Factors associated with physical activity levels in community-dwelling robust older adults: a cross-sectional study

Claudia Furtado[1]
Carla Ferreira do Nascimento[2]
Helena Fraga-Maia[2]
Cristina Salles[1]
Cristiane Dias[1]
Elen Beatriz Pinto[1,2]

Abstract

Objective: To investigate the factors associated with physical activity levels in robust community-dwelling older adults. *Method:* A cross-sectional study was conducted with individuals aged over 65 years who were considered robust according to the Clinical-Functional Vulnerability Index 20 (IVCF-20). Primary data were collected from September 2021 to November 2023. After applying the IVCF-20, individuals classified as robust completed a data collection instrument and underwent assessments using the Montreal Cognitive Assessment Basic (MoCA-B), the Activities-Specific Balance Confidence Scale (ABC), the Falls Behavioral Scale (FaB), the Timed Up and Go Test (TUG) and the Human Activity Profile (HAP). Associations between explanatory variables and the response variable (HAP) were evaluated using linear regression models, with regression coefficients (β) and 95% confidence intervals. *Results:* According to the IVCF-20, 101 older adults met the eligibility criteria, with a median age of 71 years, and the majority were female (74.3%). In the multivariate analysis, behavioral data such as balance confidence (ABC) (β=0.23) and fall risk behavior (FaB) (β=-4.19) remained independently associated with physical activity levels. *Conclusion:* The findings of this study suggest that, among robust and moderately active older adults, greater balance confidence is associated with higher levels of physical activity. Conversely, the adoption of more protective behaviors against falls is also related to increased physical activity levels.

Keywords: Older Adults. Healthy Aging. Protective Factors. Physical Activity. Cross-Sectional Studies.

[1] Escola Bahiana de Medicina e Saúde Pública, Programa de Pós-Graduação. Salvador, BA, Brasil.
[2] Universidade do Estado da Bahia, Departamento Ciências da Vida. Salvador, BA, Brasil.

There was no funding for the execution of this work.
The authors declare that there is no conflict in the conception of this work.

Correspondence
Elen Beatriz Pinto
elen.neuro@gmail.com

Received: January 3, 2025
Approved: April 7, 2025

http://dx.doi.org/10.1590/1981-22562025028.240238en

INTRODUCTION

Healthy aging is defined as the "process of developing and maintaining functional ability that enables well-being in older age"[1]. The rate and magnitude of age-related changes occur heterogeneously among older adults, partly influenced by lifestyle[2]. Robust older adults typically report a positive self-perception of health, maintain the habit of engaging in physical activity, and manage their lives independently, preserving autonomy and independence regardless of potential comorbidities[3-5].

Physical activity is considered a key aspect of healthy aging[1,6,7] offering benefits even for individuals with a previously or currently sedentary lifestyle, such as reduced mortality and improved mental health[7,8]. Furthermore, it helps mitigate declines in health and functionality among the older population[6,8-10]. Additionally, life satisfaction during the aging process[11] and reduced healthcare costs are also associated with regular physical activity practice[7]. Despite extensive favorable evidence, recent editorial highlight that physical activity levels remain globally low, with approximately 1 in 4 adults not meeting the recommended levels7. In another study, walking ability, age, sex, loneliness, and social support were identified as determinants of physical activity among community-dwelling older adults[12].

Physical activity levels can be assessed through direct measures, such as accelerometers and motion sensors, as well as self-reported measures based on diaries and questionnaires. Self-report questionnaires are easy to use and provide a more accessible and feasible alternative for screening physical activity levels in the population. With adequate psychometric properties for use in older adults[13], the Human Activity Profile (HAP) is a questionnaire designed to measure functional and physical activity levels across all age groups[14]. It includes various human activities, such as mobility, personal care, domestic and instrumental activities of daily living, and leisure activities[13,14].

Studies addressing factors related to engagement in physical activity, specifically in robust older adults, are scarce, and the factors that limit and impair physical activity levels in this population are not well established. Therefore, the aim of this study was to identify factors associated with physical activity levels in robust community-dwelling older adults.

