geriatrics

MDPI

Article

The Role of Cognitive Performance and Physical Functions in the Association between Age and Gait Speed: A Mediation Study

Marcelo de Maio Nascimento [1,*], Élvio Rúbio Gouveia [2,3,4], Bruna R. Gouveia [3,4,5,6], Adilson Marques [7,8], Priscila Marconcin [7,9], Cíntia França [2,3] and Andreas Ihle [4,10,11]

1 Department of Physical Education, Federal University of Vale do São Francisco, Petrolina 56304-917, Brazil
2 Department of Physical Education and Sport, University of Madeira, 9020-105 Funchal, Portugal; erubiog@staff.uma.pt (É.R.G.); cintia.franca@staff.uma.pt (C.F.)
3 LARSYS-Laboratory for Robotics and Engineering System, Interactive Technologies Institute, 9020-105 Funchal, Portugal; bgouveia@esesjcluny.pt
4 Center for the Interdisciplinary Study of Gerontology and Vulnerability, University of Geneva, 1205 Geneva, Switzerland; andreas.ihle@unige.ch
5 Regional Directorate of Health, Secretary of Health of the Autonomous Region of Madeira, 9004-515 Funchal, Portugal
6 Saint Joseph of Cluny Higher School of Nursing, 9050-535 Funchal, Portugal
7 CIPER-Interdisciplinary Centre for the Study of Human Performance Faculty of Human Kinetics, University of Lisbon, 1495-751 Lisbon, Portugal; amarques@fmh.ulisboa.pt (A.M.); priscilamarconcin@fmh.ulisboa.pt (P.M.)
8 ISAMB-Environmental Health Institute, Faculty of Medicine, University of Lisbon, 1649-020 Lisbon, Portugal
9 KinesioLab, Research Unit in Human Movement Analysis, Piaget Institute, 2805-059 Almada, Portugal
10 Department of Psychology, University of Geneva, 1205 Geneva, Switzerland
11 Swiss National Centre of Competence in Research LIVES—Overcoming Vulnerability: Life Course Perspectives, 1015 Lausanne, Switzerland
* Correspondence: marcelo.nascimento@univasf.edu.br; Tel.: +55-(87)-21016856

check for updates

Citation: Nascimento, M.d.M.; Gouveia, É.R.; Gouveia, B.R.; Marques, A.; Marconcin, P.; França, C.; Ihle, A. The Role of Cognitive Performance and Physical Functions in the Association between Age and Gait Speed: A Mediation Study. *Geriatrics* **2022**, *7*, 73. https://doi.org/10.3390/geriatrics7040073

Academic Editor: Timo Hinrichs

Received: 16 June 2022
Accepted: 5 July 2022
Published: 7 July 2022

Simple Summary: Age and mobility are interrelated. In this context, cognitive performance (CP) and physical functions (PF) play a mediating role. However, these concepts are multifaceted, and their interrelationships need further investigations. Thus, our study aims (1) to investigate the association between CP and PF with GS and (2) to examine whether CP and PF mediate the association between age and GS in a large sample of older Brazilian adults. The findings show that low levels of CP and PF were associated with a greater chance of the older individual presenting a slow GS. Moreover, the mediation model indicated that CP and PF mediated, by approximately 12% and 98%, respectively, the association between age and GS.

Abstract: Introduction: With vulnerable aging, gait speed (GS) undergoes progressive changes, becoming slower. In this process, cognitive performance (CP) and physical function (PF) both play an important role. This study aims (1) to investigate the association between CP and PF with GS and (2) to examine whether CP and PF mediate the association between age and GS in a large sample of Brazilian older adults. Methods: A cross-sectional study analyzed 697 individuals (mean age 70.35 $\pm$ 6.86 years) from the state of Amazonas. The CP was evaluated by the COGTEL test battery, PF by the Senior Fitness Test battery, and GS with the 50-foot Walk Test. Results: Older adults with a lower CP and PF had a 70% and 86% chance of slow GS, respectively. When CP and PF were placed simultaneously as mediators, the direct effect estimated by the model revealed a non-significant relationship between age and GS. Specifically, CP and PF mediated the association between age and GS, at approximately 12% and 98%, respectively. Conclusions: CP and PF show the potential to estimate GS performance among older adults. Moreover, CP and PF indicated a negative and direct association between age and slow GS, especially PF.

Keywords: gait; cognition; aging; physical functions

1. Introduction

Age-related adaptations during gait lead the older person to adopt a more stable gait pattern [1], which means being more cautious during walking [2]. Thus, in older adults, typical changes in gait include reduced speed [3,4], shorter stride length [5], increased stride time [6], and higher gait stability ratio [7]. Evidence has shown that with vulnerable aging, changes in mobility are strongly associated with poor cognitive performance (CP) [8,9] and reduced levels of physical functions (PF) [10]. This demonstrates that gait, cognition, and PF are interrelated systems [11–13].

Gait is a functional activity interrelated with different psychomotor variables that, in turn, contribute to or impair their speed [14]. Among them, there is the motor control [15], muscular performance and musculoskeletal condition [16], and sensory and perceptual function [17]. Losses in these functions occur naturally with increasing age and more rapidly in combination with sedentary habits [18]. A slow GS can induce a vicious cycle of physical deconditioning directly affecting health factors, such as circulatory systems, lungs, and the nervous and musculoskeletal systems [19]. Previous studies have also linked older adult GS with survival and mortality [20–22]. In a longitudinal study that examined the relationship between varying measures of time of PF and survival in men and women aged >70 years [23], a 0.1 m/s higher GS performance was seen among women with a 12% reduction in the probability of death in the subsequent year. In contrast, among men, a 0.1% m/s increase in GS represented a reduction in death by 3%. Another point to consider is that the combination of vulnerable aging and low PF levels not only constitutes a vicious cycle harmful to GS, but is also associated with an increased risk of falls [24]. In old age, falls are usually accompanied by fractures and hospitalizations and can even lead to death [25]. Thus, this suggests that GS is a determining factor in maintaining older adults' health and quality of life [26–28].

Another reason to deepen the understanding of GS in vulnerable aging is that its measurement serves as a biomarker of cognitive decline [29–31]. Considering the predictive power of gait alteration for incident cognitive decline (a pre-dementia state) [32], Verghese et al. [33] proposed a clinical tool to target interventions for older adults without disabilities or dementia at increased risk of cognitive decline. The tool was titled Motor Cognitive Risk Syndrome (MCR), which compared the diagnosis of mild cognitive impairment (MCI). MCI does not depend on a formal neuropsychological assessment as it is performed solely based on slow gait or cognitive complaints. This strategy is advantageous for being low cost, not requiring language assessment, and/or accounting for years of education. Thus, in recent decades, studies have used the dual-task paradigm during gait to assess the association between slow gait in aging and cognitive deficits [12,34–36]. As a complex motor activity, gait requires precise commands from the central nervous system [37]. Thus, a performance <0.80 m/s may reveal functional and/or structural changes in the brain [38], especially in regions associated with the front-subcortical circuit, responsible for mobility and balance [39]. Slow gait may also point to a possible reduction in grey matter volume in the prefrontal cortex [40], reduction in periventricular and subcortical white matter [41], and reduction in hippocampal volumes [31], as well as raising suspicions about possible atrophy of the medial temporal areas [42].

