TPM Vol. 32, No. S5, 2025
ISSN: 1972-6325
https://www.tpmap.org/

Open Access

COGNITIVE PERFORMANCE, PHYSICAL CAPACITY AND FUNCTIONALITY IN OLDER ADULTS

PAOLA ORTIZ VILLALBA
UNIVERSIDAD TÉCNICA DE AMBATO, FACULTAD DE CIENCIAS DE LA SALUD, CARRERA DE FISIOTERAPIA. ECUADOR
ORCID ID: https://orcid.org/0000-0001-6810-8841, EMAIL: pg.ortiz@uta.edu.ec

ALICIA ZAVALA CALAHORRANO
UNIVERSIDAD DE LAS FUERZAS ARMADAS ESPE.
ORCID ID: https://orcid.org/0000-0002-5670-7641, EMAIL: amzavala@espe.edu.ec

PATRICIO MAYORGA VALLE
PONTIFICIA UNIVERSIDAD CATÓLICA DEL ECUADOR, AMBATO
ORCID ID: https://orcid.org/0000-0002-1621-7381, EMAIL: frepamaval@hotmail.com

ANA GABRIELA SOLÍS ARMIJOS
UNIVERSIDAD TÉCNICA DE AMBATO, FACULTAD DE CIENCIAS DE LA SALUD, CARRERA DE MEDICINA.ECUADOR
ORCID ID: https://orcid.org/0009-0007-3973-1547, EMAIL: anitasolis2008@hotmail.com

JAVIER CAIZA LEMA
UNIVERSIDAD TÉCNICA DE AMBATO, FACULTAD DE CIENCIAS DE LA SALUD, CARRERA DE FISIOTERAPIA. ECUADOR
ORCID ID: https://orcid.org/0000-0003-2393-3885, EMAIL: sj.caiza@uta.edu.ec

MARÍA AUGUSTA LATTA SÁNCHEZ
UNIVERSIDAD TÉCNICA DE AMBATO, FACULTAD DE CIENCIAS DE LA SALUD, CARRERA DE FISIOTERAPIA. ECUADOR
ORCID ID: https://orcid.org/0000-0002-8896-9910, EMAIL: mariaalatta@uta.edu.ec

LISBETH JOSEFINA REALES CHACÓN
UNIVERSIDAD NACIONAL DE CHIMBORAZO- RIOBAMBA ECUADOR
ORCID ID: https://orcid.org/0000-0002-4242-3429, EMAIL.: lisbeth.reales@unach.edu.ec

Abstract

Introduction: The increase in life expectancy and a decrease in the mortality rate have resulted in a population increase, it is estimated that the number of people over 60 years of age can double, bringing with it functional, cognitive and physical alterations. . The aim was to determine the correlation between variables such as the level of physical capacity, functional dependence and cognitive deterioration of the elderly.

Methods: Cross-sectional descriptive observational study where participants over 65 years of age were randomly recruited during the year 2018.

Results: The sample was 3030 with a mean age of 75 years (SD 7.57), 77.55% were female. Disability categorized as auditory, motor and visual was obtained in 20%, 9% and 23% respectively, the category of schooling was the majority for cases without any level of schooling (n: 120). A level of significance was obtained that presumes concordance between variables ($p<0.05$) with $r=0.113$ for MMSE vs BI and $r=0.310$ for MMSE vs SPPB. Data that according to the correlation coefficient were positive, direct and between the low to moderate ranking.

Conclusions: There is a relationship between functional capacity, the degree of cognitive impairment, as well as the degree of functional independence, evaluated by questionnaires or tests. The results of this study postulate a paradigm shift, generating an evaluative approach where the largest number of variables is integrated.

Keywords: Aging, physical capacity, functional evaluation, cognitive evaluation.