METHOD

This is a cross-sectional study using baseline data from a cohort comprising individuals aged 65 years or older, who were robust and community-dwelling, and were identified through invitations shared via social media groups, fitness centers, health promotion fairs, and other institutions. The sample size was calculated based on the proposition of five subjects per variable in a multivariate linear regression model, as proposed by Green[15]. The estimated sample size was 85 individuals. Considering a 10.0% rate of potential losses, a minimum of 94 participants was defined. A snowball sampling method was used for recruitment, and all participants were evaluated at the Clínica Escola Bahiana Saúde of the Escola Bahiana de Medicina e Saúde Pública (EBMSP) in Salvador, Bahia, Brazil.

An initial screening was conducted using the Clinical-Functional Vulnerability Index-20 (IVCF-20)[3], and only older adults classified as robust were included in the study. Individuals diagnosed with vestibular disorders, or with neurological and/or orthopedic conditions that could affect balance and mobility, were excluded, as were those unable to understand the test instructions or perform the required activities.

Primary data were collected between September 2021 and November 2023 at the institution. After applying the IVCF-20, individuals classified as robust completed a questionnaire to collect sociodemographic data and information on comorbidities.

The IVCF-20 is a multidimensional instrument developed in Brazil with high reliability, designed to assess eight dimensions considered predictors of functional decline and/or mortality in older adults. The maximum score on the IVCF-20 is 40 points: a score between 0–6 indicates the individual is robust, with a low risk of clinical-functional vulnerability; 7–14 indicates moderate risk; and 15–40 indicates frailty, representing a high risk of clinical-functional vulnerability[3].

The sociodemographic data analyzed included sex, age (in years), and self-reported skin color based on the classification system of the Brazilian Institute of Geography and Statistics (IBGE)[16]. For analytical purposes, skin color was grouped into two categories: white and non-white. Education level was recorded in years, and marital status was categorized based on the presence or absence of a spouse. Social support was defined as having or not having someone to rely on in case of need, whether a family member or a friend, and was treated as a dichotomous variable.

Regarding comorbidity-related variables, participants were asked about self-reported previous diagnoses of systemic arterial hypertension, diabetes mellitus, dyslipidemia, and urinary incontinence. The number of medications in use was recorded, as well as the use of assistive walking devices.

Sleep duration was assessed using the question: "During the past month, how many hours of sleep per night did you have?" Sleep duration in healthy older adults was considered appropriate when it ranged between 7 and 8 hours, according to the recommendations of the National Sleep Foundation[17].

The Timed Up and Go (TUG) test was used to assess functional mobility. This test measures, in seconds, the time it takes for an individual to rise from a chair, walk a distance of 3 meters, turn around, return, and sit down again. It is considered a reliable and valid test for quantifying functional mobility and is useful for monitoring clinical changes over time[18].

The Activities-specific Balance Confidence (ABC) Scale is an instrument that assesses balance confidence by asking individuals to rate their confidence in performing specific activities without losing balance or becoming unsteady. Scores range from 0% (no confidence) to 100% (complete confidence). The total score corresponds to the average of all items, with lower scores indicating less confidence. Confidence levels are categorized as follows: >80% indicates high physical functioning; 50–80% indicates moderate physical functioning; and <50% indicates low physical functioning[19].

The Falls Behavioral Scale (FaB-Brazil) is a tool designed to assess daily behaviors and actions that may increase the risk of falling or offer protection against falls in older adults. It comprises 30 items describing habitual and intentional behaviors performed during daily activities that, if not conducted safely, can place individuals at risk of falling. Each item is scored on a scale from 1 (never) to 4 (always), with a "not applicable" option available for 14 items. Higher scores reflect more protective behaviors[20].