Although changes in GS caused by aging are a recurring theme in the specialized literature [9,11,39], including their associations with CP and PF levels [3,43], the interrelationships, as well as the importance of the different factors involved, remain much less understood [13,17]. Thus, a mediation study can expand the understanding of the mechanisms involved in reduced GS in aging. Second, based on the findings, it will be possible to plan and create more precise therapeutic interventions to prevent the decline in mobility in the older population, consequently benefiting their levels of independence and well-being. Third, understanding the relationship between age, CP, PF, and GS can provide new insights into the area of fall prevention [30]. Finally, the literature shows a lack of studies that include large samples of cognitively healthy older adults, as well as older adults residing in South American countries [44]. Thus, our aim is (1) to investigate the association between CP and PF with GS and (2) to examine whether CP and PF mediate aging-associated decline in GS in a large sample of Brazilian older adults.

2. Materials and Methods

2.1. Design and Participants

A cross-sectional analytical observational study was carried out with data from the research project "Health, Lifestyle, and Functional Fitness in the Older People from Amazonas, Brazil" (SEVAAI). Data were collected between 2016 and 2017 in the state of Amazonas (municipalities of Manaus, Fonte Boa, and Apuí), located in the northern region of Brazil. The investigation followed the ethical principles contained in Resolution 466/12 of the National Health Council of the Ministry of Health, evaluated and approved by the Ethics Committee in Research with Human Beings of the Universidade do Estado do Amazonas (nº 1.599.258—CAAE: 56519616. 0000.5016). Participants were recruited through newspapers, churches, support centers, groups, or associations of older people in the municipalities of Manaus, Fonte Boa, and Apuí. All participants were informed about the procedures and voluntarily signed an informed consent form before the assessments. The inclusion criteria were: residing in one of the three cities mentioned, minimum age of 60 years, being able to walk independently and performing physical assessments, presenting autonomy and independence to perform activities of daily living, and not indicating serious problems with health (contraindications for exercise). A score of <14/30 in the Mini-Mental State Examination (MMSE) [45] was considered an exclusion criterion (the MMSE was administered to potential participants after they gave consent). Of 701 people who met the search criteria and were included in the original study, 697 were included in the present eligibility:;one was excluded due to Parkinson's disease and three due to Alzheimer's disease.

2.2. Data Collection

2.2.1. Demographics and Clinical Data

Information on sex, age, years of schooling, falls, and Parkinson's and Alzheimer's diseases were collected by self-report, obtained individually in a face-to-face interview, using a health questionnaire employed in FallProof! Program [46]. The interviews were conducted by trained field staff members.

2.2.2. Cognitive Assessment

CP was assessed using the Cognitive Telephone Screening Instrument (COGTEL) test battery [47]. The test is composed of six subtests, which represent important domains of cognitive function: (1) prospective memory; (2) short-term verbal memory; (3) working memory; (4) inductive reasoning; (5) verbal fluency; and (6) long-term verbal memory. The calculation of the total score (continuous scale) was performed using the following formula: COGTEL total score = 7.2 $\times$ prospective memory + 1.0 $\times$ short-term verbal memory + 0.9 $\times$ long-term verbal memory + 0.8 $\times$ working memory + 0.2 $\times$ verbal fluency + 1.7 $\times$ inductive reasoning. Its psychometric properties were verified in the older Brazilian population [48], presenting excellent reliability and high validity. The assessments were conducted individually in face-to-face interviews by specially trained research team members.

2.2.3. Physical Functions

PF was evaluated using the Senior Fitness Test (SFT) battery [49]. For the present study, six PF indicators were selected as physical fitness parameters: (1) Lower limb strength: Participants were asked to get up from a chair, after a signal, and then return to a fully seated position, repeating this action as many times as possible for 30 s. (2) Arm curl, to assess upper body strength: After a signal, participants were instructed to flex and extend the elbow (dominant hand) through its full range of motion, lifting a weight (2.3 kg dumbbell for women and 3.6 kg dumbbell for men) as many times as possible for 30 sec. The total number of repetitions performed was used as a score. (3) Lower body flexibility (sit-and-reach chair/cm): Participants were asked to sit on the edge of a chair, with one leg bent and the other leg extended straight in front, keeping the heel on the floor, without bending the knee. The task consisted of extending the hands forward towards the feet, slowly sliding over the extended leg. The score was determined by the number of centimeters reached beyond the toes (highest score) or reached before the toes (lowest score). (4) Upper body flexibility (back scratching/cm): Participants were asked to place one hand behind the side of the same shoulder with the forearm pronated, the other hand behind the back, and fingers extended. The score was obtained by the centimeters needed for the middle finger to touch the fingers of the other hand (lowest score) or by the centimeters that the middle finger overlapped with the other hand (highest score). (5) Agility/dynamic balance (8 feet up-and-go/s): Participants were asked to sit in a chair, place hands on thighs and feet flat on the floor. After a signal, they got up from the chair, walked as quickly as possible (without running) around a cone placed 8 ft (2.44 m) in front of the chair, returning and sitting fully in the chair. The test result was mensured by the time in seconds used to get up from the sitting position, walk and return to the sitting position. (6) Aerobic endurance (6MWT): Participants were asked to walk, after a signal, as fast as possible (without running) along a marked path. This action occurred as many times as possible. The test score was established by the distance (meters) covered in the six-minute interval (6 min). The calculation of the continuous global measure of the participants' PF was determined by summing the scores of all six indicators provided by the SFT battery [49].

2.2.4. Gait

GS was assessed using the 30-foot walk test. Participants were required to walk a distance of 30 feet (9 m) at their preferred speed. For each participant, three measures were collected, and the best performance was considered in the analysis. A full description of the test administration instructions for the 30-foot walk test is reported in Rose [46].

2.2.5. Covariates

Through face-to-face interviews, participants reported sex, age, years of education, and the number of falls in the last 12 months.

