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Incidence of Muscular Strength, Anthropometry, and Asymmetry in the General Index of Autonomy in Older Chilean Women

Incidencia de la Fuerza Muscular, Antropometría y Asimetría en el Índice General de Autonomía en Mujeres Mayores Chilenas

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SUMMARY: Frailty affects the functional autonomy (FA) of older adults and could manifest itself in muscle imbalances in the limbs, resulting in a disparity in size and strength between them. In Chile, information on the relationship between muscle strength (MS) levels and FA asymmetries in older women is limited. This study related the levels of MS, anthropometric parameters, and asymmetries of the lower and upper limbs, with the FA of a group of older Chilean women. The study included 39 women who participated, and their FA was evaluated using the GDLAM index (IG). Based on the score obtained in the IG, they were classified by percentiles as Group 1 with favorable FA ($P \leq 50$) and Group 2 with low FA ($P > 50$). Anthropometric parameters were BMI, fat percentage, bone mass, circumferences (arm, thigh, calf), diameters (humerus, femur) and upper/lower limb strength was evaluated to determine asymmetries. The differences between the covariates of both groups were evaluated using the student's t test and the Mann-Whitney test for independent samples. G1 presented less asymmetry ($p > 0.05$) in the lower limbs and greater calf circumference than G2 ($p < 0.05$). G1 presented greater bilateral strength (dominant and non-dominant limb) compared to G2 ($p < 0.05$). The covariates of age, anthropometry, MS, and lower/upper limb asymmetries influence FA in older women.

KEY WORDS: Functional autonomy; Latin American Group for maturity protocol; Older people; Women.

INTRODUCTION

Due to the advances in medicine and the improvement of socioeconomic conditions, human beings have rapidly increased their life expectancy in recent decades, which has caused a gradual increase in the population of older people (OP) (Wyss-Coray, 2016). In the case of Chile, 16.2 % of the population corresponds to people aged 60 and over, since the average life expectancy reaches 80.7 years and it is expected that by the year 2050, this group of people will reach 32 % of the total population (Comisión Económica para América Latina y el Caribe, 2018). In this context, it has been reported that women have a higher life expectancy compared to men, from 77.2 years in 1992 to 83.8 years in 2021, and it is expected that by 2030 the life expectancy of Chilean women will exceed the 90-year-old barrier (Rojas *et al*., 2022).

Aging is a natural process in which the structural integrity of an organism gradually decreases over time, leading to a decline in the function of different systems and ultimately increasing the risk of morbidity and mortality (Chen *et al*., 2020). In this sense, one of the systems mainly affected is the musculoskeletal, during the aging process there are changes in the activity of protein metabolism that alter its conservation. (Sartori *et al*., 2021). In this context, longitudinal studies have shown that muscle mass decreases from 0.64 to 0.7 % per year in women from the age of 75, a phenomenon known as sarcopenia. Additionally, muscle strength and function in older women (OW) have been shown to be lost faster than muscle mass, specifically at a rate of 2.5-3.0 % per year (Mitchell *et al*., 2012). These losses are

