

# Correlation between functional condition, diet, depression indices and independence of older adults participating in physical activity programs of the national sports institute of the Maule Region, Chile

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## ABSTRACT

This study analyzes the relationships between functional status, diet, depression, and independence in older adults participating in physical activity workshops at the National Sports Institute (IND) in the Maule Region of Chile. For five months, bi-weekly 60-minute sessions were held, focusing on functional fitness (flexibility, balance, strength, agility, gait speed, and endurance), complemented by social and recreational activities. Pre- and post-intervention assessments used tools such as BMI, waist-to-hip ratio, the Functional Fitness Battery, a food frequency questionnaire, the Geriatric Depression Scale, and the Katz Index. The main findings show significant correlations: gait speed is moderately inversely related to age, strongly inversely related to agility, moderately positively related to lower limb strength, and weakly positively related to left leg balance. Endurance shows a moderate inverse correlation with depression. Lower limb strength is moderately positively associated with gait speed and walking distance, and inversely associated with agility and waist circumference. The discussion aligns these results with the literature, highlighting gait speed as a "vital sign" for autonomy, fall prevention, and mental health. Programs that enhance strength, agility, and balance are essential to promote independence, reduce depression, and manage adiposity in an aging population.

**Keywords:** Chile, Functional fitness, Functional independence, Geriatric depression, Older adults, Physical activity.

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**Competing Interests:** The authors declare that they have no competing interests.

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### Highlights of this paper

- Population aging in Chile demands the establishment of programs to improve the quality of life of the elderly population.
- Programs that enhance strength, agility, and balance are essential to promote independence, reduce depression, and control obesity in an aging population.
- Physical activity is the best strategy for maintaining and improving health.

## 1. INTRODUCTION

Studies have indicated that the health and quality of life of older adults can be maximized through their involvement with physical activity (Pereira et al., 2019; Vaz, 2021). An active lifestyle, with regular physical activity, contributes to improving physical, psychological, and social well-being.

This evidence contributes to the establishment of physical activity programs for older adults as social policies in all regions of Chile, also considering the population's life expectancy statistics (81.4 years in 2023; National Institute of Statistics – INE), with a view to maintaining and improving the health and quality of life of older adults. (SENAMA, 2023).

Despite the recognized benefits of physical activity for functional status, depression and dependence/independence are indicators present in the older adult population, which can be influenced by social and dietary variables present in activities of daily living; and these quality-of-life indicators are related: Physical activity, depression, independence/dependence, diet, and social relationships (da Cruz Silva & Landim, 2020; Fernandes, 2021; Leite, de Jesus, Orlandi, & Zazzetta, 2019; Morais Filho & Sales, 2022; Passos et al., 2022; C. K. A. Silva, de Melo Pita, de Melo Ribeiro, Parrela, & Tourinho, 2022; I. E. D. Silva, 2019).