2.3. Statistical Analysis

Categorical variables are presented as frequencies and percentages, while continuous variables are presented as means and standard deviations. The main characteristics of the participants were compared using the chi-squared test (categorical variables) and the unpaired Student's *t*-test for independent samples (continuous variables). The composition of groups was determined by a cut-off point established by the overall mean of the participant's performance on the cognitive test (COGTEL), based on the following equation: COGTEL total score [18.9 points] minus 1 standard deviation. The calculation was based on the literature, indicating the method effectively identified individuals with cognitive vulnerability and/or mild cognitive impairment [50]. Thus, two groups were established: mild cognitive impairment with <17.9 points vs. normal cognition with ≥17.9 points. In a second step, two separate logistic regression analyses were performed to test cross-sectional associations between CP and PF with GS (the study's first objective). Thus, based on the performance of CP and PF, the chance of older adults presenting a low GS was evaluated. Three models were calculated: Model 1 unadjusted; Model 2 adjusted by sex and age; Model 3 adjusted by sex, age, MMSE, and years of education. The insertion order was from highest to lowest (forward model), respecting the magnitude of Spearman's correlation coefficient. The odds ratio (OR) and their respective confidence intervals (95% CI) were used to present the results. Effect size estimates were reported using the adjusted R^2.

Finally, a mediation analysis was performed to examine whether CP and PF mediate the association between age and GS (the second objective of the study). A mediation, or indirect effect, occurs when the causal effect of an independent variable X (age) can predict the dependent variable Y (GS) transmitted by mediators M_1 and M_2 (CP and PF) [51]. A complete mediation is observed if the joint inclusion of objectively measured M_1 and M_2 reduces the observed association between X and Y to non-significance. A partial mediation occurs if the observed association between X and Y becomes weaker after the inclusion of M_1 and M_2. An indirect effect was considered significant when the confidence interval did not include zero. Mediation hypotheses were tested using the bias-corrected bootstrap method with 5000 samples to calculate confidence intervals (95%). To perform the analysis, a computational complement of the SPSS program was applied using PROCESS v4.0, a model estimation analysis developed by Hayes [52]. The significance level for all analyses was defined as $\alpha < 0.05$.

3. Results

3.1. Main Characteristics of the Participants

Table 1 presents the participants' characteristics stratified by cognitive status. A total of 697 participants was included in the study. Of these, 48.2% had mild cognitive impairment. The mean age was 70.35 ± 6.86, with 61.7% being female. Except for the falls variable, all the others presented different statistical results ($p < 0.001$). Moreover, members of the group without cognitive deficit indicated better results in most variables (years of education, MMSE, COGTEL, total PF, and GS).

Table 1. Main characteristics of the sample.

Variable	Full Sample (n = 697)	Cognitive Impairment (n = 336)	No Cognitive Impairment (n = 361)	*p*-Value
Age (years)	70.35 ± 6.86	71.58 ± 7.47	69.23 ± 6.05	<0.001
Sex n (%)				0.001
Female	430 (61.7)	183 (55.3)	247 (67.5)	
Male	267 (38.3)	148 (44.7)	119 (32.5)	
Education (years) (n)	5.35 ± 5.54	1.97 ± 2.90	8.40 ± 5.61	<0.001
Falls (n)	0.59 ± 1.32	0.68 ± 1.66	0.51 ± 0.90	0.087
MMSE (n)	24.40 ± 4.23	22.12 ± 4.16	26.51 ± 3.03	<0.001
Cognition (n)				
COGTEL (score)	18.95 ± 9.45	11.11 ± 4.59	26.17 ± 6.59	<0.001
Physical function (n)				
PF total (score)	470.63 ± 96.16	461.09 ± 99.95	479.40 ± 91.81	<0.001
Gait (m/s)				
GS	1.35 ± 0.47	1.12 ± 0.34	1.55 ± 0.48	<0.001

Note: MMSE: Mini-mental state examination; PF: physical functions; GS: gait speed; m/s: meters per second. $p \leq 0.005$.

3.2. Associations between CP and PF with GS

Table 2 presents the associations and odds ratios between a low level of CP and PF with GS. After adjusting for covariates (e.g., sex, age, MMSE, and years of education), older adults with a low CP indicated a greater chance of having a low GS than those with a high CP (OR = 0.296, 95% CI = 0.128–0.302, $p < 0.001$, $R^2 = 0.301$). Moreover, after adjusting for covariates (e.g., sex, age, MMSE, and years of education), older adults with low PF level also indicated a greater chance of having low GS (OR = 0.141, 95% CI = 0.091–0.198, $p < 0.001$, $R^2 = 0.310$).

Table 2. Association between physical functions and cognitive performance.

Variable	Model 1 OR 95% CI *p*-Value	Model 2 OR 95% CI *p*-Value	Model 3 OR 95% CI *p*-Value
Lower CP	0.450 (0.359–0.484) <0.001	0.437 (0.347–0.473) <0.001	0.296 (0.128–0.302) <0.001
Lower PF	0.206 (0.125–0.261) <0.001	0.188 (0.105–0.247) <0.001	0.141 (0.091–0.198) <0.001

Note: CP: cognitive performance; PF: physical functions; Model 1: unadjusted; Model 2: adjusted by sex and age; Model 3: adjusted by sex, age, MMSE, and years of education. $p < 0.001$.

3.3. Mediation Analysis: CP and PF in the Relationship between Age and GS

Figure 1 presents the results of the multiple mediation analysis. The total effect of the model (*x*–*y*) showed a significant negative relationship between increasing age and low GS performance (β = −0.011, 95% CI = −0.0164–0.0064, $t = -4.4934$, $p < 0.001$). Model 1 was controlled for confounders (i.e., sex and years of education) and showed that age (independent variable) had a negative and significant association with the CP mediator (β = −0.254, 95% CI = −0.3552–0.1538, $t = -4.9611$, $p < 0.001$), and also with the PF mediator (β = −4.6549, 95% CI = −5.6386–3.6712, $t = -9.2909$, $p < 0.001$). Model 2 shows significant and positive associations between the CP mediator (β = 0.023, 95% CI = 0.0203–0.0265, $t = 14.7091$, $p < 0.001$) and the PF mediator (β = 0.001, 95% CI = 0.0008–0.0015, $t = 7.0577$, $p < 0.001$) with GS (dependent variable). When the mediating variables (m1 and m2) were included, the direct effect estimated by the model (*x*–*y*) revealed a non-significant relationship between age and GS (β = −0.001, 95% CI = −0.0047–0.0044), $t = -0.0591$, $p = 0.9529$). The indirect effects showed that both CP (β = −0.006, 95% CI BCa = −0.0085–0.0035) and PF (β = −0.005, 95% CI BCa = −0.0074–0.0036) were independent mediators of the negative effect that aging has on the GS performance of older adults. Thus, the proportion of the total effect of age on GS mediated by CP and PF was approximately 12% and 98%, respectively.