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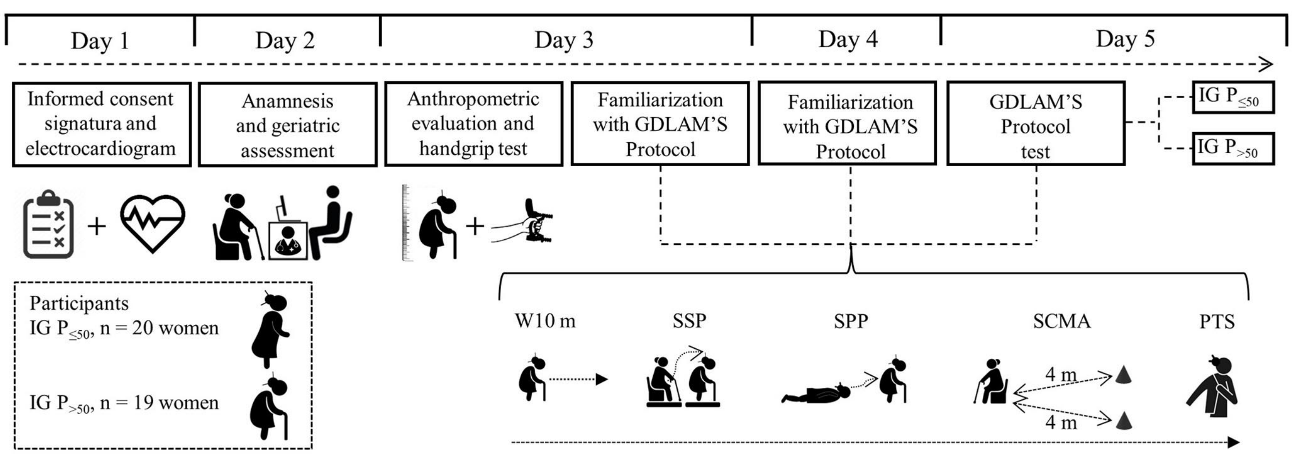
associated with an increased risk of frailty syndrome which derives from the combination of several altered physiological mechanisms, affecting multiple organs and systems (Angulo *et al*., 2020). Indeed, frailty could considerably affect the ability to perform basic and instrumental activities of daily living, decreasing functional autonomy (FA) and the independence of the people who suffer from it (Dent *et al*., 2019).

Frailty in OP may be accentuated to a greater extent in one of the limbs, leading to asymmetry in both size and muscle strength of the lower limbs (Carabello *et al*., 2010). Usually, these differences are compared between strong and weak members and/or dominant (D) and non-dominant (Non_D) members (Bond *et al*., 2017). One of the factors contributing to the development of muscle size and strength asymmetry is increased dominance of one limb over the other, which could lead to the development of superior muscle strength and function in the predominantly used limb (Maupas *et al*., 2002). Asymmetries based on muscle strength <10 % have been reported to be considered normal, while asymmetries based on muscle strength >10 % have clinical significance (Skelton *et al*., 2002; Bishop *et al*., 2018). In this sense, it has been observed that OP with asymmetries ≥ 20 %, are more likely to decrease their levels of functionality and autonomy (LaRoche *et al*., 2017). Likewise, it has been reported that greater asymmetry in the lower limbs is associated with less control of activities that depend on dynamic balance, increasing the possibilities of falls (Portegijs *et al*., 2005). Muscle function assessments could be useful to detect functional asymmetries in the most affected body segments over the years (McGrath *et al*., 2022). Therefore, an early diagnosis of asymmetries would allow the identification of individuals at high risk of frailty and thus guide future interventions related to physical training, benefiting the maintenance of FA in OP (Troncoso-Pantoja *et al*., 2020).

To the best of our knowledge, in Chile there is limited information on the relationship between muscle strength levels and asymmetries in FA in OW (Huerta Ojeda *et al*., 2022). In this sense, in the research carried out by Huerta Ojeda *et al*. FA (2022) asymmetries were determined, from muscle strength tests, of the lower and upper limbs in Chilean OP and, later, they were related to FA. At the end of the study, it is ruled out that a higher level of asymmetries in the older adults (OA) shows a lower level of FA (Huerta Ojeda *et al*., 2022). These antecedents show that early evaluation allowed an intervention to be correctly channeled, as well as the evidence which relates muscle strength, anthropometry, and asymmetries with FA in this segment of the Chilean population is scarce. Consequently, this study aimed to determine the levels of muscle strength, anthropometric parameters, and asymmetries, both lower and upper limbs, that are related to the functional autonomy of older Chilean women living in the community. Therefore, it was hypothesized that older women with greater asymmetry in strength and muscle size, in both the lower and upper limbs, would exhibit lower functional autonomy compared to older women with less asymmetry. in the different segments.