The Montreal Cognitive Assessment Basic (MoCA-B) is a simplified version of the MoCA and provides a brief test for evaluating cognitive abilities such as attention, memory, language, reasoning, and orientation. The MoCA-B consists of 30 items, with a maximum total score of 30 points[21]. Higher scores indicate greater cognitive functioning.

The Human Activity Profile (HAP) was used to assess self-reported physical activity levels and is designed to evaluate an individual's capacity to perform activities commonly encountered in daily life[13,14]. The instrument's items are organized according to the energy expenditure required for each activity and include three response options: (1) still doing, (2) stopped doing, and (3) never did.

The Maximum Activity Score (MAS) is defined by the highest-numbered item marked as "still doing," while the Adjusted Activity Score (AAS) is calculated by subtracting from the MAS the number of activities marked as "stopped doing." Activity levels are classified based on the AAS: individuals are considered inactive (AAS<53), moderately active (53≤AAS≤74), and active (AAS>74)[13].

All instruments used in this study were validated for the older population in Brazil. To minimize the potential for information bias, all data were collected by evaluators trained in the application of these instruments. Data collection was conducted in a private setting to ensure the confidentiality of the information obtained.

In the descriptive analysis, variables were presented according to their distribution, which was

assessed using histograms and the Shapiro–Wilk test. Numerical variables with a normal distribution were presented as mean and standard deviation (SD), while those with a skewed distribution were presented as median and interquartile range (IQR). Associations between explanatory variables and the outcome variable (HAP) were examined using linear regression models, with results expressed as regression coefficients (β) and 95% confidence intervals. Variables with a p-value ≤ 0.10 in the bivariate analysis were included in the multivariate model. A backward selection method was applied, retaining variables with statistically significant associations or those that contributed to improving the model's fit. Associations with a p-value < 0.05 were considered statistically significant. The variance inflation factor (VIF) was used to assess multicollinearity in the final model. To evaluate the distribution of residuals, a quantile–quantile (Q–Q) plot was generated. Additionally, the assumption of homoscedasticity was tested using the Breusch–Pagan test.

The study was approved by the Research Ethics Committee (CEP) of the Escola Bahiana de Medicina e Saúde Pública under permit number 4.947.968 (CAAE 50039721.8.0000.5544). All participants provided written informed consent by signing the Informed Consent Form (ICF). The primary outcome of the parent study is the occurrence of falls among robust older adults. To this end, sociodemographic characteristics, functional performance, sleep quality, and other relevant variables were assessed in relation to falls over a one-year follow-up period. In the present analysis of the cohort's baseline data, our objective was to investigate the factors associated with physical activity levels in robust older adults, given the importance of this variable for promoting healthy aging.

DATA AVAILABILITY

The complete dataset supporting the findings of this study is available upon request from the corresponding author.

RESULTS

A total of 133 older adults were evaluated, of whom 32 were excluded for not being classified as robust according to the IVCF-20. Sociodemographic characteristics, comorbidities, and functional attributes are summarized in Table 1. A total of 101 older adults met the eligibility criteria, with a median age of 71 years. Most participants were female and self-identified as non-white. The median education level was 15 years (IQR: 12–16), and the majority reported having a spouse and a support network (n = 96).

Urinary incontinence was reported by 5.6% of participants, and the median number of medications used was 2 (IQR: 1–3). Additionally, 7.9% of the participants used a walking aid, 40.4% reported sleep durations of 7–8 hours, and 27.7% had experienced a fall in the past year.

Participants had a median score of 25 (23–27) on the Montreal Cognitive Assessment – Basic version (MoCA-B) and 3 (2–5) points on the Clinical-Functional Vulnerability Index 20 (IVCF-20). They did not exhibit impaired functional mobility, as evidenced by a median Timed Up and Go (TUG) score of 10.5 seconds (9.6–12.0). High levels of balance confidence were observed, with a median ABC score of 82.5 (73.1–90.6), along with protective behaviors against falls, as reflected in a median FaB-Brazil score of 2.9. Participants were classified as moderately active, with a mean (SD) score of 56.6 (9.5) on the Human Activity Profile (HAP).