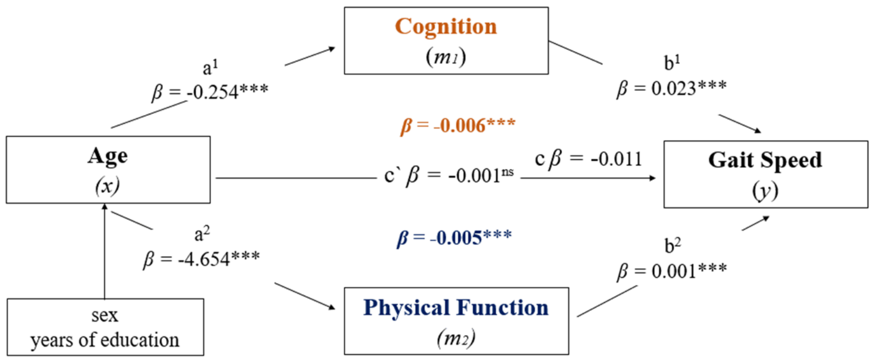

Figure 1. Mediation analysis: CP and PF in the relationship between age and GS. Parallel mediation analysis of the effects of age (aging) on GS ($m \cdot s^{-1}$) through CP (COGTEL, total score) and PF (Senior Fitness Test, total score), adjusted for sex and years of education. The analysis considered the number of bootstrap samples = 5000. The indirect effect was statistically significant at the 95% confidence interval (CI) when the CI did not include 0. Betas (β) are reported as the product of simultaneous regression with substitution of bootstrap: (1) Path a^1 and a^2 = association between age and CP and PF, respectively, and (2) Path b^1 and b^2 = association between CP and PF with GS; (3) Path c′ = direct effect (*x*–*y*): m_1(brown color) and m_2 (blue color) associations = indirect effect (*x*–*y*) by CP and PF, respectively. NS = not significant; *** $p < 0.001$, c = total effect; c′ = direct effect; a = path Model 1; b = path Model 2.

4. Discussion

The present study aimed to investigate the association between CP and PF with GS and to examine whether CP and PF mediate the association between age and GS in a large sample of Brazilian older adults. Our main findings were the following: First, based on the results of the logistic regression, in the final model controlling for sex, age, MMSE, and years of education, older adults with a lower CP and lower PF levels indicated a chance of having a slow GS, in 70% and 86%, respectively. Second, when CP and PF were placed simultaneously as mediators, the observed association between x and y became weaker, and the direct effect estimated by the model revealed a non-significant relationship between age and GS. Thus, CP and PF were able to partially mediate the association between age and GS in approximately 12% and 98%, respectively.

To the best of our knowledge, this is the first study to estimate the mediation exerted by CP and PF in the association between age and GS in a large sample of Brazilian older adults. Thus, our findings may contribute to the current knowledge, providing in-depth evidence on the role that CP and PF play in the relationship between age and GS in the older population. Overall, our findings are in agreement with previous investigations; PA levels may be a possible strategy to improve GS performance over aging [3]. Logically, the second point also depends on the local creation of health, infrastructure, and education policies that allow the older population to practice physical exercises [53]. As a result, we can expect an improvement in CP and PF levels [54]. In the case of the older population, a medium to high level of PA is positively associated with a good physical performance [55]. The measure is recommended as a strategy to reduce health risks [56], such as cardiovascular diseases and diabetes, as well as a preventive factor for falls [57], which are strongly associated with a slow gait [58], and consequently increased risk of mortality [59]. It is worth noting that, after another fall [60], older adults tend to adopt a slower gait due to fear of another fall [61,62]. Moreover, falls generate high costs for health services, being considered a public health problem [63,64].

The associations of the mediation analysis revealed by the present study may contribute to a conceptual advance on the role of age in GS, as they demonstrated, in percentage terms, how CP and PF act in the relationship exerted by aging on GS. The findings also showed that, in our sample, the percentage of mediation indicated by CP was approximately eight times lower than the value indicated by PF. So, the CP may have a direct impact on PF. Therefore, a practical implication is to increase PF, which in turn will benefit GS. Among age-related changes, the reduction in muscle strength resulting from the loss of skeletal muscle mass (sarcopenia) and is one of the limiting agents for older adults to present adequate PF performance [64]. Changes in the musculoskeletal system directly affect spatial and temporal parameters of the gait, including speed, cadence, and stride length [65]. The literature highlights that a longer stride length during gait benefits biomechanical efficiency [66]. On the other hand, an increase in stride-time variability may be associated with abnormally high cortical levels of gait control, altering the stride mechanism [65]. This confirms the mediating role that PF and CP have in the relationship between age and GS. A longitudinal study [67] and systematic review with a meta-analysis [11] showed a causal relationship between poor performance on measures of PF (including gait parameters) and the worsening of CP. In a population-based study (n = 3460; $\geq$65 years), an association was shown between CP and a reduced probability of disability in several domains of PF [68]. It is worth noting that low performance on the 6MWT aerobic endurance test not only suggests possible heart failure, as it also reflects a low GS [69]. Therefore, short steps, in addition to reducing GS, serve as a prognosis of heart failure [66]. Although our study did not focus on age-related changes in body composition, it is important to note that there is strong evidence of an association between BMI in the obesity range and physical disability in older adults [70]. A relationship between older adult obesity and cognitive impairment has been indicated by population-based studies [71,72]. Therefore, a cohort study (n = 572; $\geq$60 years) carried out to assess the relationship between anthropometric measurements and PF showed greater associations between muscle mass index and anthropometric measures of central fat with worse PF performance for both sexes [73]. In this context, an effective strategy capable of reducing the physical frailty of the obese older adult population focuses on increasing levels of physical activity associated with a healthy lifestyle [74].

As for the study's strengths, we can mention the analysis based on a large sample of older adults. Second, the three municipalities where the study was carried out are located in the northern region of the Brazilian territory, which, compared to the southern and southeastern regions of Brazil, is considered a territory of social and economic vulnerability [75,76]. This means that the present study brought to light, for the first time, information on aspects of GS, CP, and PF of community-dwelling older adults in Brazil, who age in precarious conditions [76]. Third, the instruments used to assess CP, PF, and GS are reliable and valid measures [46–49]. Moreover, the novelty of examining the mediating role of CP and PF in the association between age and GS of older adult Brazilians is a further strength. Thus, our findings can inform public policies to improve the quality of life and healthy aging of older adult Brazilians [77], especially those in vulnerable situations [78]. Although the present study did not intend to deepen comparisons by sex, it is worth noting that the descriptive analysis showed that, comparatively, women had proportionally greater cognitive deficits than men. Moreover, older adults in the group with cognitive impairment had four times fewer years of education than those in the group without cognitive impairment. Regarding study limitations, we highlight the cross-sectional design, limiting causal conclusions. Therefore, the present study encourages future investigations based on longitudinal approaches. A further possible focus for future research would be to investigate the age-related decline in GS, mediated by CP and PF, including sex as a potential moderator, to determine whether there is a difference between older men and women. Additionally, as the PF reveals a greater role as a mediator of the association between age and GS, it will be interesting to investigate the role of PF as a mediator of CP and gait speed.