MATERIAL AND METHOD

Research design. This is a comparative cross-sectional observational study (Ato *et al*., 2013). The evaluation process lasted five days with an interval of 24 hours between sessions. The sessions included the signing of the informed consent by all the participants, the geriatric interview, the anthropometric and muscular strength evaluation, the familiarization with the test and finally the application of GDLAM (Fig. 1). Once data derived from the five tests that make up the GDLAM battery were obtained, the FA index (GI) of each of the participants was calculated. After this,



GDLAM'S Protocol, Latin-American Development to the Maturity Group; W10 m, walk 10 meters; SSP, stand up from sitting position; SPP, standing up from the prone position; SCMA, to sit and get up from the chair and move around the house; PTS, to put on and take off a T-shirt; IG $P_{\leq 50}$, Functional Autonomy Index less than or equal to 50th percentile; IG $P_{>50}$, Functional Autonomy Index greater than 50th percentile;

Fig. 1. Research Desing.

the results were ordered from lowest to highest to classify them by percentiles and divide them into two groups. The first group was made up of participants with GI values equal to or less than the 50th percentile (GI P<50), while the second group was made up of participants who obtained GI values above the 50th percentile. (GI P>50). Subsequently, the differences between the covariates of each group were compared.

Participants. Statistical software (G*Power, v3.1.9.7, Heinrich-Heine-Universität, Germany) was used to calculate the sample. The combination of tests used in the statistical software to calculate the sample size was as follows: a) t-test, b) Means: Difference between two independent means (two groups), and c) A priori: Compute required size – given α, power, and effect size. Tests considered two tails, Effect size = 0.91, α-error < 0.05 and a desired power (1-β error) = 0.8, Allocation ratio N2/N1 = 1, the total sample size for EG1 was 20 participants and EG2 was 20 participants.

Thirty-nine OW between 60 and 86 years of age belonging to neighborhood councils in Talca participated voluntarily in this study. The inclusion criteria were the following: Being female, being 60 years of age or older and belonging to neighborhood councils in Talca, being able to move around autonomously and without technical assistance, having the autonomy to give consent or, if not, being represented by a family member or legal representative. In contrast, the exclusion criteria were terminal illnesses, uncontrolled chronic diseases, severe cardiovascular conditions, severe pulmonary conditions, fractures in the last three months, neurodegenerative diseases, severe dementia, physical impossibility to perform some of the proposed tests, or refusal to sign the informed consent form. All participants were informed of the objectives of the study. Initially, 40 women were included in the study. However, one participant was unable to perform one of the tests independently; For this reason, she was excluded from the study. Before applying the protocols, all participants signed informed consent. The study and informed consent were approved by the Ethics Committee of the Universidad de O'Higgins (CEC_PI_2023003). In addition, the study was developed under the ethical standards for exercise and sports sciences (Harriss *et al*., 2019).

Anthropometric measurements and handgrip test. For the characterization of the sample, body mass, stature, body mass index (BMI), body fat percentage and grip strength were evaluated. Body mass, stature, and body fat percentage were assessed with the OP barefoot, wearing shorts and a light T-shirt. Stature (m) was assessed using a stadiometer from the feet to the vertex (Frankfurt plane). Body mass (kg) and height were measured by using a scale with stadiometer (SECA 700® model, Hamburg, Germany). BMI was calculated by dividing body mass in kg by height in m2. The maximum hand grip was evaluated using a hand-held dynamometer (Smedley® model, Tokyo, Japan) (Mathiowetz, 2002). The test was performed with the participants seated, arm at the side of the body, elbow at 90° and the forearm in pronosupination, while the maximum isometric contraction time of the hand grip was 3 to 5 seconds (s). Two evaluations were applied for the (D) and (Non-D) hands. A three-minute rest interval was assigned between trials for the same hand. The force generated was recorded in N and then normalized by dividing by body mass (relative force: $N \cdot kg^{-1}$ body mass). For the statistical analysis, the maximum value obtained in the two repetitions was used, both for the D hand and for the non-D hand. Regarding the calculation of asymmetries, the following formula was used (Bishop *et al*., 2018)

$$\text{Asymmetry} = [(\text{D - Non-D})/\text{D}] \times 100$$

GDLAM'S Protocol. The Latin American Group for Maturity (GDLAM) protocol was used to assess the FA of OP (Dantas *et al*., 2014). This protocol considers the application of five functional tests (Fig. 1). The five functional tests were described by Huerta Ojeda *et al*. (2022):

Walk 10 meters (W10 m): The purpose of this test was to evaluate the time in s that the participant needed to cover the distance of 10 meters walking without running.