INTRODUCTION

The general population is ageing at an accelerated rate1; according to the World Health Organization (WHO), by 2050 the percentage of the planet's inhabitants over 60 years of age will almost double, from 12% to 22%[2]. Aging consists of a transformation of the human being in general, that is, a change of the person in not only the physical state, but also the psychological state and systems that are altered by the passage of time3,4. The changes resulting from aging can generate a deterioration in areas such as cognitive, functional and physical areas that are transcendental for the development of the person, it is important to mention that among the alterations that we can find is physical deterioration, characterized by the loss of muscle mass, speed, flexibility, endurance and strength5, notorious changes in the cognitive area, the same that involves: language, memory, perception together with attention[6] and finally the functional area characterized by a decrease in the skills that allow the person to develop his or her full independence, expressed in the execution of activities of daily living (ADL)[7].

The evaluation of the geriatric population is essential; this, both clinically and in research, allows the identification of the presence of some degree of disability, so there are several tests that can be applied to consider whether the person is suffering from a cognitive, functional or physical alteration8. The development of tests or questionnaires are strategies that allow quantifying the deterioration that accompanies the elderly, currently there is a wide range of evaluations among which the Mini Mental State Examination (MEEM), the Barthel Index (IB) and the Short Physical Performance Battery (Short Physical Performance Battery; SPPB) as high-reliability instruments being reproducible and repeatable to measure cognition, functional capacity and physical capacity respectively, and can also be used in the hospital setting as an outpatient clinic.[9,10]

It is for this reason that the objective of this study is to determine the correlation between variables such as the level of physical capacity, functional dependence and cognitive impairment of the elderly.

MATERIAL AND METHOD

The design of this study is observational, descriptive, cross-sectional, in order to establish a correlation between the three variables studied. A total of 303 participants over 65 years of age were randomly recruited during 2018, who voluntarily agreed to be part of the study. The participating geriatric population included healthy people, as well as people with visual, motor and hearing disabilities, of both sexes, living in rural areas and with different levels of education. Any pathology that could be an impediment to their evaluation was set as an exclusion criterion.

Prior to obtaining informed consent, all the information corresponding to their participation was delivered in written and verbal form. The study was approved by the Bioethics Committee of the Technical University of Ambato, ethical principles were guaranteed, safeguarding the data of the participants, giving faithful compliance with ethical standards.

Data collection

First, strategies were generated to socialize the study with the elderly and with family members through informative talks, then useful information for the anamnesis could be collected through an interview.

Cognition impairment was measured with the MEEM which consists of 11 items: temporal orientation, spatial orientation, immediate recall of 3 words, attention or calculation (reverse spelling or sequential subtraction), delayed recall of the three words, naming of 2 objects, repetition of a phrase, comprehension of a verbal and a written command, writing a sentence and copying a diagram, with a maximum of 30 points being obtained11.

To measure functional capacity, the IB was applied, it is a questionnaire of 10 questions about the activities of daily living at home, which can obtain a maximum score of 100 points, which would indicate a maximum degree of dependence. Among the items, it considers aspects of self-care such as mobility such as food, dressing, walking, and grooming independently, if they go to the toilet alone, if they have urinary and fecal continence, among others12.

The SPPB was used for the variable of physical capacity, it consists of three subtests: a hierarchical balance test, which allowed estimating motor control; a short walk at the usual pace, with which a cardiorespiratory functional condition was estimated and a test of getting up from a chair five consecutive times, with which the condition of lower limb strength was investigated. The test is scored from 0 to 4 for each subtest, considering between 0 and 3 as severe limitation, 4-6 as moderate limitation, 7-9 as minimal limitation, and 10-12 as Normal13.

Statistical analysis

For the analysis of the results of this research, the SPSS statistical program in its version 20.0 was used. All sociodemographic data were submitted to descriptive statistics that express them in their mean, mode, standard deviation and minimum and maximum values.

The data from the evaluations of each of the tests were subjected to normality tests applying Kolmogorov-Smirnov and for the correlations between the three variables, cognitive impairment, functional capacity and physical capacity, Spearman was used.

RESULTS

The demographic characteristics of all the participants as well as the values obtained in each of the evaluations are shown in Table 1, expressed in mean, standard deviation, number of cases and percentage. The sample had a mean age of 75 years (SD 7.57), 77.55% were female. Disability categorized as auditory, motor and visual was obtained in 20%, 9% and 23% respectively, the category of schooling was the majority for cases without any level of schooling (n:120). The geographical origin was captured from rural areas.