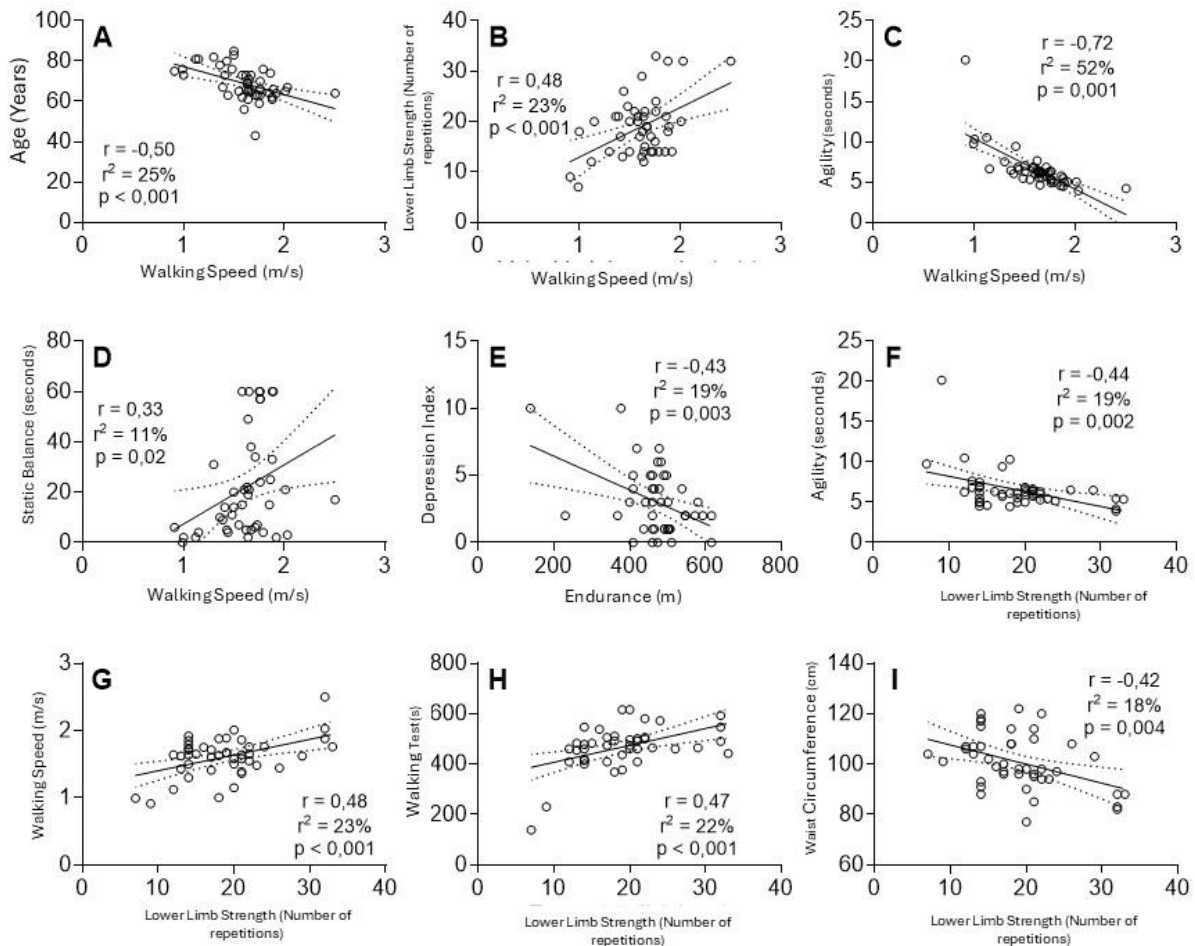
Studies such as those by Hoffmann, Capanema, Franco, Gil, and Mazo (2022); Hernandez and da Cunha Voser (2019) and Oliveira et al. (2019) indicate that older adults who exercise have lower rates of depression and improved social relationships. There is also evidence of a relationship between increased functional capacity and improved self-perceived quality of life in physically active older adults (de Oliveira et al., 2022; J. Rocha et al., 2022; Rodrigues et al., 2022). Regarding nutritional aspects, healthy eating habits and physical exercise are crucial for older adults in preventing and managing various diseases and reducing functional decline, thus contributing to greater independence and improved health (Da Silva et al., 2022; Rocha, Farias, & Siquiera, 2022). Quinot et al. (2022) found that obese older people engaged in more physical activity compared to those classified as underweight.

The objective of this study was to verify if there is a relationship between functional condition, diet, depression rates and independence of older adults who participate in the physical activity programs of the National Sports Institute of the Maule Region, Chile.