Stand up from the sitting position (SSP): The purpose of this test was to evaluate the functional capacity of the lower limbs (LL) of the participants. This test consisted of standing up five consecutive times without assistance or resting the arms on any support. The test starts from sitting, while the chair height is 50 centimeters from the floor. The unit of measurement for this test was timed in s. During the development of the SSP test, the asymmetry of force in the lower limbs (LE) was evaluated by measuring the force generated in the five repetitions of the test. To evaluate the force exerted by each leg during the Sit and Stand movement (Sit-to-Stand, STS), a force platform was used (Valkyria Trainer V1.1.8®, Sunchales, Argentina). The values obtained were recorded in Newtons (N) and normalized by dividing them by body weight (relative strength: N·kg-1 of body weight). In the statistical analysis, the average of the five repetitions were done on each leg, both D and Non-D, as well as for both legs together (BL). Regarding the calculation of asymmetry, the following formula was used (Bishop *et al*., 2018): Asymmetry = [(D – Non-D)/D] × 100.

Sit and get up from the chair and move around the house (SCMA): The purpose of this test was to evaluate the agility and balance capacity of the participants in daily life situations. With a chair fixed to the floor, two cones were placed diagonally to the chair (four meters to the back and three meters to the right and left sides, respectively), the participant begins the test by sitting on the chair with their feet off the floor; at the go signal, the participant stands up, moves to the right, making a turn around the cone, then returning to the chair, sits down and removes both feet from the floor; the participant then immediately performs the same movement to the left. This sequence is repeated twice, emphasizing completing the course in the shortest possible time. The unit of measurement for this test was timed in s.

To put on and take off a T-shirt (PTS): The purpose of this test was to evaluate the FA of the participants to dress themselves in their daily life. The test consisted of putting on a T-shirt and taking it off in the shortest possible time. The individual must be standing, with arms at the side of the body and with an extra-large size (XL) T-shirt held in the D hand. On signal, the participant must put on the T-shirt and immediately take it off, returning to the initial position. The unit of measurement for this test was timed in s.

The rest interval between trials was five minutes. Then, the results of the five tests were used to calculate the GDLAM index of autonomy (GI) using the following formula:

$$GI = [(W10\ m + SSP + SPP + PTS) \times 2] + SCMA]/4$$

Data analysis. Data from the five functional tests of the GDLAM'S protocol, GI, anthropometric parameters, strength (handgrip and sit-to-stand test), and blood pressure were sorted in a spreadsheet designed for the study. Descriptive data are presented as means and standard deviations (SD). The normal distribution of the data was confirmed by the Shapiro-Wilk test ($p > 0.05$). The groups, based on the score obtained in the IG, were classified according to the percentiles (P), in Group 1 (G1) with good FA (P≤50) and Group 2 (G2) with low FA (P> 50). The following tests were used to determine the differences between the covariates of both groups: for parametric data the student's t test was used, while for non-parametric data the Mann-Whitney test was used, both for independent samples (Hopkins *et al*., 2009). All statistical analyses were performed with Prism version 7.00 for Windows® software. The confidence interval for all statistical analyses was 95 %, while the significance level for all statistical analyses was $p < 0.05$.

RESULTS

GDLAM and GI. When separating the group of 39 participants by percentiles (P≤50 and P>50), significant differences were observed in the five tests of the GDLAM protocol and the GI ($p = 0.0001$). The means and SD values are reported in Table I.

Anthropometry and age. When analyzing the covariates between both groups, it was observed that both age and leg circumference presented significant differences ($p < 0.05$). In the specific case of leg circumference, G1 (as the best FA) presented a significantly higher value than G2 (with worse FA). Mean values and SDs for all comparisons are reported in Table II.

Handgrip y sit-to-stand test. When analyzing the strength levels of the upper limbs between both groups, it is shown that both in the D limb and in the non-D limb, the group with greater FA presents higher levels of strength, without significant difference with the group with less FA ($p > 0.05$). Similarly, when analyzing the strength levels of the lower limbs, it was shown that the group with greater FA presented higher strength levels bilaterally ($p < 0.05$), in the D limb ($p < 0.05$) and non-D. ($p > 0.05$). In relation to the asymmetries of the lower limbs, it was shown that G1 has a lower level of asymmetries than G2 ($p > 0.05$) (Fig. 2).

