Análise Psicológica (2017), 1 (XXXIV): 37-43 doi: 10.14417/ap.1145

# Analysis of the relationship between the syndrome of frailty and cognitive deficit in older adults with independent living

Gilson Luis da Cunha* / Sueli Maria Cabral* / Geraldine Alves dos Santos*

* Universidade Feevale, Programa de Pós-Graduação em Diversidade Cultural e Inclusão Social, Brasil

Elderly frailty is a syndrome composed of motor and metabolic factors and aspects of cognitive decline. The objective of this work was to evaluate the relationship between indicators of frailty and cognitive deficit in older adults with independent life, living in the city of Ivoti, Rio Grande do Sul State, Brazil. This study had a cross-sectional quantitative design, considering sociodemographic variables, cognitive status, and frailty syndrome components. Inclusion criteria were to have 65 years, understand the instructions, agree to participate and be a permanent resident at home and census tract. Data were analyzed using Pearson's bivariate correlation test. The results showed 15 correlations between frailty and other variables of the study, 9 of them also occur in the cognitive deficits and 6 are present only in the frailty syndrome. Cognitive deficit and frailty syndrome are not mutually exclusive in the subjects studied, but influence each other. In this study, 27 variables were tested for correlation with frailty and cognitive deficit. 21 of them were correlated to cognitive deficit. 15 were correlated to the frailty syndrome. This slight predominance of issues unrelated to the motor performance suggests psychosocial factors may have a significant impact on the establishment of the frailty syndrome.

**Key words:** Elderly, Frailty, Cognitive deficit, Successful aging.

## Introduction

The world population is aging rapidly and this demographic transition, both in developed and in developing countries, greatly will increase the demand for health services and social security for the elderly in the coming decades. Within this possible future, two different scenarios oppose each other: the individuals who reach successful aging condition and those affected by the frailty syndrome (Cosco, Armstrong, Stephan, & Brayne, 2015). Successful aging already has more than 100 operational definitions, ranging from physical and cognitive to self-reported measures of life satisfaction. These definitions mainly employ concepts established by Baltes and Baltes (1993). The model Baltes and Baltes emphasizes the SOC strategy (selection, optimization and compensation). The selection would have a voluntary basis, based on the fields of spectrum limitation (relationships, personal goals, health, etc.), or as it ages, the individual begins to restrict her or his goals, the time spent and resources to what is more easily available. The optimization is based on the use of actions taken by the elderly to get the most out of the resources that are available. For example, the use of mnemonic techniques to learn and retain data, so that elderly individuals can perform activities for which they have interest. The compensation would be the action of the elderly to find new resources and deal with the declines that threaten their functionality. The elderly should improve the most of the skills that still have to compensate for the absence of those who lost. For example, in the martial arts, the capacity of the

Correspondence concerning this article should be addressed to: Gilson Luis da Cunha, Universidade Feevale, Programa de Pós-Graduação em Diversidade Cultural e Inclusão Social, Av. Dr. Maurício Cardoso, 510, Hamburgo Velho, Novo Hamburgo – RS, 93510-250, Brasil. E-mail: gilsonlcunha@gmail.com

old and experienced practitioner to assess an opponent and anticipate their movements compensate the loss of speed and strength caused by age (Mariske, Lang, Baltes, & Baltes, 1995).

The SOC strategy brings together a number of behaviors targeted by seniors to specific situations, to produce answers that gives them adaptive advantages. However, while actions such as minimizing losses of age and maintain social support networks are important in obtaining successful aging, maintenance of cognitive capacity would be essential for this task, because compensate a series of physical and psychosocial losses related to the advancement of age (Vance, Ball, Moore, & Benz, 2007).