Table 1. Sociodemographic, comorbidity, and functional characteristics of 101 robust older adults. Salvador, Bahia, 2022-2023.

Variables	N = 101
Age in years, median (IQR)	71.0 (68-74)
Female sex, n (%)	75 (74.3)
Non-white skin color, n (%)	79 (78.2)
Education in years, median (IQR)	15 (12-16)
Presence of a spouse, n (%)	44 (43.6)
Support network, n (%)	96 (95.0)
BMI, median (IQR)	25.8 (23.9-28.0)
Comorbidities:	
Diabetes Mellitus, n (%)	16 (15.8)
Hypertension, n (%)	60 (59.4)
Dyslipidemia, n (%)	23 (22.8)
Urinary incontinence, n (%)	6 (5.9)
Number of medications used, median (IQR)	2 (1-3)
Use of walking aid, n (%)	8 (7.9)
Sleep duration between 7-8 hours, n (%) *	40 (40.4)
History of falls in the past year, n (%)	28 (27.7)
Clinical-functional vulnerability (IVCF-20), median (IQR)	3 (2-5)
Cognitive function (MoCA-B), median (IQR)	25 (23-27)
Functional mobility (TUG), median (IQR)	10.5 (9.6-12.0)
Balance confidence (ABC), median (IQR)	82.5 (73.1-90.6)
Risk behavior for falling (FaB), mean (SD)	2.9 (0.5)
Physical activity level (PHA), mean (SD)	56.6 (9.5)
EAA score, mean (SD)	-
EMA score, mean (SD)	-

IVCF-20: Clinical-Functional Vulnerability Index 20; MoCA-B: Montreal Cognitive Assessment Basic; TUG: Timed Up and Go; FaB-Brazil: Falls Behavioral Scale Brazil; IQR: interquartile range; SD: standard deviation. *Variable collected from 99 individuals. **Source:** The Authors.

Table 2 presents the factors associated with physical activity levels among robust older adults, based on linear regression analysis. In the univariate model, the following variables showed significant associations with physical activity levels: age (β= -0.48, 95% CI: -0.85; -0.12), use of a walking aid (β= -8.50, 95% CI = -15.24; -1.75), functional mobility (β= -0.91, 95% CI = -1.43; -0.39), balance confidence (β=0.30, 95% CI =0.17; 0.43), and risk behaviors for falls (β= -7.14, 95% CI = -11.01; -3.27).

In the adjusted (multivariate) model, only the behavioral factors—balance confidence (β=0.23, 95% CI = 0.10; 0.36) and risk behaviors for falls (β= -4.19, 95% CI = -8.13; -0.25) remained independently associated with physical activity levels. The Variance Inflation Factor (VIF) values were 1.18 for balance confidence, 1.18 for risk behaviors for falls, and 1.12 for age (in years), respectively.

Table 2. Factors associated with physical activity levels in 101 robust older adults. Salvador, Bahia, 2022-2023.

Variable	Univariate Models		Multivariate Model[$]	p-value
	β (95% CI)	p-value	β (95% CI)	
Age in years	-0.48 (-0.85; -0.12)	0.010	-0.22 (-0.57; 0.14)	0.228
Female sex	-1.45 (-5.74; 2.83)	0.502		
Non-white skin color	-3.74 (-8.23; 0.75)	0.101		
Education in years	0.31 (-0.04; 0.66)	0.084		
BMI	-0.40 (-0.86; 0.06)	0.086		
Diabetes Mellitus	1.25 (-3.89; 6.39)	0.631		
Hypertension	1.62 (-2.19; 5.43)	0.400		
Dyslipidemia	0.55 (-3.93; 5.03)	0.807		
Urinary incontinence	1.49 (-9.44; 6.44)	0.709		
Number of medications used	0.21 (-0.86; 1.28)	0.700		
Use of walking aid	-8.50 (-15.24; -1.75)	0.014		
Sleep duration <7 or >8 hours*	-1.76 (-5.64; 2.12)	0.370		
History of falls in the past year	-2.18 (-6.35; 2.00)	0.303		
Cognitive function (MoCA-B)	0.53 (0.05; 1.02)	0.032		
Functional mobility (TUG)	-0.91 (-1.43; -0.39)	<0.001		
Balance confidence (ABC)	0.30 (0.17; 0.43)	<0.001	0.23 (0.10; 0.36)	0.001
Risk behavior for falling (FaB-Brazil)	-7.14 (-11.01; -3.27)	<0.001	-4.19 (-8.13; -0.25)	0.037