Table I. Comparison of the GDLAM test between high and low percentile groups.

	$G1_{P\leq50}$ (n = 20)	$G2_{P>50}$ (n = 19)	Mean diff	95 % CI of diff	*t*	*p*-value
V10 M (s)*	7.19 ± 0.17	9.11 ± 0.26	1.91	1.27 to 2.55	6.07	0.0001
SP (s)*	11.92 ± 0.40	15.11 ± 0.60	3.19	1.74 to 4.64	4.45	0.0001
PP (s)**	4.29 ± 1.58	7.97 ± 3.02	3.68	2.13 to 3.24	4.80	0.0001
CMA (s)*	42.76 ± 0.89	54.39 ± 1.33	11.63	8.41 to 14.86	7.31	0.0001
TS (s)**	14.74 ± 2.74	21.56 ± 4.89	6.82	4.26 to 9.38	5.40	0.0001
G (points)*	29.78 ± 0.74	40.50 ± 1.05	10.73	8.13 to 13.32	8.37	0.0001

CI, confidence intervals; diff, difference; G1P≤50, Functional Autonomy Index less than or equal to 50th percentile; G2P>50, Functional Autonomy Index greater than 50th percentile; GDLAM'S Protocol, Latin-American Development to the Maturity Group; W10 m, walk 10 meters; SSP, stand up from sitting position; SPP, standing up from the prone position; SCMA, to sit and get up from the chair and move around the house; PTS, to put on and take off a T-shirt; s, seconds. * For the comparison between groups, the t-test was applied.** For the comparison between groups, the Mann-Whitney test was applied.

Table II. Comparison of age and anthropometric parameters between high and low percentile groups.

	$G1_{P\leq50}$ (n = 20)	$G2_{P>50}$ (n = 19)	Mean diff	95 % CI of diff	*t*	*p*-value
Age (years)	68.9 ± 1.49	73.7 ± 1.24	4.83	0.87 to 8.80	2.47	0.018
Body mass (kg)	69.9 ± 2.41	65.4 ± 3.45	-4.51	-12.98 to 3.94	1.08	ns
Stature (m)	1.52 ± 0.01	1.50 ± 0.01	-1.83	-5.00 to 1.33	1.17	ns
BMI (kg/m²)	30.7 ± 0.94	29.8 ± 1.75	-0.88	-4.86 to 3.10	0.44	ns
Fat mass (%)	33.9 ± 0.94	33.9 ± 0.89	0.02	-2.61 to 2.67	0.02	ns
Lean body mass (%)	34.8 ± 0.92	34.2 ± 0.83	-0.63	-3.16 to 1.92	0.50	ns
Bone mass (%)	11.6 ± 0.29	12.16 ± 0.27	0.47	-0.34 to 1.28	1.17	ns
Circumferences						
Arm (cm)	31.24 ± 0.59	29.57 ± 0.81	-1.66	-3.69 to 0.36	1.66	ns
C Arm (cm)	31.82 ± 0.67	30.11 ± 0.88	-1.71	-3.94 to 0.52	1.55	ns
Thigh (cm)	48.96 ± 1.11	45.94 ± 1.09	-3.10	-6.17 to 0.14	1.91	ns
Leg (cm)	35.94 ± 0.78	33.77 ± 0.67	-2.16	-4.26 to -0.66	2.09	0.0433
Diameter						
Humerus (cm)	6.58 ± 0.08	6.48 ± 0.08	-0.09	-0.34 to 0.14	0.78	ns
Femur (cm)	9.69 ± 0.13	9.36 ± 0.14	-0.32	-0.72 to 0.07	1.62	ns

C Arm; counted arm; CI, confidence intervals;diff, difference; G1P≤50, Functional Autonomy Index less than or equal to 50th percentile; G2P>50, Functional Autonomy Index greater than 50th percentile; ns, not significant.All comparisons were with student's t-test.