In parallel, the pathological aging is characterized by increased frequency of physical and mental disorders, reducing the autonomy and independence of the elderly and finally to the institutionalization thereof, with all the economic, social and emotional costs it entails. Frailty syndrome and cognitive deficit are among the most striking pictures of the pathological aging. For Fried et al. (2001) symptoms manifested by frailty syndrome are weight loss, weakness, fatigue, and decreased food intake. The most common signs would be abnormalities in balance and gait, sarcopenia, decreased bone mass and loss of physical conditioning. Based on this criteria, this researcher proposed, a phenotype of frailty, where the elderly should present at least three of the following components to be considered frail: unintentional weight loss; decreased grip strength of the dominant hand according to sex and body mass index; exhaustion; slow and low physical activity index. Elderly patients with three or more of these characteristics are classified as frail, while those presenting one or two would qualify as pre-frail. Elderly people who have none of these properties are considered non-frail elderly. In addition, the author reinforces the importance of establishing explicit conditions to characterize the frailty of the health professionals providing organize the necessary interventions to minimize the effects of the syndrome on the health of the elderly. Cognitive deficit is a heterogeneous framework in which operate pathologies such as vascular dementia, Alzheimer's and other dementias with different etiologies (Kulmala, Nykänen, Mänty, & Hartikainen, 2014).

Different authors suggest that physical frailty and cognitive frailty have common denominators, such as depression, although the relationship between these parameters are not always clear.

Leonardo et al. (2014) evaluated the cognitive state and the frailty of a sample of 50 elderly 80 years old in the city of Ribeirão Preto (SP) found a prevalence of frailty 64%. Of these, 38% with mild weakness, 14% with moderate frailty and 12% with severe frailty.

The same authors also found an association between the Mini Mental State Examination (MMSE), gender, age, years of study and frailty classification, and also a strong correlation between the level of frailty and cognitive deficit. Souza et al. (2006) evaluated a sample of 230 people older than 65 years as the cognitive deficit assessed by MMSE and depression assessed by the Geriatric Depression Scale (GDS-15), obtaining a positive correlation. This correlation indicates that, when moving from one age group to another, the occurrence of depression and cognitive deficit rises concomitantly the possibility to enter the frailty phase. Due to the above evidence, this article aims to collect a data set on the psychosocial profile of seniors with independent living over 65 years and evaluate the occurrence of correlations between cognitive deficit and frailty as well as to identify, in the sample studied factors which establish an intersection between these two conditions.

## Method

This paper presents a study of quantitative and cross-sectional data collected in the city of Ivoti, Rio Grande do Sul Sate, Brazil. The sample size calculation was used to estimate a ratio of a finite population, with alpha set at 5%, sample error of 5% and an estimated 50% for the distribution of the variable under study. For these parameters, the sample was composed of 235 elderly from

Ivoti. However, this sample size calculation was based on the total number of elderly and the present study included only the elderly living in urban areas and who were not institutionalized.

In this study we selected a random sample by cluster sampling technique, with the sampling unit 19 census tracts in the urban zone of the municipality. As the city is considered small, ie less than 20,000 inhabitants, the draw of census tracts was not performed.

Therefore, the elderly were recruited in all census tracts, including those who did not have, according to data from IBGE (Brazilian Institute Of Geography And Statistics), elderly residents. The total sample was 197 Ivoti elderly.

The inclusion criteria used during the recruitment of the elderly were to be older than 65 years, to understand the instructions, agree to participate and to be a permanent resident at home and census tract. According recommendations of Ferrucci et al. (2004), were considered ineligible for research through observation: (a) seniors with severe cognitive deficit suggestive of dementia, evidenced by memory problems, attention, spatial and temporal orientation, and communication; (b) those who were using a wheelchair or finding themselves temporarily or permanently bedridden; (c) patients with severe sequelae of cerebrovascular accident, with localized loss of strength and/or aphasia; (d) people with Parkinson's disease in severe or unstable stage, with severe motor deficits, speech or affectivity; (e) patients with severe hearing or vision deficits that severely hamper communication; (f) those who were terminally ill. The instruments used are given below and refer to the evaluation of socio-demographic variables, cognitive deficit and frailty syndrome.

*Sociodemographic data* – age, gender, education, marital status, employment status, financial status, family composition and ownership of the residence. The results were noted by the evaluators in the research form.

*Mental Status* – Mental health conditions of the sample subjects were assessed by the Mini-Mental State Examination test developed by Folstein, Folstein and MacHugh (1975), validated and adapted to Brazilian reality by Bertolucci, Brucki, Campacci and Juliano (1994). This is based on a 20 items questionnaire, which evaluates seven groups of cognitive functions. Its maximum score is 30 points divided into: temporal orientation, spatial orientation, immediate memory, attention and calculation, recall, language and constructive praxis.