Table 1. Demographics.

Characteristics	mean - SD - n - %			
Age	75	7,57		
Gender				
Male			96	32
Female			207	68
Geographical distribution				
Urban				
Rural				100
Schooling				
No educational level			120	39,60
Incomplete primary school			78	25,74
Complete primary school			87	28,71
High school			18	5,94
Disability				
Auditive			70	20
Motorboat			32	9
Visual			77	23
No			162	48

The correlation obtained thanks to Spearman's statistical test carried out between MEEM, IB and SPPB is shown in Table 2, where a level of significance was obtained that presumes a high agreement between variables ($p<0.05$) with $r=0.113$ for MEEM and IB and $r=0.310$ for MEEM vs SPPB. Data that according to the correlation coefficient were positive, direct and between the low to moderate scale.

Table 2. Concordance between tests applied.

Comparative	Level of Significance (p)	Correlation (r)
MEEM vs IB	0,05	0,113
MEEM vs SPPB	0,00	0,310

Abbreviations: MEEM: Mini Mental State Examination; IB: Barthel Index; SPPB: Short Physical Performance Battery

The positive correlation between the three variables measured could lead to the formulation of a tricompartmental evaluation model as shown in Figure 1, which is equivalent to a radar graph that allows visualizing the deficits and strengths of cognitive, physical and functional aspects.

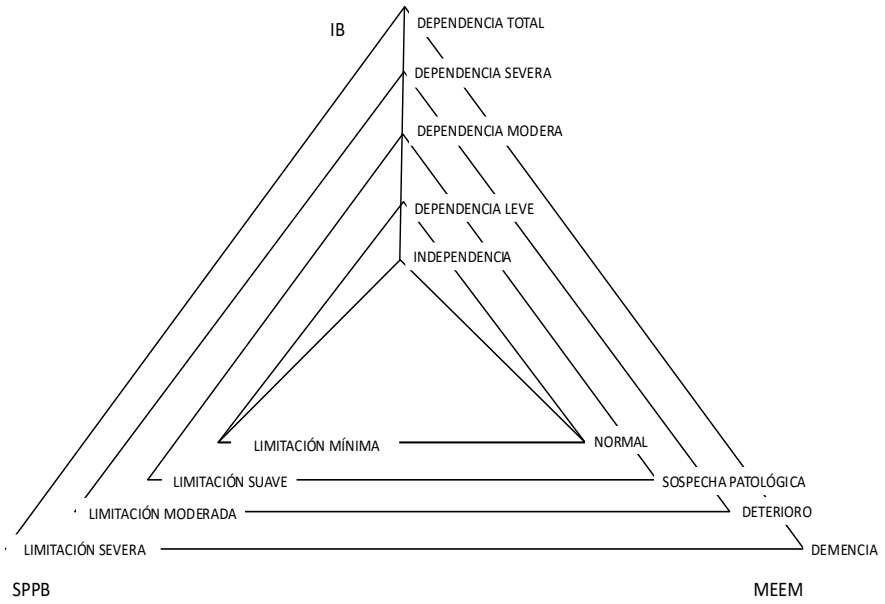

Figure 1. Tricompartmental evaluation model. In original language: Spanish

DISCUSSION

The results found in this study give an important premise of the positive correlation between the three most commonly used tests in the geriatric population, such as the MEEM, SPPB and IB.

No studies were found in which the three variables were directly related, however, some were found in which the same tests were applied as the present work with different objectives, such as the study by Martínez et al., which stipulates that the practice of moderate to vigorous intensity physical activity decreases the risk of dependence measured by scales such as Brody's. Lawton, IB, SPPB and MEEM14. Likewise, Boga et al., in their study, added the sleep scale, the depression scale together with the IB and the MEEM in search of a result that allows establishing a close relationship between mental state, depression and the functioning of daily life15.