β, regression coefficient; CI, confidence interval; MoCA-B, Montreal Cognitive Assessment Basic; TUG, Timed Up and Go; ABC, Activities-Specific Balance Confidence Scale; FaB-Brazil, Falls Behavioral Scale Brazil. [$]*p-value of Breusch-Pagan test = 0.803.* **Variable collected from 99 individuals.* Source: The Authors.

DISCUSSION

In the present study, behavioral variables such as balance confidence and risk behaviors for falls were found to be associated, suggesting a relationship between subjective factors and physical activity levels in robust older adults. Supporting these findings, previous studies[22,23] have also reported associations between physical activity levels and balance confidence using the Activities-specific Balance Confidence (ABC) scale and self-reported physical activity. The engagement of older adults in physical activity programs may promote active aging[24], enhance balance confidence, and improve postural control in community-dwelling older women[25]. Furthermore, reduced balance confidence has been strongly associated with lower levels of physical activity, which may increase the risk of falls and social isolation among the older population[25,26].

Our results demonstrate an association between fall-related behavior and physical activity levels. The habitual or intentional behaviors of older adults in their daily lives may be either protective or risky regarding the likelihood of falls. It is well established that, with aging, changes in postural control[27-29], muscle strength, and gait performance[29] may occur, leading older individuals to adopt more protective behaviors to prevent falls[30,31]. In line with our findings, previous investigations[20,31] have also reported that older adults exhibit protective behaviors against falls. However, the relationship between these behaviors and physical activity levels has not yet been firmly established. The study that validated the FaB scale in Brazil[20] did not identify an association between risk behaviors for falls and physical activity levels. The exclusive inclusion of robust older adults selected using a specific screening tool[3], in the present study may explain the discrepancies observed.

In the expanded investigation, the variable sleep duration was included, which has previously been associated with physical activity levels[32]; however, no such association was observed in the present study. Similarly, age was not found to be associated with physical activity levels, contrary to findings from other studies[33,34]. These discrepancies may be attributed both to the exclusive inclusion of robust older adults in the present sample and to methodological differences in the assessment of physical activity levels.

The older adults in this study were classified as moderately according to the Human Activity Profile (HAP), which encompasses activities such as walking, climbing stairs, running, cycling, and carrying weights—activities endorsed by the World Health Organization (WHO) in its International Guidelines on Physical Activity[35]. Identifying factors associated with physical activity levels in moderately active older adults, as assessed by the HAP, may contribute to the planning and strengthening of healthy aging policies. It is well established that physical activity serves as a protective factor against falls, while fear of falling and sustaining injury can serve as a barrier to physical activity engagement. The findings of this study highlight that balance confidence and fall-related risk behavior are associated with physical activity levels—factors that are potentially modifiable through educational and preventive interventions targeting the older population.

The use of validated and culturally adapted instruments for the Brazilian older population enhanced the reliability of the data collected. Furthermore, data collection conducted by trained researchers ensured consistency and accuracy of the information obtained. However, this study is not without limitations, such as the use of self-reported data, which may be subject to recall bias and lead to under- or overestimation of physical activity levels. Nonetheless, because the sample consisted exclusively of robust individuals, the potential for self-report bias was likely minimized.