*Frailty* – is characterized by the following components: (1) unintentional weight loss, according to self-report (A dichotomous item and a reply item structured by the elderly); (2) Fatigue assessed by self-report (Items 7:20 of the CES-D with 4 points each); (3) The handgrip strength was measured with Jamar dynamometer (Lafayette Instruments, Lafayette, USA) placed in the dominant hand of each elderly in three attempts, respecting 1 min. interval between themFor each old, it was calculated the average of the three measures, which was adjusted by gender and according to the body mass index (BMI=weight/height 2). The cutoff points for men were: IMC≤23, cutoff (PC)≤27.00kgf; 23<BMI<28, PC≤28,67kgf; 28≤IMC<30, PC≤29,50; BMI≥30, PC≤28,67. For women, were IMC≤23, PC≤16,33; 23<BMI<28, PC≤16,67; 28≤IMC<30, PC≤17,33; BMI≥30, PC≤16,67) (Marucci & Barbosa, 2003). (4) self-report measures on weekly frequency and duration of exercise daily and domestic activities and the maintenance of these activities in the last 15 days in the last three months and in the last 12 months. 30 dichotomous items and structured response by the elderly, based in the Minnesota Leisure Activity Questionnaire (Lustosa, Pereira, Dias, Britto, & Pereira, 2010; Taylor et al., 1978) adapted to this research. Later measure of the weekly metabolic expenditure in kcal based on the value of each activity in metabolic equivalents (METs), conforme Ainsworth et al. (2000). (5) Gait speed. The gait velocity test was based on the time required (timed in seconds) that each old took to go in usual step, a distance of 4.6 meters marked on the floor plan, by adhesive tape. This stretch was delimited by cross marks the line of 4.6M. Before and after this line were added 2m lines each. The first stretch of 2m was used for output and acceleration and the time to travel it was not counted. The same was true of the later passage to the line of 4.6M, which served to slowdown. It was allowed

the elderly use a cane or walker. Three attempts were made. The examiner calculated the mean result and noted down in the protocol (Guralnik et al., 1994; Nakano, 2007). The average of each elderly was adjusted by gender and height. For men, the cutoff scores were: height≤168, PC≤5,49secs; altura>168, PC≤5,54secs.; for women were: height≤155, PC≤6,61secs; height>155, PC≤5,92secs.

Data were submitted to descriptive statistical analysis and correlation using Pearson's test using the SPSS statistical package (Statistical Package for Social Sciences – v. 22.0), with a significance level≤0.05.

## Results

A comparison of the correlations in Table 1 suggests that frailty and cognitive deficit are not mutually exclusive conditions, but that overlap to some extent. In Table 1, from 15 correlations between frailty criteria and other data collected, 9 are also present in the correlation of MMSE score, while 6 are not. Of these 6, 5 deal essentially with factors related to frailty, specifically metabolic and motor (weight loss, Mets walk, Mets exercises away from home, Kcal spent on exercises, Kcal spent on housework) but no direct cognitive implications. In this study, 12 variables correlated only to cognitive performance. Paradoxically, 9 of them are indicators of the elderly frailty status and not necessarily of their cognitive status, suggesting that decreases in cognitive ability could contribute as much as metabolic and motor aspects in the definition of the frailty syndrome.

Table 1

*Bivariate correlations of the variables number of frailty criteria and score the MMSE*