The study population that allowed this correlation to be generated was from rural areas in a similar way, such as the study by Nugraha et al., where they highlight that the living environment measured with the IB together with the SPPB may indicate an increase in incidence on the risk of falling in the rural population16. The descriptive characteristics of the elderly such as age, gender, the presence of disability or comorbidity can improve the identification of physical or cognitive deficits, supporting this. Omura et al. mention the importance of assessing cognition, independence and morbidities, since these variables can increase mortality in people with diabetes over 70 years of age17.

The evaluation of geriatrics continues to be a challenge, however, there are already several postulates that support the idea of generating an instrument that tries to encompass several edges as mentioned by Takata et al., in their prospective study with a 12-year follow-up where they applied the competence index of the Tokyo Metropolitan Institute of Gerontology (TMIG) that establishes functional aspects, physical and cognitive studies, concludes that higher scores obtained with the application of a multidimensional scale decreases mortality18.

Undoubtedly, the application of tests that try to objectify the physical, functional and cognitive state of the person are widely approved, however, in the elderly a multivariate analysis is required since their condition may be subject to sporadic changes, which is why the well-being of the elderly outside the variables exposed in this study could be related to an appreciation of the nutritional status. physical activity, chronic pathology, environment, emotional state and pharmacological consumption.

Our study has some limitations First, the measures that were taken to correlate the three variables were the overall scores of each test. Second, the study population is a small number to be able to estimate a conclusion towards an etiological perspective and finally the data cannot be compared since it lacks similar evidence. The authors recommend taking the results shown in this document with caution and urge future research to support the results found, integrating more variables into the evaluation model.

CONCLUSIONS

The conclusion reached by this study is that, if there is a relationship between functional capacity, the degree of cognitive impairment, as well as the degree of functional independence, since a positive

correlation was found when applying tests such as the MEEM, SPPB and IB in the geriatric population, finally the results of this study postulate a paradigm shift, generating an approach where the greatest number of variables are integrated to objectify the evaluation and achieve a punctuated intervention with a focus on strengthening the most limited points.

Conflict of interest : The authors declare that they have no conflict of interest to declare