CONCLUSION

The findings of this study suggest that, among robust and moderately active older adults, greater balance confidence is associated with higher levels of physical activity Conversely, the adoption of more protective behaviors against falls is also related to increased physical activity levels. Further research employing prospective models is warranted to explore the factors influencing physical activity levels and to inform the development of interventions aimed at promoting physical activity among robust older adults.

AUTHORSHIP

- Claudia Furtado – study conception and design, data analysis and interpretation, manuscript writing, critical review, and approval of the final version to be published.
- Carla Ferreira do Nascimento – data analysis and interpretation, manuscript writing, critical review, and approval of the final version to be published.
- Helena Fraga-Maia – data analysis and interpretation, manuscript writing, critical review, and approval of the final version to be published.
- Cristina Salles – study conception and design, critical review of the manuscript, and approval of the final version to be published.
- Cristiane Dias – study conception and design, critical review of the manuscript, and approval of the final version to be published.
- Elen Beatriz Pinto – responsible for all aspects of the work, ensuring that issues related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Edited by: Camila Alves dos Santos

REFERENCES

1. World Heatlh Organization. Decade of healthy ageing: baseline report. Geneva: World Health Organization; 2020. Available from: https://www.who.int/publications/i/item/9789240017900.
2. Daskalopoulou C, Koukounari A, Wu YT, Terrera GM, Caballero FF, de la Fuente J, et al. Healthy ageing trajectories and lifestyle behaviour: the Mexican Health and Aging Study. Sci Rep. 2019 Jul 30;9(1):11041. Available from: https://doi.org/10.1038/s41598-019-47238-w.
3. Moraes EN, Carmo JA, Lanna FM, Azevedo RS, Machado CJ, Romero DEM. Índice de Vulnerabilidade Clínico Funcional-20 (IVCF-20): reconhecimento rápido do idoso frágil. Rev Saude Publica. 2016 Dec 22; 50: 81. Available from: https://doi.org/10.1590/S1518-8787.2016050006963.
4. Maia LC, Colares TFB, Moraes EN, Costa SM, Caldeira AP. Idosos robustos na atenção primária: fatores associados ao envelhecimento bem-sucedido. Rev Saude Publica. 2020 Apr 6; 54:35. Available from: https://doi.org/10.11606/s1518-8787.2020054001735.
5. Cruz RR, Beltrame V, Dallacosta FM. Envelhecimento e vulnerabilidade: análise de 1.062 idosos. Revi Rev. Bras. Geriatr. Gerontol. 2019; 22 (3): e180212. Available from: http://dx.doi.org/10.1590/1981-22562019022.180212.
6. Moreno-Agostino D, Daskalopoulou C, Wu YT, Koukounari A, Haro JM, Tyrovolas S. The impact of physical activity on healthy ageing trajectories: evidence from eight cohort studies. Int J Behav Nutr Phys Act. 2020 Jul 16;17 92. Available from: https://doi.org/10.1186/s12966-020-00995-8.
7. The Lancet Healthy Longevity. Physical activity knows no age limit. Lancet Healthy Longev. 2024 Jul;5(7):e447. Available from: https://doi.org/10.1016/S2666-7568(24)00115-6.
8. Wickramarachchi B, Torabi MR, Perera B. Effects of Physical Activity on Physical Fitness and Functional Ability in Older Adults. Gerontol Geriatr Med. 2023 Feb 23; 9:23337214231158476. Available from: https://doi.org/10.1177/23337214231158476.
9. Albrecht BM, Stalling I, Recke C, Doerwald F, Bammann K. Associations between older adults' physical fitness level and their engagement in different types of physical activity: cross-sectional results from the OUTDOOR ACTIVE study. BMJ Open 2023 Mar 29;13: e068105. Available from: https://doi.org/10.1136/bmjopen-2022-068105.
10. Buckinx F, Peyrusqué É, Granet, J, Aubertin-Leheudre M. Impact of current or past physical activity level on functional capacities and body composition among elderly people: a cross-sectional analysis from the YMCA study. Arch Public Health. 2021 Apr 15; 79, 50. Available from: https://doi.org/10.1186/s13690-021-00573-9.
11. Gellert P, Wienert J, Ziegelmann JP, Kuhlmey A. Profiles of physical activity biographies in relation to life and aging satisfaction in older adults: longitudinal findings. Eur Rev Aging Phys Act. 2019 Aug 9; 16:14. Available from: https://doi.org/10.1186/s11556-019-0221-6.
12. D'Amore C, Saunders S, Bhatnagar N, Griffith LE, Richardson J, Beauchamp MK. Determinants of physical activity in community-dwelling older adults: an umbrella review. Int J Behav Nutr Phys Act. 2023 Nov 21; 20:135. Available from: https://doi.org/10.1186/s12966-023-01528-9.
13. Bastone A de C, Moreira B de S, Vieira RA, Kirkwood RN, Dias JM, Dias RC. Validation of the human activity profile questionnaire as a measure of physical activity levels in older community-dwelling women. J Aging Phys Act. 2014 Jul; 22(3):348-56. Available from: https://doi.org/10.1123/japa.2012-0283.
14. Souza AC, Magalhães LC, Salmela LFT Adaptação transcultural e análise das propriedades psicométricas da versão brasileira do Perfil da Atividade Humana. Cad Saúde Pública. 2006 Dec; 22(12): 2623-2636. Available from: https://doi.org/10.1590/S0102-311X2006001200012.
15. Green S. How many subjects does it take to do a regression analysis. Multivariate Behav Res. 1991 Jul 1;26(3):499-510. Available from: https://doi.org/10.1207/s15327906mbr2603_7.
16. IBGE (Instituto Brasileiro De Geografia E Estatística). Características Étnico-Raciais da População: Um Estudo das Categorias de Classificação de Cor ou Raça, 2008. Available from: https://www.comercioexterior.ub.edu/fpais/brasil-nordeste/img/PCERP2008.pdf
17. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, et al. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. Sleep Health. 2015 Mar;1(1):40-43. Available from: https://doi.org/10.1016/j.sleh.2014.12.010.