## 2. METHOD

Older adults were evaluated from 37 physical activity workshops for seniors offered by the National Sports Institute (IND) in the Maule Region, Chile. The workshops provided two 60-minute sessions per week, with activities related to variables of functional fitness in older adults (flexibility, balance, upper and lower limb strength, agility, gait speed, aerobic endurance), as well as social and recreational activities, over a period of five months. The data collected were: BMI (WHO, 2010) Waist-to-hip ratio (Dalton et al., 2003; Fauziana et al., 2016; Kawamoto, Kikuchi, Akase, Ninomiya, & Kumagi, 2019) and the Functional Fitness Battery for Older Adults (Johnson & Nelson, 1986; Ortega, 2000; Rikli & Jones, 1999). Static single-leg balance test, lower limb strength test (stand up and sit down in 30 seconds), upper limb strength test (elbow flexion with 2 or 3 kg, right and left), lower limb flexibility (sitting in a chair, touch the toes), upper limb flexibility (scratching the back), agility test (stand up, walk

2.45 m and sit down again), gait speed (walk briskly 30 meters), aerobic endurance test (walk for 6 minutes, 46 m rectangle); Food frequency survey (Block, Gillespie, Rosenbaum, & Jenson, 2000; Contreras et al., 2005). Geriatric depression scale (Hoyl, Valenzuela, & Marín, 2000). Katz Index of Independence in Activities of Daily Living (Katz, 1983). Data collection was carried out in pre- and post-tests. With a 5-month interval between assessments. Sample: 45 subjects met the inclusion criteria: having data for each of the tests and surveys.



**Figure 1.** Correlations and linear regression curves ( $\pm 95\%$  CI) between walking speed and age in years (A), lower limb strength (B), agility (C), static balance on the left leg (D), between endurance and depression index (E), and between lower limb strength and agility (F), walking speed (G), walking test (H), and waist circumference (I).

The **Figure 1** illustrates a correlations and linear regression curves ( $\pm 95\%$  CI) between walking speed and age in years (A), lower limb strength (B), agility (C), static balance on the left leg (D), between endurance and depression index (E), and between lower limb strength and agility (F), walking speed (G), walking test (H), and waist circumference (I).

### 3. RESULTS

Walking speed was moderately, inversely, and significantly correlated with age, strongly, inversely, and significantly correlated with agility, moderately, positively, and significantly correlated with lower limb strength, and weakly, positively, and significantly correlated with static balance on the left leg.

Resistance was moderately, inversely, and significantly correlated with the depression index.

Lower limb strength was moderately, inversely, and significantly correlated with agility and waist circumference, and moderately, positively, and significantly correlated with walking speed and distance covered in the walking test.

Sure. Below is a four-paragraph explanation, using academic language and focusing on the interpretation of the correlation matrix.

The matrix shows the relationships between anthropometric, functional, fitness, and mental health variables in the participants. In general, body size indicators—such as weight, waist circumference, hip circumference, BMI, WHtR, and abdominal circumference—tend to be positively correlated with each other, indicating that when one adiposity measure increases, the others also tend to increase. This suggests a relatively consistent body profile within the sample, where body composition variables reflect the same trend of mass and circumference accumulation.

Regarding physical performance, relevant associations are observed between strength, agility, gait, endurance, and balance. Lower limb strength is favorably related to gait speed and distance covered, while it is negatively associated with adiposity measures and some components of agility. Similarly, gait speed appears linked to better functional abilities, confirming its role as a sensitive indicator of overall physical performance. Static balance and flexibility also show correlations with other functional variables, although of more variable magnitude.

Regarding mental health and habits, depression shows negative associations with some physical abilities, especially aerobic endurance, suggesting that better levels of physical fitness may be related to fewer depressive symptoms. Meanwhile, dietary fat and fiber intake show limited or weaker links with the other variables, indicating that diet, at least in this sample, does not alone explain the observed functional behavior. Independence, measured by the corresponding index, shows few and weak correlations with the other indicators.

In summary, the results indicate that the most important functional variables—such as lower limb strength, gait speed, endurance, and balance—are related to each other and also to some anthropometric markers. This suggests that better physical fitness is associated with less adiposity, improved mobility, and, to some extent, better emotional well-being. In practical terms, the matrix supports the importance of interventions that combine physical exercise, body composition monitoring, and mental health promotion in older adults.

