups, which may underestimate or overestimate the prevalence of low HGS. To our knowledge, this is the first systematic review with a meta-analysis on the prevalence of low HGS in LAolder adults. For this study, appropriate methodological strategies were adopted, with the participation of independent researchers at different stages of the work, in addition to the use of reliable and broad-spectrum databases. To assess the risk of bias among the articles included, a specific tool for prevalence meta-analysis was applied. A subgroup analysis was also performed to increase the reliability of the results.

CONCLUSION

Weperformed a meta-analysis of the prevalence of low HGS in LA, presenting an expressive estimate of the pooled prevalence of this condition among various LA countries. Although only a few countries were represented in this study, the panorama of the region was satisfactorily demonstrated. Considerable variability in theprevalence of HGSwas observed among the countries, which probably also reflects the heterogeneity of the aging process and makes it difficult to standardize the technical criteria employed for the classification of low strength. Cuba was the country with the highest estimated prevalence of low HGS, while Colombia was the lowest. The estimated prevalence of low HGS was higher amongolder adult females than males. The summary measure did not seem to be influenced by less robust studies and those with smaller sample sizes. The increasing older adult population in Latin America reinforces the need to measure low HGS when evaluating older adults as a global indicator of health and functionality.

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