| | Frailty Criteria | | MMSE | |
|---|---|---|---|---|
| Variable | Pearson's Correlation | Bilateral Significance | Pearson's Correlation | Bilateral Significance |
| **MMSE Score** | **-,248** | **,000** | 1 | |
| **Weight Loss** | **-,245** | **,001** | ,078 | ,280 |
| **Mets walking** | **-,269** | **000** | ,063 | ,378 |
| **Mets exercise away from home** | **-,147** | **,039** | -,010 | ,894 |
| **Kcal in physical exercise** | **-,192** | **,007** | ,078 | ,274 |
| **Kcal in domestic activities** | **-,278** | **,000** | ,134 | ,061 |
| **Mets light housework** | **-,282** | **,001** | **,186** | **,009** |
| **Average grip strength** | **-,311** | **,000** | **,329** | **,000** |
| **Average gait speed** | **,521** | **,000** | **,242** | **,001** |
| **Total Kcal** | **-,327** | **,000** | **-,353** | **,000** |
| **Kcal in passive leisure** | **-,166** | **,020** | **-,175** | **,014** |
| **Currently works** | **,154** | **,030** | **-,248** | **,000** |
| **Age of the interviewee** | **,345** | **,000** | **-,257** | **,000** |
| **Lives with companion/helper** | **-,180** | **,012** | **-,392** | **,000** |
| **Residence Owner** | **,171** | **,016** | **,151** | **,034** |
| Number of frailty criteria | 1 | | **-,257** | **,000** |
| Years of schooling | -,049 | ,496 | **-,159** | **,000** |
| literate | ,000 | ,995 | **,315** | **,000** |
| Personal income | -,074 | ,304 | **,145** | **,042** |
| Family income | -,075 | ,330 | **,207** | **,004** |
| Have enough money | ,114 | ,112 | **,243** | **,001** |
| Average diastolic pressure | -,062 | ,388 | **-,176** | **,014** |
| body weight | -,039 | ,590 | **,142** | **,048** |
| Height | -,120 | ,093 | **,227** | **,001** |
| Mets kitchen | -,164 | ,054 | **,182** | **,032** |
| Mets reading newspapers | -,099 | ,169 | **,212** | **,012** |
| Frailty in physical activity | **,600** | **,000** | **,151** | **,034** |

*Note.* Correlations highlighted in bold were significant ($p \leq 0.05$). Correlations inside rectangles are common to both Frailty criteria and MMSE score.

## Discussion

Published data show that cognitive performance tests, particularly spatial memory and reaction time in water maze tests and evasion in rodents tend to have better results in patients undergoing aerobic physical training (Wang et al., 2013). The explanation suggested by the authors is that aerobic activity stimulates the action of antioxidant defense mechanisms and cellular repair damage to macromolecules systems, since such damage is significantly lower in the brains of animals with better test scores cited (Ogonovszkyet al., 2005; Sarga et al., 2013; Tsou et al., 2015; Yin et al., 2013). The transposition of these data for humans is not merely a matter of physiology due to cultural and psychosocial aspects, absent in experimental animals. However, the correlations obtained in this study suggest some trends. For example, physical exercise can be a protective factor or maintain cognitive ability levels, as indicated by recent studies in humans (Young, Angevaren, Rusted, & Tabet, 2015). These data suggest that cognitive ability and motor performance cannot be summarily dissociated (List & Sorrentino, 2010). Cognitive ability can also affect physical performance, since older people who have awareness of the benefits of physical activity and those who recognize that need it, are the most likely to practice it spontaneously (Barnes, 2015). In this study, data on how people with whom the old lies and financial conditions can be interpreted as dependence indicators. The elderly in situations of frailty and cognitive deficit tends to adapt. For this to occur are carried out changes in family structures and accessibility. These periodic adaptive changes, to support the transition situations, promote an improvement in functional capacity (Fonseca, 2012).

Some of results had a less obvious interpretation. For example, body weight was positively correlated with punctuation in the MMSE, and also the number of frailty criteria. Recent literature suggests that overweight would be a protective factor against some types of dementia (Qizilbash et al., 2015), but its role was unclear. The importance of the role of diastolic pressure on cognition was also an unexpected data. However, a recent review of Leto and Feola (2014) shows that a number of cardiovascular disorders can affect cognitive performance, through mechanisms such as ischemia. However, the fact that psychosocial factors have influenced more about the phenotypes of frailty syndrome than those on cognitive deficit seems to indicate that frailty and dementia are not separated entities.

## Conclusion

The causes of frailty have not been precisely established. However, physiological age-related changes are accepted as key factors, followed by psychological or environmental factors such as polypharmacy, low protein intake and physical inactivity in youth. However, the correlations found in this study suggest that psychosocial factors have a slightly greater weight in the frailty syndrome setting than its organic components. How these factors influence the development of the physical symptoms of frailty syndrome remains uncertain and further investigations need to be done to clarify this process. These data are added to other findings in the literature suggesting that dementia components have a close association with the frailty syndrome, perhaps even being part of its development.

## References

Ainsworth, B. E., Haskell, W. L., Whitt, M. C., Irwin, M. L., Swartz, A. M., & Strath, S. J. (2000). Compendium of physical activities: An update of activity codes and MET intensities. *Medicine and Sciences in Sports and Exercise, 32*, 498-516.