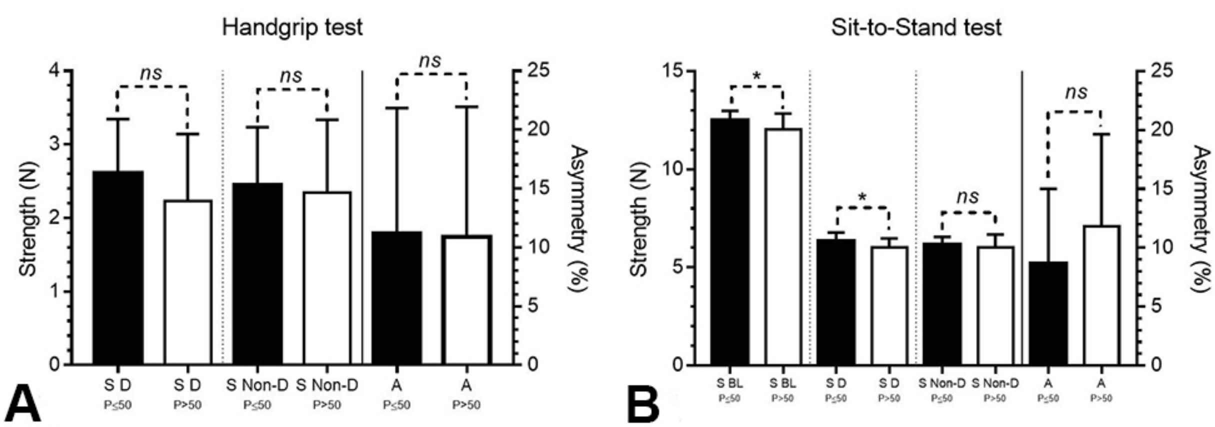


Fig. 2. Comparison of strength levels, through handgrip and sit-to-stand test, between high and low percentile groups. A, asymmetry; BL, bilateral; D, dominant limb; N, Newton; Non-D, non-dominant limb; ns, not significative; P≤50, Functional Autonomy Index (GI) less then or equal to 50th percentile; P≥50, Functional Autonomy index (GI) greater than 50th percentile; S, strength;*, $p<0.05$.

DISCUSSION

In the present study, the levels of muscular strength, anthropometric parameters, and asymmetries, both lower and upper limbs, were related to the FA of a group of older Chilean women residing in the community. For this, the participants were classified into a group with adequate FA (G1 [GI P≤50]) and another group with low FA (G2 [GI P>50]). Regarding the levels of muscular strength of the lower limbs, it was observed that G1 presented greater bilateral strength than G2 ($p < 0.05$). Likewise, in the asymmetries of the lower limbs it was observed that G1 has a lower level of asymmetries than G2 ($p < 0.05$). In this sense, there is evidence that if the asymmetries present in the lower limbs are ≥1 5 %, they cause the distribution of loads to be inequitable (Bishop *et al*., 2018), generating imbalances in gait mechanics and body instabilities, increasing the sensation of pain, risk of falls and injuries (Laroche *et al*., 2012). Due to the background that shows an influence of muscle strength with its asymmetries and anthropometric parameters on FA levels, it is important to carry out adequately dosed strength training to control the covariates described. In this way, FA and the quality of life of FAs can be improved, reducing the sensation of pain generated by imbalances and asymmetries, in order to reduce the risk of falls and possible injuries.