18. Shumway-Cook A, Brauer S, Woollacott M. Predicting the Probability for Falls in Community-Dwelling Older Adults Using the Timed Up & Go Test. Physical Therapy. 2000 Sep; 80: 896-902. Available from: https://doi.org/10.1093/ptj/77.8.812.

19. Marques AP, Mendes YC, Taddei U, Pereira CA, Assumpção A. Brazilian-Portuguese translation and cross cultural adaptation of the activities-specific balance confidence (ABC) scale. Braz J Phys Ther. 2013 Mar-Apr;17(2):170-8. Available from: https://doi.org/10.1590/S1413-35552012005000072.

20. Almeida LRS, Valenca GT, Canning CG, Carvalho K, Silva AC, Oliveira-Filho J, et al. Cross-cultural adaptation and psychometric properties of the Brazilian-Portuguese version of the Falls Behavioral (FaB-Brazil) Scale. Disabil Rehabil. 2023 Nov;45(23):3922-3929. Available from: https://doi.org/10.1080/09638288.2022.2141356.

21. Julayanont P, Tangwongchai S, Hemrungrojn S, Tunvirachaisakul C, Phanthumchinda K, Hongsawat J, et al. The Montreal Cognitive Assessment-Basic: A Screening Tool for Mild Cognitive Impairment in Illiterate and Low-Educated Elderly Adults. J Am Geriatr Soc. 2015 Dec 9; 63(12): 2550–2554. Available from: https://doi.org/10.1111/jgs.13820.

22. Freitas RM, Ribeiro KF, Barbosa JS, Gomes CDS, Deshpande N, Guerra RO. Validity and reliability of the Brazilian activities-specific balance confidence scale and determinants of balance confidence in community-dwelling older adults. Physiother Theory Pract. 2022 Feb;38(2):345-354. Available from: https://doi.org/10.1080/09593985.2020.1747122.