Baltes, P. B., & Baltes, M. M. (1993). *Successful aging: Perspectives from the behavioral sciences.* Cambridge: Cambridge University Press.

Barnes, J. N. (2015). Exercise, cognitive function, and aging. *Adv Physiol Educ, 39*, 55-62. doi: 10.1152/advan.00101

Bertolucci, P. H. F., Brucki, S. M. D., Campacci, S. R., & Juliano, Y. (1994). O Mini-exame do Estado Mental em uma população geral: Impacto da escolaridade. *Arquivos de Neuro-psiquiatria, 52*, 1-7.

Cosco, T. D., Armstrong, J. J., Stephan, B. C., & Brayne, C. (2015). Successful aging and frailty: Mutually exclusive paradigms or two ends of a shared continuum?. *Can Geriatr J, 18*, 35-36.

Ferrucci, L., Guralnik, J. M., Studenski, S., Fried, L. P., Cutler Jr, G. B., & Walston, J. D. (2004). Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: A consensus report. *Journal of the American Geriatrics Society, 52*, 625-624.

Folstein, M., Folstein, S., & Machugh, P. (1975). Mini-Mental State. A practical method for grading the cognitive status of patients for the clinician. *Journal of Psychiatric Research, 12*, 189-198.

Fonseca, A. M. (2012). Desenvolvimento psicológico e processos de transição-adaptação no decurso do envelhecimento. In C. Paúl & R. Ribeiro (Eds.), *Manual de gerontologia* (pp. 95-106). Lisboa: Lidel Editora.

Fried, L. P., Tangen, C. M., Waltson, J., Newman, A. B., Hirsch, C., Gottdiener, J., . . . Mc Burnie, A. (2001). Frailty in older adults: Evidence for a phenotype. *J Gerontol A Biol Sci Med Sci, 56*, 146-156.

Guralnik, J. M., Simonsick, E. M., Ferrucci, L., Glynn, R. J., Berkman, L. F., Blazer, D. G., . . . Wallace, R. B. (1994). A short physical performance battery assessing lower extremity function: Association with self-reported disability and prediction of mortality and nursing home admission. *Journal of Gerontology Medical Sciences, 49*, 85-94.

Kulmala, J., Nykänen, I., Mänty, M., & Hartikainen, S. (2014). Association between frailty and dementia: A population-based study. *Gerontology, 60*, 16-21.

Leto, L., & Feola, M. (2014). Cognitive deficit in heart failure patients. *J Geriatr Cardiol, 11*, 316-328.

List, I., & Sorrentino, G. (2010). Biological mechanisms of physical activity in preventing cognitive decline. *Cell Mol Neurobiol, 30*, 493-503.

Lustosa, L., Pereira, D., Dias, R., Britto, R., & Pereira, L. (2010). *Tradução, adaptação transcultural e análise das propriedades psicométricas do Questionário Minnesota de Atividades Físicas e de Lazer.* Belo Horizonte: Universidade Federal de Minas Gerais.

Marsiske, M., Lang, F. R., Baltes, M. M., & Baltes, P. B. (1995). Selective optimization with compensation: Life-span perspectives on successful human development. In R. A. Dixon & L. Bäckman (Eds.), *Compensation for psychological deficits and declines: Managing losses and promoting gains* (pp. 35-79). Hillsdale, NJ: Erlbaum.

Marucci, M. F. N., & Barbosa, A. R. (2003). Estado nutricional e capacidade física. In M. L. Lebrão & Y. A. O. Duarte (Orgs.), *O projeto SABE no município de São Paulo: Uma abordagem inicial* (pp. 95-117). Brasília: OPAS/MS.

Nakano, M. M. (2007). *Versão brasileira da Short Physical Performace Battery-SPPB: Adaptação cultural e estudo de confiabilidade*. Dissertação de Mestrado, Faculdade de Educação, Universidade Estadual de Campinas, Campinas.

Ogonovszky, H., Berkes, I., Kumagai, S., Kaneko, T., Tahara, S., Goto, S., & Radák, Z. (2005). The effects of moderate-, strenuous- and over-training on oxidative stress markers, DNA repair, and memory, in rat brain. *Neurochem Int, 46*, 635-640.