#### **4. DISCUSSIONS**

This discussion addresses the main findings obtained in the analysis of the relationship between functional status, diet, depression indices, and independence in older adults participating in physical activity programs at the National Sports Institute of the Maule Region, Chile. Special emphasis has been placed on gait speed as a central variable and its correlation with other functional aspects evaluated.

Several recent studies have confirmed that gait speed is a robust indicator of functional and health status in older adults, even being considered a geriatric “vital sign” due to its ability to predict autonomy, falls, mortality, and cognitive decline (Virto, de Frutos, Pérez, Zorrilla, & García-Zapirain, 2024). In line with the findings of this research, a moderate, inverse, and significant correlation was observed between gait speed and age. This trend has been documented in contemporary research, which indicates that gait speed decreases proportionally after age 65, associated with a reduction in muscle strength and alterations in the musculoskeletal system characteristic of aging (Agapii & BRANIȘTE, 2024; Ponce, Guadalupe, Cruz, & Gómez, 2023). Furthermore, the literature indicates that a lower gait speed increases the risk of cognitive decline and loss of functional independence in daily activities (Cigarroa et al., 2020; Virto et al., 2024).

Regarding the link between agility and gait speed, the data show a strong, inverse, and significant correlation. This confirms that a higher level of agility is associated with faster and more efficient walking, as reported by recent research indicating that older adults with greater agility have shorter walking times and superior functional performance in mobility and independence tests (Cordellat Marzal, Roldán Aliaga, Monteagudo Chiner, Forte Deltell, & Blasco-Lafarga, 2021; Virto et al., 2024).

The relationship between lower limb strength and gait speed was found to be moderate, positive, and significant, reinforcing the importance of muscle strength, particularly in the lower limbs, as a determining factor for efficient mobility. Current studies conducted in Chilean and Latin American populations have documented that, for both normal and maximum gait, lower limb strength is one of the main predictors of a fast and safe gait, surpassing the influence of other variables such as body mass index or upper limb strength (Rybertt, Cuevas, Winkler, Lavados, & Martínez, 2015). These findings suggest that interventions aimed at strengthening muscle are essential for maintaining independence and preventing functional decline.

Regarding balance, a weak but significant correlation was found between gait speed and static balance in the left leg. Despite its smaller magnitude compared to strength or agility, data available in recent literature underscore that balance is a key component in fall prevention and the promotion of independent and safe walking, especially in functional and community contexts (Barañano Martín, Abreus Mora, González Curbelo, & Bernal Valladares, 2020; García-Flores, Rivera-Cisneros, Sánchez-González, Guardado-Mendoza, & Torres-Gutiérrez, 2016).

The results support the value of physical activity programs that include activities to improve strength, agility, and balance, as these functional components not only positively influence gait speed but also promote autonomy and independence in the daily lives of older adults. Integrating periodic assessments of these parameters into the sports context would allow for the early identification of older adults at risk and enhance personalized interventions aimed at maintaining or restoring their functionality and independence (Rybertt et al., 2015; Virto et al., 2024).

The results obtained in this study reveal a moderate, inverse, and significant correlation between physical fitness and depression scores in the older adults in the sample. This finding aligns with recent scientific evidence supporting the relationship between better physical fitness and lower levels of depressive symptoms in older adults (Atencio-Osorio, Carrillo-Arango, & Ramirez-Velez, 2022; Noetel et al., 2024; Sáez-Padilla, Sierra-Robles, Tornero-Quiñones, Espina-Díaz, & Carvajal-Duque, 2020).