BIBLIOGRAPHY

1. Albala C, Lebrão ML, León Díaz EM, Ham-Chande R, Hennis AJ, Palloni A, et al. Rev Panam Salud Publica [Internet]. 2005; 17(5–6):307–22. Available in: http://dx.doi.org/10.1590/s1020-49892005000500003
2. Ageing and health [Internet]. Who.int. [cited 2022 Sep 22]. Available in: http://www.who.int/mediacentre/factsheets/fs404/en/
3. Leite MT, Castioni D, Kirchner RM, Hildebrandt LM. Functional capacity and cognitive level of older adults living in a community in southern Brazil. Enferm glob [Internet]. 2015 [cited 22 September 2022]; 14(1):1–11. Available in: https://scielo.isciii.es/scielo.php?script=sci_abstract&pid=S1695-61412015000100001
4. Monteiro-Junior RS, Figueiredo LF da S, Maciel-Pinheiro P de T, Abud ELR, Engedal K, Barca ML, et al. Virtual reality-based physical exercise with exergames (PhysEx) improves mental and physical health of institutionalized older adults. J am med dir assoc [Internet]. 2017; 18(5):454.e1-454.e9. Available in: http://dx.doi.org/10.1016/j.jamda.2017.01.001
5. Garbaccio JL, Tonaco LAB, Estêvão WG, Barcelos BJ. Aging and quality of life of elderly people in rural areas. Rev Bras Enferm [Internet]. 2018; 71 Suppl 2(suppl 2):724–32. Available in: http://dx.doi.org/10.1590/0034-7167-2017-0149
6. Cortés-Muñoz C, Cardona-Arango D, Segura-Cardona Á, Garzón-Duque MO. Rev Salud Publica (Bogotá) [Internet]. 2016; 18(2):167–78. Available in: http://dx.doi.org/10.15446/rsap.v18n2.49237
7. Nogueira SL, Ribeiro RCL, Rosado LEFPL, Franceschini SCC, Ribeiro AQ, Pereira ET. Determinant factors of functional capacity in long-lived idoses. Braz J Phys Ther [Internet]. 2010; 14(4):322–9. Available in: http://dx.doi.org/10.1590/s1413-35552010005000019
8. García-Arango V, Osorio-Ciro J, Aguirre-Acevedo D, Vanegas-Vargas C, Clavijo-Usuga C, Gallo-Villegas J. Predictive validity of a functional classification method in older adultsValidação preditiva de método de classificação funcional em idosos. Rev Panam Salud Publica [Internet]. 2021; 45:E15. Available in: http://dx.doi.org/10.26633/RPSP.2021.15
9. Amaral Gomes ES, Ramsey KA, Rojer AGM, Reijnierse EM, Maier AB. The association of objectively measured physical activity and sedentary behavior with (instrumental) activities of daily living in community-dwelling older adults: A systematic review. Clin Interv Aging [Internet]. 2021; 16:1877–915. Available in: http://dx.doi.org/10.2147/CIA.S326686
10. Haigis D, Pomiersky R, Altmeier D, Frahsa A, Sudeck G, Thiel A, et al. Feasibility of a geriatric assessment to detect and quantify sarcopenia and physical functioning in German nursing home residents-A pilot study. Geriatrics (Basel) [Internet]. 2021 [cited 22 September 2022]; 6(3):69. Available in: https://www.mdpi.com/2308-3417/6/3/69
11. Kahle-Wrobleski K, Corrada MM, Li B, Kawas CH. Sensitivity and specificity of the mini-mental state examination for identifying dementia in the oldest-old: the 90+ study: Sensitivity and specificity of mmse in those aged 90 and older. J Am Geriatr Soc [Internet]. 2007; 55(2):284–9. Available in: http://dx.doi.org/10.1111/j.1532-5415.2007.01049.x
12. Aminalroaya R, Mirzadeh FS, Heidari K, Alizadeh-Khoei M, Sharifi F, Effatpanah M, et al. The validation study of both the modified Barthel and Barthel index, and their comparison based on Rasch analysis in the hospitalized acute stroke elderly. Int J Aging Hum Dev [Internet]. 2021; 93(3):864–80. Available in: http://dx.doi.org/10.1177/0091415020981775
13. Motl RW, Learmonth YC, Wójcicki TR, Fanning J, Hubbard EA, Kinnett-Hopkins D, et al. Preliminary validation of the short physical performance battery in older adults with multiple sclerosis: secondary data analysis. BMC Geriatr [Internet]. 2015; 15(1):157. Available in: http://dx.doi.org/10.1186/s12877-015-0156-3
14. Martínez-Hernández BM, Rosas-Carrasco O, López-Teros M, González-Rocha A, Muñoz-Aguirre P, Palazuelos-González R, et al. Association between physical activity and physical and functional performance in non-institutionalized Mexican older adults: a cohort study. BMC Geriatr [Internet]. 2022; 22(1):388. Available in: http://dx.doi.org/10.1186/s12877-022-03083-7
15. Boga SM, Saltan A. Identifying the relationship among sleep, mental status, daily living activities, depression and pain in older adults: a comparative study in Yalova, Turkey. J Pak Med Assoc [Internet]. 2020; 70(2):236–42. Available in: http://dx.doi.org/10.5455/JPMA.301384

16. Nugraha S, Prasetyo S, Susilowati IH, Rahardjo TBW. Urban-rural dimension of falls and associated risk factors among community-dwelling older adults in west java, Indonesia. J Aging Res [Internet]. 2021;2021:8638170. Available in: http://dx.doi.org/10.1155/2021/8638170
17. Omura T, Tamura Y, Sakurai T, Umegaki H, Iimuro S, Ohashi Y, et al. Functional categories based on cognition and activities of daily living predict all-cause mortality in older adults with diabetes mellitus: The Japanese Elderly Diabetes Intervention Trial. Geriatr Gerontol Int [Internet]. 2021; 21(6):512–8. Available in: http://dx.doi.org/10.1111/ggi.14171
18. Takata Y, Ansai T, Soh I, Awano S, Nakamichi I, Akifusa S, et al. High-level activities of daily living and disease-specific mortality during a 12-year follow-up of an octogenarian population. Clin Interv Aging [Internet]. 2013; 8:721–8. Available in: http://dx.doi.org/10.2147/CIA.S43480