GDLAM'S Protocol. The GDLAM protocol is a battery of tests that evaluate the FA of the OP and is directly related to performance in activities of daily living (Daniel *et al*., 2012). The first analysis of this test is the age of the participants. In this context, the differences observed in each of the tests that make up the GDLAM battery and the GI between both groups could be related to the age of the participants (G1 = 68.9 ± 1.49, G2 = 73.7 ± 1.24 years, $p = 0.018$). In relation to this variable, it has been shown that the levels of FA decrease with the passing of the years (Rundell *et al*., 2022). In fact, it has been shown that 22.9 % of OP between 60 and 69 years of age and 42.9 % of OP 80 years of age or older report limitations in their FA and, in general, have higher medical expenses (Dipietro *et al*., 2019). That is, age is inversely proportional to FA, and this association is even more pronounced in octogenarians (Pivetta *et al*., 2020). Likewise, it has been observed that women have a longer life expectancy compared to men and, in addition, it has been proven that they experience a decrease in muscle function at earlier ages (Gordon & Hubbard, 2020). These circumstances could lead to adverse situations, such as falls, and, consequently, to a decrease in FA, since women would face the aging process with less functional reserve (Tornero-Quiñones *et al*., 2020), which could mean a greater number of years in a situation of disability. In this context, it has been reported that, from the age of 45 on average, 12 % of women already present a decrease in gait speed, which has been associated with a greater risk of frailty (Bortone *et al*., 2021). In addition, as age advances, physical limitations could negatively affect FA, social relationships, and intellectual abilities (Martinho *et al*., 2013). In this scenario, the participation of OW in the community may be diminished, affecting the interaction with their peers and the family group, which may reduce their quality of life (Dunn *et al*., 2016). Faced with this problem, the GDLAM battery has proven to be a useful, practical, and effective tool for the early diagnosis of the levels of functionality of the older adults in the community (Marcos-Pardo *et al*., 2023). Its implementation is essential to establish intervention strategies against the loss of FA, which allows the design of specific policies aimed at promoting the well-being of OW. By facilitating an early and accurate diagnosis, the GDLAM battery contributes to the implementation of preventive measures that promote comprehensive care and a better quality of life at this stage of life, since it has been observed that the greater the FA, the greater is the degree of independence and, therefore, the higher the health-related quality of life (Marcos-Pardo *et al*., 2019).

Anthropometric parameters. It is a fact that muscle mass decreases with age, while body fat increases, a situation that could influence muscle strength and FA (Merchant *et al*., 2021). Therefore, if the health and well-being of FAs is to be maintained and/or improved, it is important to monitor and track these variables throughout life. In this context, the evidence has shown the importance of evaluating the circumferences of the upper and lower limbs, since they are an indicator of the progressive loss of muscle mass associated with aging (sarcopenia) (Cruz-Jentoft *et al*., 2019). In this sense, calf circumference is a reliable indicator of leg muscle mass, since a decrease in the circumference of this segment is associated with a greater risk of frailty and loss of FA, which could potentially contribute to the appearance of a physical disability (Xu *et al*., 2022). The findings of our study have shown that G1 presented a greater calf circumference than G2 ($p < 0.05$). In this context, G2 is made up of participants who present lower levels of FA and, in turn, are older than G1 ($p < 0.05$). These results are consistent with the evidence in the current literature, since it has been shown that calf circumference tends to decrease as age advances (Gonzalez *et al*., 2021). In fact, evidence has shown that conditions such as sarcopenia, disability, and chronic noncommunicable diseases have a close relationship with calf circumference (Zhang *et al*., 2017). Furthermore, this parameter could predict nutritional risks, frailty, and predict mortality in the older adults (Wei *et al*., 2022) In summary, the monitoring and control of some anthropometric parameters such as the measurement of the circumferences of the limbs, is a simple, practical, and important way of evaluating the health of the older adults in the community context.

Handgrip y sit-to-stand test. Measurements of grip strength and the ability to get up from a chair are two important tests in the evaluation of functionality in OP (Cruz-Jentoft *et al*., 2019). Grip strength has been proposed as a biomarker and has been shown to be related to various aspects of physical health in the older adults, such as upper limb function, fractures, falls, malnutrition, multimorbidity (Patrizio *et al*., 2020). In our investigation, even though G1 presented higher levels of strength than G2, these differences were not statistically significant in both limbs ($p > 0.05$). On the other hand, the SSP assesses a person's ability to perform an essential daily activity, and it has been shown to be related to FA in OP (Alcazar *et al*., 2018). In this line, our findings show that G1 presents higher levels of strength bilaterally, both in the D and non-D limbs, compared to G2 ($p < 0.05$). When comparing the asymmetries of the lower limbs, it was observed that G1 presents a lower level of asymmetries than G2 ($p < 0.05$). Increased muscle strength in both the lower and upper limbs in G1 may improve the ability to perform activities of daily living, such as walking, climbing stairs, lifting objects, and performing household tasks, which may contribute to greater FA (Huang & Wu, 2022). Conversely, the lower muscle strength in G2 may limit the ability to perform these daily activities, which could negatively affect FA and quality of life (Cai *et al*., 2022). In addition, the lower level of asymmetry in the lower limbs in G1 may improve balance and coordination ability in the older adults, which may also contribute to greater FA (Lin *et al*., 2004). On the other hand, asymmetries in muscle strength could affect balance and stability when walking or performing activities that require balance, which may increase the risk of falls and injuries (Laroche *et al*., 2012). Therefore, our findings, like the existing evidence, suggest that muscle strength and limb asymmetries are important factors to consider in the FA of OP. In this scenario, strategies that focus on improving muscle strength and reducing asymmetries in the lower and upper limbs may have a positive impact in this population. The use of the tests proposed in this research may help to identify people who are at higher risk of loss of functionality and, therefore, may benefit from preventive interventions to maintain or improve their performance in carrying out their daily activities.