5. Conclusions

The findings revealed in this large sample of older adults from three municipalities in the northern region of Brazil highlighted the role that CP and PF have in the relationship between age and GS performance. Moreover, CP and PF explained the negative association between age and slow GS. These results reinforce the importance of older adults adopting an active lifestyle as a possible strategy for maintaining PF and thereby also adequate GS levels. Our results also strengthen the essential role that a preserved cognitive function during aging offers for GS, which in turn is a determinant of motor capacity for older adults' autonomy. Finally, based on the findings, local health policies and interventions can be planned and/or (re)directed to promote active [79] and successful aging [80] in the northern region of Brazil.

Author Contributions: Conceptualization, M.d.M.N., É.R.G., P.M., A.M. and A.I.; methodology, M.d.M.N. and É.R.G.; software, P.M., A.M. and É.R.G.; validation, M.d.M.N., É.R.G., B.R.G. and A.M.; formal analysis, M.d.M.N.; investigation, M.d.M.N., É.R.G., B.R.G., A.M. and A.I.; resources, É.R.G., B.R.G. and A.I.; data curation, M.d.M.N. and É.R.G.; writing—original draft preparation, M.d.M.N., writing—review and editing, P.M., B.R.G., A.M., C.F. and A.I.; visualization, M.d.M.N., P.M., A.M., C.F. and É.R.G.; supervision, É.R.G., B.R.G. and A.I.; project administration, É.R.G., B.R.G., A.M. and A.I.; funding acquisition, É.R.G., B.R.G. and A.I. All authors have read and agreed to the published version of the manuscript.

Funding: We acknowledge support from the Swiss National Centre of Competence in Research LIVES—Overcoming vulnerability: life course perspectives, which is funded by the Swiss National Science Foundation (grant number: 51NF40-185901). Moreover, A.I. acknowledges support from the Swiss National Science Foundation (grant number: 10001C_189407). E.R.G., C.F. and B.R.G. acknowledge support from LARSyS—Portuguese national funding agency for science, research and technology (FCT) pluriannual funding 2020–2023 (Reference: UIDB/50009/2020).

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the local ethics committee before the start of the data collection (ethic committee name: The Research Ethics Committee—Human Beings; approval code: CAAE: 56519616.6.0000.5016, Number: 1.599.258, Brazil Platform; approval date: 20 June 2016).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study before participation.

Data Availability Statement: The data presented in this study are available upon request from the corresponding author.

Acknowledgments: The authors are grateful to Duarte L. Freitas and Jefferson Jurema for their help in setting up the study as well as Maria A. Tinôco, Floramara T. Machado, Angenay P. Odim, and Bárbara R. Muniz for technical assistance in the data collection and management. We are especially grateful to the older people for their participation and interest.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Cromwell, R.L.; Newton, R.A. Relationship between Balance and Gait Stability in Healthy Older Adults. *J. Aging Phys. Act.* **2004**, *12*, 90–100. [CrossRef] [PubMed]
2. Herssens, N.; Verbecque, E.; Hallemans, A.; Vereeck, L.; Van Rompaey, V.; Saeys, W. Do spatiotemporal parameters and gait variability differ across the lifespan of healthy adults? A systematic review. *Gait Posture* **2018**, *64*, 181–190. [CrossRef] [PubMed]
3. Fitzpatrick, A.L.; Buchanan, C.K.; Nahin, R.L.; Dekosky, S.T.; Atkinson, H.H.; Carlson, M.C.; Williamson, J.D. Associations of gait speed and other measures of physical function with cognition in a healthy cohort of elderly persons. *J. Gerontol. A Biol. Sci. Med. Sci.* **2007**, *62*, 1244–1251. [CrossRef] [PubMed]
4. Rogers, H.L.; Cromwell, R.L.; Grady, J.L. Adaptive Changes in Gait of Older and Younger Adults as Responses to Challenges to Dynamic Balance. *J. Aging Phys. Act.* **2008**, *16*, 85–96. [CrossRef]
5. Danion, F.; Varraine, E.; Bonnard, M.; Pailhous, J. Stride variability in human gait: The effect of stride frequency and stride length. *Gait Posture* **2003**, *18*, 69–77. [CrossRef]
6. Kirkwood, R.N.; Araújo, P.A.; Dias, C.S. Biomecânica da marcha em idosos caidores e não caidores: Uma revisão da literatura. *Rev. Bras. Ciênc. Mov.* **2006**, *14*, 103–110.
7. Martin, K.L.; Blizzard, L.; Wood, A.G.; Srikanth, V.; Thomson, R.; Sanders, L.M.; Callisaya, M.L. Cognitive Function, Gait, and Gait Variability in Older People: A Population-Based Study. *J. Gerontol. Ser. A* **2013**, *68*, 726–732. [CrossRef]
8. Holtzer, R.; Verghese, J.; Xue, X.; Lipton, R.B. Cognitive processes related to gait velocity: Results from the Einstein aging study. *Neuropsychology* **2006**, *20*, 215–223. [CrossRef]
9. Montero-Odasso, M.M.; Barnes, B.; Speechley, M.; Muir Hunter, S.W.; Doherty, T.J.; Duque, G.; Gopaul, K.; Sposato, L.A.; Casas-Herrero, A.; Borrie, M.J.; et al. Disentangling Cognitive-Frailty: Results From the Gait and Brain Study. *J. Gerontol. Ser. A Biol. Sci. Med. Sci.* **2016**, *71*, 1476–1482. [CrossRef]
10. Perez-Sousa, M.A.; Venegas-Sanabria, L.C.; Chavarro-Carvajal, D.A.; Cano-Gutierrez, C.A.; Izquierdo, M.; Correa-Bautista, J.E.; Ramírez-Vélez, R. Gait speed as a mediator of the effect of sarcopenia on dependency in activities of daily living. *J. Cachexia Sarcopenia Muscle* **2019**, *10*, 1009–1015. [CrossRef]
11. Peel, N.M.; Alapatt, L.J.; Jones, L.V.; Hubbard, R.E. The association between gait speed and cognitive status in community-dwelling older people: A systematic review and meta-analysis. *J. Gerontol. Ser. A Biol. Sci. Med. Sci.* **2019**, *74*, 943–948. [CrossRef] [PubMed]
12. Rasmussen, L.J.H.; Caspi, A.; Ambler, A.; Broadbent, J.M.; Cohen, H.J.; D'Arbeloff, T.; Elliott, M.; Hancox, R.J.; Harrington, H.; Hogan, S.; et al. Association of Neurocognitive and Physical Function With Gait Speed in Midlife. *JAMA Netw. Open* **2019**, *2*, e1913123. [CrossRef] [PubMed]
13. Verlinden, V.J.A.; van der Geest, J.N.; Hofman, A.; Ikram, M.A. Cognition and gait show a distinct pattern of association in the general population. *Alzheimers Dement.* **2014**, *10*, 328–335. [CrossRef] [PubMed]
14. Fritz, S.; Lusardi, M. White Paper: "Walking Speed: The Sixth Vital Sign.". *J. Geriatr. Phys. Ther.* **2009**, *32*, 2–5. [CrossRef]
15. Annweiler, C.; Beauchet, O.; Bartha, R.; Wells, J.L.; Borrie, M.J.; Hachinski, V.; Montero-Odasso, M. Motor cortex and gait in mild cognitive impairment: A magnetic resonance spectroscopy and volumetric imaging study. *Brain* **2013**, *136*, 859–871. [CrossRef]
16. Pérez-Sousa, M.Á.; del Pozo-Cruz, J.; Olivares, P.R.; Cano-Gutiérrez, C.A.; Izquierdo, M.; Ramírez-Vélez, R. Role for Physical Fitness in the Association between Age and Cognitive Function in Older Adults: A Mediation Analysis of the SABE Colombia Study. *Int. J. Environ. Res. Public Health* **2021**, *18*, 751. [CrossRef] [PubMed]
17. Cohen, J.A.; Verghese, J.; Zwerling, J.L. Cognition and gait in older people. *Maturitas* **2016**, *93*, 73–77. [CrossRef]
18. Kasović, M.; Štefan, L.; Zvonař, M. Domain-Specific and Total Sedentary Behavior Associated with Gait Velocity in Older Adults: The Mediating Role of Physical Fitness. *Int. J. Environ. Res. Public Health* **2020**, *17*, 593. [CrossRef]
19. Cesari, M.; Onder, G.; Zamboni, V.; Manini, T.; Shorr, R.I.; Russo, A.; Bernabei, R.; Pahor, M.; Landi, F. Physical function and self-rated health status as predictors of mortality: Results from longitudinal analysis in the ilSIRENTE study. *BMC Geriatr.* **2008**, *8*, 34. [CrossRef]