Qizilbash, N., Gregson, J., Johnson, M. E., Pearce, N., Douglas, I., Wing, K., . . . Pocock, S. J. (2015). BMI and risk of dementia in two million people over two decades: A retrospective cohort study. *Lancet Diabetes Endocrinol, 3*, 431-436.

Sarga, L., Hart, N., Koch, L. G., Britton, S. L., Hajas, G., Boldogh, I., . . . Radak, Z. (2013). Aerobic endurance capacity affects spatial memory andsirt1 is a potent modulator of 8-oxoguanine repair. *Neuroscience, 252*, 326-336.

Souza, A. C., Magalhães, L. C., & Teixeira-Salmella, L. T. (2006). Adaptação transcultural e análise das propriedades psicométricas da versão brasileira do Perfil de Atividade Humana. *Cadernos de Saúde Pública, 22*, 2623-2636.

Taylor, H. L., Jacobs, D. R., Schucker, B., Knudsen, J., Leon, A. S., & Debacker, G. (1978). A questionnaire for the assessment of leisure time physical activities. *Journal of Chronic Disease, 31*, 741-755.

Tsou, Y. H., Shih, C.T., Ching, C. H., Huang, J. Y., Jen, C. J., Yu, L., . . . Chuang, J. I. (2015). Treadmill exercise activates Nrf2 antioxidant system to protect the nigrostriatal dopaminergic neurons from MPP+toxicity. *Exp Neurol, 263*, 50-62. doi: 10.1016/j.expneurol.2014.09.021

Vance, D. E., Ball, K. K., Moore, B.S., & Benz, R. L. (2007). Cognitive remediation therapies for older adults: Implications for nursing practice and research. *J Neurosci Nurs, 39*, 226-231.

Wang, Q., Xu, Z., Tang, J., Sun, J., Gao, J., Wu, T., & Xiao, M. (2013). Voluntary exercise counteracts Aβ25-35-induced memory deficit in mice. *Behav Brain Res, 256*, 618-625. doi: 10.1016/j.bbr.2013.09.024

Yin, M. M., Wang, W., Sun, J., Liu, S., Liu, X. L., Niu, Y. M., . . . Fu, L. (2013). Paternal treadmill exercise enhances spatial learning and memory related to hippocampus among male offspring. *Behav Brain Res, 253*, 297-304.

Young, J., Angevaren, M., Rusted, J., & Tabet, N. (2015). Aerobic exercise to improve cognitive function in older people without known cognitive deficit. *Cochrane Database Syst Rev, 22*. CD005381. doi: 10.1002/14651858.CD005381

A fragilidade do idoso é uma síndrome composta de fatores motores e metabólicos e aspectos de declínio cognitivo. O objetivo deste trabalho foi avaliar a relação entre indicadores de fragilidade e déficit cognitivo em adultos idosos com vida independente, residentes na cidade de Ivoti, Rio Grande do Sul, Brasil. Este estudo teve um desenho quantitativo transversal, considerando variáveis sociodemográficas, estado cognitivo e componentes da síndrome da fragilidade. Os critérios de inclusão foram ter 65 anos, entender as instruções, concordar em participar e ser um residente permanente em casa e setor censitário. Os dados foram analisados utilizando o teste de correlação bivariada de Pearson. Os resultados mostraram 15 correlações entre fragilidade e outras variáveis do estudo, 9 delas também ocorrem nos déficits cognitivos e 6 estão presentes apenas na síndrome de fragilidade. O déficit cognitivo e a síndrome da fragilidade não são mutuamente exclusivos nos sujeitos estudados, mas influenciam-se mutuamente. Neste estudo, foram testadas 27 variáveis para correlação com fragilidade e déficit cognitivo. 21 deles foram correlacionados ao déficit cognitivo. 15 foram correlacionados com a síndrome da fragilidade. Esta ligeira predominância de questões não relacionadas com o desempenho motor sugere que fatores psicossociais podem ter um impacto significativo sobre o estabelecimento da síndrome de fragilidade.

**Palavras-chave:** Idosos, Fragilidade, Déficit cognitivo, Envelhecimento bem-sucedido.

*Submitted:* 24/08/2015 *Accepted:* 20/06/2016