Several studies published in the last five years have explored this relationship in greater depth. For example, research has found that higher levels of aerobic capacity and endurance are associated with a lower likelihood of experiencing depressive symptoms. In a meta-analysis and systematic review, it was observed that older adults with low levels of physical fitness had up to a 64% higher risk of developing depression compared to those with good functional capacity (Atencio-Osorio et al., 2022). Furthermore, for every increase in aerobic capacity measured through physical tests, a proportional decrease in the incidence of depression has been reported.

Studies conducted in various regions, including Chile, have confirmed that regular physical exercise, especially resistance and aerobic exercise, not only improves functional fitness but also significantly reduces depressive symptoms (Noetel et al., 2024; Sáez-Padilla et al., 2020). The effect appears to be dose-dependent; that is, the greater the frequency and regularity of physical activity, the greater the reduction in depression scores on standardized clinical scales.

These results suggest that promoting physical endurance through structured group physical activity programs for older adults can be an effective strategy, not only to promote independence and functionality, but also as a complementary tool in the prevention and treatment of depression in old age. Interventions that combine strength and aerobic exercises report comprehensive benefits on mood, quality of life, and the reduction of depressive

symptoms, reinforcing the importance of their systematic inclusion in public programs aimed at this population segment (Atencio-Osorio et al., 2022; Noetel et al., 2024; Sáez-Padilla et al., 2020).

The moderate, inverse, and significant correlation between lower limb strength and agility might seem counterintuitive, but it is supported by recent literature. This relationship may reflect a phenomenon in which greater agility requires not only strength but also neuromuscular control and complex coordination, aspects that are not always linearly related to maximum muscle strength. Several studies have reported that aspects such as motor coordination and reaction time impact agility independently of pure strength, which may explain this association (Cigarroa et al., 2020; Sgaravatti, Santos, Bermúdez, & Barboza, 2018).

On the other hand, the significant inverse correlation with waist circumference is consistent with current evidence linking greater abdominal adiposity with reduced muscle strength, especially in the lower extremities. Abdominal obesity generates systemic inflammation and mechanical restrictions that affect the capacity for muscle force generation and motor function, which in turn impacts the mobility and autonomy of older adults (Alegría-Molina, Marzuca-Nassr, & Gabriel, 2023; Rodríguez-Gutiérrez, Alarcón-Rivera, Concha-Cisternas, Valdés-Badilla, & Guzmán-Muñoz, 2022; Sánchez, Poveda, Córdova, & Villalba, 2022).

Regarding the positive correlations with gait speed and distance covered in the gait test, these results are consistent with recent studies that identify lower limb strength as one of the main determinants of efficient locomotion and endurance in older adults (Andrade-Avalos, Trujillo-Chávez, Macias-Silva, & Guananga-Díaz, 2025; Rybertt et al., 2015). Adequate muscle strength ensures better performance in functional tests and is a predictor of a lower risk of future disability, promoting physical independence and quality of life (Bårdstu, Andersen, Fimland, Raastad, & Saeterbakken, 2022; Dipietro et al., 2019; Jofré-Saldía, Villalobos-Gorigoitía, Cofré-Bolados, Ferrari, & Gea-García, 2023).

These findings underscore the importance of lower limb muscle strengthening interventions within physical activity programs for older adults, as they not only improve key functional parameters such as gait speed and endurance, but also help manage associated risk factors such as abdominal adiposity. Comprehensive assessment of muscle strength, agility, and body composition should be a standard component for monitoring functional health and dependency risk in this population (Rodríguez-Gutiérrez et al., 2022).

## 5. CONCLUSION

This study provides updated evidence that reaffirms the complex but significant relationship between lower limb strength, agility, body composition, and motor function in older adults, fundamental aspects for promoting their autonomy and independence.

Furthermore, they support and strengthen the international recommendation to incorporate regular physical activity as part of comprehensive mental health and functional care for older adults, particularly in community and preventative settings. They also provide updated evidence that reaffirms the complex yet significant relationship between lower limb strength, agility, body composition, and motor function in older adults—fundamental aspects for promoting their autonomy and independence.

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