20. Hardy, S.E.; Perera, S.; Roumani, Y.F.; Chandler, J.M.; Studenski, S.A. Improvement in Usual Gait Speed Predicts Better Survival in Older Adults. *J. Am. Geriatr. Soc.* **2007**, *55*, 1727–1734. [CrossRef]
21. Studenski, S.; Faulkner, K.; Inzitari, M.; Brach, J.; Chandler, J.; Cawthon, P.; Connor, E.B.; Kritchevsky, S.; Badinelli, S.; Harris, T.; et al. Gait Speed and Survival in Older Adults. *JAMA J. Am. Med. Assoc.* **2015**, *305*, 50–58. [CrossRef] [PubMed]
22. Veronese, N.; Stubbs, B.; Volpato, S.; Zuliani, G.; Maggi, S.; Cesari, M.; Lipnicki, D.M.; Smith, L.; Schofield, P.; Firth, J.; et al. Association Between Gait Speed With Mortality, Cardiovascular Disease and Cancer: A Systematic Review and Meta-analysis of Prospective Cohort Studies. *J. Am. Med. Dir. Assoc.* **2018**, *19*, 981–988.e7. [CrossRef] [PubMed]
23. Karunananthan, S.; Moodie, E.E.M.; Bergman, H.; Payette, H.; Diehr, P.H.; Wolfson, C. Physical Function and Survival in Older Adults: A longitudinal study accounting for time-varying effects. *Arch. Gerontol. Geriatr.* **2021**, *96*, 104440. [CrossRef] [PubMed]
24. Osoba, M.Y.; Rao, A.K.; Agrawal, S.K.; Lalwani, A.K. Balance and gait in the elderly: A contemporary review. *Laryngoscope Investig. Otolaryngol.* **2019**, *4*, 143–153. [CrossRef] [PubMed]
25. Davis, J.C.; Robertson, M.C.; Ashe, M.C.; Liu-Ambrose, T.; Khan, K.M.; Marra, C.A. International comparison of cost of falls in older adults living in the community: A systematic review. *Osteoporos. Int.* **2010**, *21*, 1295–1306. [CrossRef]
26. Weijer, R.H.A.; Hoozemans, M.J.M.; van Dieën, J.H.; Pijnappels, M. Self-perceived gait stability modulates the effect of daily life gait quality on prospective falls in older adults. *Gait Posture* **2018**, *62*, 475–479. [CrossRef]
27. Steckhan, G.M.A.; Fleig, L.; Schwarzer, R.; Warner, L.M. Perceived Physical Functioning and Gait Speed as Mediators in the Association Between Fear of Falling and Quality of Life in Old Age. *J. Appl. Gerontol.* **2020**, *41*, 421–429. [CrossRef]
28. Van Schooten, K.S.; Pijnappels, M.; Lord, S.R.; van Dieën, J.H. Quality of Daily-Life Gait: Novel Outcome for Trials that Focus on Balance, Mobility, and Falls. *Sensors* **2019**, *19*, 4388. [CrossRef]
29. Beauchet, O.; Allali, G.; Launay, C.; Herrmann, F.R.; Annweiler, C. Gait variability at fast-pace walking speed: A biomarker of mild cognitive impairment? *J. Nutr. Health Aging* **2013**, *17*, 235–239. [CrossRef]
30. Montero-Odasso, M.; Verghese, J.; Beauchet, O.; Hausdorff, J.M. Gait and Cognition: A Complementary Approach to Understanding Brain Function and the Risk of Falling. *J. Am. Geriatr. Soc.* **2012**, *60*, 2127–2136. [CrossRef]
31. Taniguchi, Y.; Yoshida, H.; Fujiwara, Y.; Motohashi, Y.; Shinkai, S. A Prospective Study of Gait Performance and Subsequent Cognitive Decline in a General Population of Older Japanese. *J. Gerontol. Ser. A Biol. Sci. Med. Sci.* **2012**, *67*, 796–803. [CrossRef] [PubMed]
32. Morris, R.; Lord, S.; Bunce, J.; Burn, D.; Rochester, L. Gait and cognition: Mapping the global and discrete relationships in ageing and neurodegenerative disease. *Neurosci. Biobehav. Rev.* **2016**, *64*, 326–345. [CrossRef] [PubMed]
33. Verghese, J.; Wang, C.; Lipton, R.B.; Holtzer, R. Motoric Cognitive Risk Syndrome and the Risk of Dementia. *J. Gerontol. Ser. A Biol. Sci. Med. Sci.* **2013**, *68*, 412–418. [CrossRef] [PubMed]
34. Jaroslawska, A.J.; Gathercole, S.E.; Holmes, J. Following instructions in a dual-task paradigm: Evidence for a temporary motor store in working memory. *Q. J. Exp. Psychol.* **2018**, *71*, 2439–2449. [CrossRef]
35. Falbo, S.; Condello, G.; Capranica, L.; Forte, R.; Pesce, C. Effects of Physical-Cognitive Dual Task Training on Executive Function and Gait Performance in Older Adults: A Randomized Controlled Trial. *BioMed Res. Int.* **2016**, *2016*, 5812092. [CrossRef]
36. Wrightson, J.G.; Ross, E.Z.; Smeeton, N.J. The effect of cognitive-task type and walking speed on dual-task gait in healthy adults. *Mot. Control* **2016**, *20*, 109–121. [CrossRef]
37. Allali, G.; Montembeault, M.; Brambati, S.M.; Bherer, L.; Blumen, H.M.; Launay, C.P.; Liu-Ambrose, T.; Helbostad, J.L.; Verghese, J.; Beauchet, O. Brain structure covariance associated with gait control in aging. *J. Gerontol. Ser. A Biol. Sci. Med. Sci.* **2019**, *74*, 705–713. [CrossRef]
38. Tian, Q.; An, Y.; Resnick, S.M.; Studenski, S. The relative temporal sequence of decline in mobility and cognition among initially unimpaired older adults: Results from the Baltimore Longitudinal Study of Aging. *Age Ageing* **2016**, *46*, 445–451. [CrossRef]
39. Watson, N.L.; Rosano, C.; Boudreau, R.M.; Simonsick, E.M.; Ferrucci, L.; Sutton-Tyrrell, K.; Hardy, S.E.; Atkinson, H.H.; Yaffe, K.; Satterfield, S.; et al. Executive Function, Memory, and Gait Speed Decline in Well-Functioning Older Adults. *J. Gerontol. Ser. A Biol. Sci. Med. Sci.* **2010**, *65A*, 1093–1100. [CrossRef]
40. Murray, E.A.; Wise, S.P. Interactions between orbital prefrontal cortex and amygdala: Advanced cognition, learned responses and instinctive behaviors. *Curr. Opin. Neurobiol.* **2010**, *20*, 212–220. [CrossRef]
41. Montero-Odasso, M. Gait as a biomarker of cognitive impairment and dementia syndromes. Quo vadis? *Eur. J. Neurol.* **2016**, *23*, 437–438. [CrossRef] [PubMed]
42. Li, C.; Verghese, J.; Holtzer, R. A comparison of two walking while talking paradigms in aging. *Gait Posture* **2014**, *40*, 415–419. [CrossRef] [PubMed]
43. Taraldsen, K.; Helbostad, J.L.; Follestad, T.; Bergh, S.; Selbæk, G.; Saltvedt, I. Gait, physical function, and physical activity in three groups of home-dwelling older adults with different severity of cognitive impairment—A cross-sectional study. *BMC Geriatr.* **2021**, *21*, 670. [CrossRef]
44. Garcia-Cifuentes, E.; Márquez, I.; Vasquez, D.; Aguillon, D.; Borda, M.G.; Lopera, F.; Cano-Gutierrez, C. The Role of Gait Speed in Dementia: A Secondary Analysis from the SABE Colombia Study. *Dement. Geriatr. Cogn. Disord.* **2020**, *49*, 565–572. [CrossRef] [PubMed]