Limitations. This study is subject to certain limitations that must be considered when interpreting the results. First, the sample used in this study was small, which limited our ability to classify by age range. In addition, this low number of participants does not allow establishing a specific classification according to the functional autonomy index and the covariates considered in this research.

CONCLUSION

Our findings showed that the covariates age, anthropometry, muscle strength levels, and asymmetries, both in the lower and upper limbs, influence and condition FA in OP living in the community. Therefore, the evaluation of FA, and the monitoring of anthropometric parameters, muscle strength levels and the respective asymmetries, facilitate early diagnosis and help in the development of preventive strategies for the maintenance of functionality, improving the quality of life of OW living in the community.

Perspectives. To explore the influence of covariates on FA in all OP, future research should include older men in future FA-related interventions in the older population. Valuing men. In parallel, a GDLAM qualitative scale is required for older Chilean men and women. Finally, future research should design and implement personalized physical exercise programs, considering the FA profile of older Chilean men and women. These programs should focus their purpose on maintaining and increasing FA, improving muscle strength, and reducing levels of asymmetries in this population.

JOFRÉ-SALDÍA, E.; HUERTA OJEDA, A.; ARRIAGADA MOLINA, J.; VILLALOBOS-GORIGOITÍA, A.; VALLADARES-IDE, D. & BRAVO, M. Incidencia de la fuerza muscular, antropometría y asimetría en el índice general de autonomía en mujeres mayores chilenas. *Int. J. Morphol., 42(2)*:437-445, 2024.

RESUMEN: La fragilidad afecta la autonomía funcional (AF) de las personas mayores y podría manifestarse en desequilibrios musculares en los miembros, dando lugar a una disparidad de tamaño y fuerza entre ellos. En Chile, la información que relaciona los niveles de fuerza muscular (FM) y las asimetrías con la AF en mujeres mayores es limitada. Este estudio relacionó los niveles de FM, parámetros antropométricos y asimetrías de los miembros inferiores y superiores, con la AF de un grupo de mujeres mayores chilenas. Participaron 39 mujeres, cuya AF se evaluó mediante el índice GDLAM (IG). En función de la puntuación obtenida en el IG, se clasificaron por percentiles en Grupo 1 con AF favorable ($P \leq 50$) y Grupo 2 con AF baja ($P > 50$). Los parámetros antropométricos fueron IMC, porcentaje de grasa, masa ósea, circunferencias (brazo, muslo, pantorrilla), diámetros (húmero, fémur) y se evaluó la fuerza de los miembros superiores/inferiores para determinar asimetrías. Las diferencias entre las covariables de ambos grupos se evaluaron mediante la prueba t de student y la prueba de Mann-Whitney para muestras independientes. G1 presentó menor asimetría ($p > 0,05$) en los miembros inferiores y mayor perímetro de pantorrilla que G2 ($p < 0,05$). G1 presentó mayor fuerza bilateral (miembro dominante y no dominante) en comparación con G2 ($p < 0,05$). Las covariables de antropometría, FM y asimetrías de extremidades inferiores/superiores influyen en la AF en mujeres mayores.

PALABRAS CLAVE: Autonomía funcional; Protocolo del Grupo de Desarrollo Latinoamericano para la Madurez; Personas mayores; Mujeres.

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