23. Hosseini F S, Hatamnezhad O. Relationship Between Self-Regulation and Balance-Confidence in Active and Inactive Elderly Men. Salmand: Iranian Journal of Ageing. 2018 Jan; 12 (4) :470-481. Available from: https://doi.org/10.21859/sija.12.4.470.

24. Nor R, Justine M, Joanny A, Zolkafli AA. Effectiveness of a 3-month antifalling program in the mobility, balance confidence, and muscle performance of older adults. J Exerc Rehabil. 2021 Aug 23. 23;17(4):247-255. Available from: https://doi.org/10.12965/jer.2142412.206.

25. Aibar-Almazán A, Martínez-Amat A, Cruz-Díaz D, De la Torre-Cruz MJ, Jiménez-García JD, Zagalaz-Anula N, et al. Effects of Pilates on fall risk factors in community-dwelling elderly women: A randomized, controlled trial. Eur J Sport Sci. 2019 Nov;19(10):1386-1394. Available from: https://doi.org/10.1080/17461391.2019.1595739.

26. Yuan Y, Li J, Fu P, Jing Z, Wang Y, Zhou C. Association between physical activity and falls among older adults in rural China: are there gender and age related differences? BMC Public Health. 2022 Feb 19;22(1):356. Available from: https://doi.org/10.1186/s12889-022-12773-1.

27. Vermette MJ, Prince F, Bherer L, Messier J. Concentrating to avoid falling: interaction between peripheral sensory and central attentional demands during a postural stability limit task in sedentary seniors. Geroscience. 2024 Feb;46(1):1181-1200. Available from: https://doi.org/10.1007/s11357-023-00860-z.

28. Michalska J, Kamieniarz A, Sobota G, Stania M, Juras G, Słomka KJ. Age-related changes in postural control in older women: transitional tasks in step initiation. BMC Geriatr. 2021 Jan 6; 21(1):17. Available from: https://doi.org/10.1186/s12877-020-01985-y.

29. Elam C, Aagaard P, Slinde F, Svantesson U, Hulthén L, Magnusson PS, et al. The effects of ageing on functional capacity and stretch-shortening cycle muscle power. J Phys Ther Sci. 2021 Mar 17; 33(3):250-260. Available from: https://doi.org/10.1589/jpts.33.250.

30. Clemson L, Bundy AC, Cumming RG, Kay L, Luckett T. Validating the Falls Behavioural (FaB) scale for older people: a Rasch analysis. Disabil Rehabil. 2008;30(7):498-06. Available from: https://doi.org/10.1080/09638280701355546.

31. Taheri-Kharameh Z, Bashirian S, Heidarimoghadam R, Poorolajal J, Barati M, Rásky É. Predictors of Fall Protective Behaviors Among Iranian Community-Dwelling Older Adults: An Application of the Protection Motivation Theory. Clin Interv Aging. 2020 Feb 5; 15:123-129. Available from: https://doi.org/10.2147/CIA.S224224.

32. Bloomberg M, Brocklebank L, Hamer M, Steptoe A. Joint associations of physical activity and sleep duration with cognitive ageing: longitudinal analysis of an English cohort study. Lancet Healthy Longev. 2023 Jul; 4: e345–53. Available from: https://doi.org/10.1016/S2666-7568(23)00083-1.

33. Costa TB, NeriI AL. Associated factors with physical activity and social activity in a sample of Brazilian older adults: data from the FIBRA Study. Rev Bras Epidemiol. 2019 Apr; 22: e190022. Available from: https://doi.org/10.1590/1980-549720190022.

34. Silva BP, Tosi MM, Santos NQ, Oliveira DV, Fidelix YL, Nascimento Júnior JRA, et al. Level of physical activity of hypertensive elderly citizens and its association with sociodemographic data and health conditions. J Physiother Res. 2022 Apr 1;12: e4398. Available from: http://dx.doi.org/10.17267/2238-2704rpf.2022.e4398.

35. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020 Dec;54(24):1451-1462. Available from: http://dx.doi.org/10.1136/bjsports-2020-102955.