45. Creavin, S.T.; Noel-Storr, A.H.; Smailagic, N.; Giannakou, A.; Ewins, E.; Wisniewski, S.; Cullum, S. Mini-Mental State Examination (MMSE) for the detection of Alzheimer's dementia and other dementias in asymptomatic and previously clinically unevaluated people aged over 65 years in community and primary care populations. In *Cochrane Database of Systematic Reviews*; Creavin, S.T., Ed.; John Wiley & Sons, Ltd: Chichester, UK, 2016.
46. Rose, D.J. *Fallproof!: A Comprehensive Balance and Mobility Training Program*, 2nd ed.; Human Kinetics: Champaign, IL, USA, 2010; ISBN 978-0-7360-6747-8.
47. Kliegel, M.; Martin, M.; Jäger, T. Development and Validation of the Cognitive Telephone Screening Instrument (COGTEL) for the Assessment of Cognitive Function Across Adulthood. *J. Psychol.* **2007**, *141*, 147–170. [CrossRef] [PubMed]
48. Ihle, A.; Gouveia, É.R.; Gouveia, B.R.; Kliegel, M. The Cognitive Telephone Screening Instrument (COGTEL): A Brief, Reliable, and Valid Tool for Capturing Interindividual Differences in Cognitive Functioning in Epidemiological and Aging Studies. *Dement. Geriatr. Cogn. Dis. Extra* **2017**, *7*, 339–345. [CrossRef]
49. Rikli, R.E.; Jones, C.J. Development and Validation of Criterion-Referenced Clinically Relevant Fitness Standards for Maintaining Physical Independence in Later Years. *Gerontologist* **2013**, *53*, 255–267. [CrossRef] [PubMed]
50. Bischkopf, J.; Busse, A.; Mc, A. Mild cognitive impairment 1—A review of prevalence, incidence and outcome according to current approaches. *Acta Psychiatr. Scand.* **2002**, *106*, 403–414. [CrossRef]
51. Preacher, K.J.; Rucker, D.D.; Hayes, A.F. Addressing Moderated Mediation Hypotheses: Theory, Methods, and Prescriptions. *Multivar. Behav. Res.* **2007**, *42*, 185–227. [CrossRef]
52. Hayes, A.F.; Rockwood, N.J. Regression-based statistical mediation and moderation analysis in clinical research: Observations, recommendations, and implementation. *Behav. Res. Ther.* **2017**, *98*, 39–57. [CrossRef]
53. Costa, T.B.; Neri, A.L. Associated factors with physical activity and social activity in a sample of Brazilian older adults: Data from the FIBRA Study. *Rev. Bras. Epidemiol.* **2019**, *22*, e190022. [CrossRef] [PubMed]
54. De Asteasu, M.L.S.; Martínez-Velilla, N.; Zambom-Ferraresi, F.; Casas-Herrero, Á.; Izquierdo, M. Role of physical exercise on cognitive function in healthy older adults: A systematic review of randomized clinical trials. *Ageing Res. Rev.* **2017**, *37*, 117–134. [CrossRef]
55. Pau, M.; Leban, B.; Collu, G.; Migliaccio, G.M. Effect of light and vigorous physical activity on balance and gait of older adults. *Arch. Gerontol. Geriatr.* **2014**, *59*, 568–573. [CrossRef]
56. Gomez-Bruton, A.; Navarrete-Villanueva, D.; Pérez-Gómez, J.; Vila-Maldonado, S.; Gesteiro, E.; Gusi, N.; Villa-Vicente, J.G.; Espino, L.; Gonzalez-Gross, M.; Casajus, J.A.; et al. The Effects of Age, Organized Physical Activity and Sedentarism on Fitness in Older Adults: An 8-Year Longitudinal Study. *Int. J. Environ. Res. Public Health* **2020**, *17*, 4312. [CrossRef]
57. Klenk, J.; Kerse, N.; Rapp, K.; Nikolaus, T.; Becker, C.; Rothenbacher, D.; Peter, R.; Denkinger, M.D. Physical Activity and Different Concepts of Fall Risk Estimation in Older People–Results of the ActiFE-Ulm Study. *PLoS ONE* **2015**, *10*, e0129098. [CrossRef] [PubMed]
58. Ronthal, M. Gait Disorders and Falls in the Elderly. *Med. Clin. N. Am.* **2019**, *103*, 203–213. [CrossRef] [PubMed]
59. Hu, K.; Zhou, Q.; Jiang, Y.; Shang, Z.; Mei, F.; Gao, Q.; Chen, F.; Zhao, L.; Jiang, M.; Ma, B. Association between Frailty and Mortality, Falls, and Hospitalization among Patients with Hypertension: A Systematic Review and Meta-Analysis. *BioMed Res. Int.* **2021**, *2021*, 2690296. [CrossRef]
60. Asai, T.; Misu, S.; Sawa, R.; Doi, T.; Yamada, M. The association between fear of falling and smoothness of lower trunk oscillation in gait varies according to gait speed in community-dwelling older adults. *J. Neuroeng. Rehabil.* **2017**, *14*, 5. [CrossRef]
61. Lavedán, A.; Viladrosa, M.; Jürschik, P.; Botigué, T.; Nuín, C.; Masot, O.; Lavedán, R. Fear of falling in community-dwelling older adults: A cause of falls, a consequence, or both? *PLoS ONE* **2018**, *13*, e0194967. [CrossRef]
62. Hartholt, K.A.; Polinder, S.; Van der Cammen, T.J.M.; Panneman, M.J.M.; Van der Velde, N.; Van Lieshout, E.M.M.; Patka, P.; Van Beeck, E.F. Costs of falls in an ageing population: A nationwide study from the Netherlands (2007–2009). *Injury* **2012**, *43*, 1199–1203. [CrossRef]
63. Florence, C.S.; Bergen, G.; Atherly, A.; Burns, E.; Stevens, J.; Drake, C. Medical Costs of Fatal and Nonfatal Falls in Older Adults. *J. Am. Geriatr. Soc.* **2018**, *66*, 693–698. [CrossRef] [PubMed]
64. Larsson, L.; Degens, H.; Li, M.; Salviati, L.; Lee, Y.I.; Thompson, W.; Kirkland, J.L.; Sandri, M. Sarcopenia: Aging-Related Loss of Muscle Mass and Function. *Physiol. Rev.* **2019**, *99*, 427–511. [CrossRef] [PubMed]
65. Noce Kirkwood, R.; de Souza Moreira, B.; Mingoti, S.A.; Faria, B.F.; Sampaio, R.F.; Alves Resende, R. The slowing down phenomenon: What is the age of major gait velocity decline? *Maturitas* **2018**, *115*, 31–36. [CrossRef] [PubMed]
66. Pepera, G.K.; Sandercock, G.R.; Sloan, R.; Cleland, J.J.F.; Ingle, L.; Clark, A.L. Influence of step length on 6-minute walk test performance in patients with chronic heart failure. *Physiotherapy* **2012**, *98*, 325–329. [CrossRef]
67. Callisaya, M.L.; Beare, R.; Phan, T.G.; Blizzard, L.; Thrift, A.G.; Chen, J.; Srikanth, V.K. Brain structural change and gait decline: A longitudinal population-based study. *J. Am. Geriatr. Soc.* **2013**, *61*, 1074–1079. [CrossRef]
68. Kuo, H.-K.; Leveille, S.G.; Yu, Y.-H.; Milberg, W.P. Cognitive Function, Habitual Gait Speed, and Late-Life Disability in the National Health and Nutrition Examination Survey (NHANES) 1999–2002. *Gerontology* **2007**, *53*, 102–110. [CrossRef]
69. Jones, N.R.; Roalfe, A.K.; Adoki, I.; Hobbs, F.D.R.; Taylor, C.J. Survival of patients with chronic heart failure in the community: A systematic review and meta-analysis. *Eur. J. Heart Fail.* **2019**, *21*, 1306–1325. [CrossRef]
70. Woo, J.; Leung, J.; Kwok, T. BMI, Body Composition, and Physical Functioning in Older Adults*. *Obesity* **2007**, *15*, 1886–1894. [CrossRef]

71. Gardener, H.; Caunca, M.; Dong, C.; Cheung, Y.K.; Rundek, T.; Elkind, M.S.V.; Wright, C.B.; Sacco, R.L. Obesity Measures in Relation to Cognition in the Northern Manhattan Study. *J. Alzheimers Dis.* **2020**, *78*, 1653–1660. [CrossRef]
72. Gunstad, J.; Lhotsky, A.; Wendell, C.R.; Ferrucci, L.; Zonderman, A.B. Longitudinal Examination of Obesity and Cognitive Function: Results from the Baltimore Longitudinal Study of Aging. *Neuroepidemiology* **2010**, *34*, 222–229. [CrossRef]
73. Ling, C.H.Y.; Meskers, C.G.M.; Maier, A.B. Can anthropometric measures be used as proxies for body composition and physical function in geriatric outpatients? *Arch. Gerontol. Geriatr.* **2021**, *94*, 104379. [CrossRef] [PubMed]
74. Porter Starr, K.N.; McDonald, S.R.; Bales, C.W. Obesity and Physical Frailty in Older Adults: A Scoping Review of Lifestyle Intervention Trials. *J. Am. Med. Dir. Assoc.* **2014**, *15*, 240–250. [CrossRef]
75. Aracaty, M.L.; de Souza Rojas, S.R. Índice de vulnerabilidade Social vulnerability index (IVS) of the metropolitan regions of Belém do Pará-PA (RMB) and Manaus-AM (RMM). *Econ. Desenv.* **2021**, *33*, 1.
76. SBGG-Brazilian Society of Geriatrics and Gerontology Mais Idosos Poucos Geriátras [More Older Adult Few Geriatricians]. Available online: http://www.sbgg-sp.com.br/pub/mais-idosos-poucos-geriatras/ (accessed on 26 March 2019).
77. Nascimento, M.D.M. Healthy aging in Brazil: Odyssey or strategy? *Educ. Gerontol.* **2021**, *47*, 419–431. [CrossRef]
78. Sousa, N.F.; Medina, L.d.P.B.; Bastos, T.F.; Monteiro, C.N.; Lima, M.G.; Barros, M.B.D.A. Social inequalities in the prevalence of indicators of active aging in the Brazilian population: National Health Survey, 2013. *Rev. Bras. Epidemiol.* **2019**, *22* (Suppl. 2), E190013.
79. WHO-World Health Organization. *Active Ageing: A Policy Framework, a Contribution of the World Health Organization to the Second United Nations World Assembly on Ageing*; World Health Organization: Madrid, Spain; Geneva, Switzerland, 2002.
80. Rowe, J.W.; Kahn, R.L. Successful Aging 2.0: Conceptual Expansions for the 21st Century. *J. Gerontol. Ser. B Psychol. Sci. Soc. Sci.* **2015**, *70*, 593–596. [CrossRef]