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THE RELATIONSHIP BETWEEN MOBILITY, PHYSICAL ACTIVITY AND STRENGTH WITH DEPRESSION, COGNITIVE STATE AND HEALTH STATUS IN THE ELDERLY IN PORTUGAL

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Abstract

This study attempts to understand the relationship between physical activity, strength and mobility with depression, cognitive state and health status among the elderly in Portugal and identify which measures best relate with these. Using a descriptive, cross-sectional and correlational study, a sample of 118individuals was selected by exclusion and inclusion criteria. The measuring instruments used were the Mini-Mental State Examination (MMSE), Geriatric Depression Scale (GDS), 12-Item Short Form Health Survey (SF-12), International Physical Activity Questionnaire (IPAQ), Timed Up and Go (TUG) and Hand Grip Strength (HGS). The sample had a normal distribution. Pearson's test and ANOVA were used for the statistical analysis and revealed meaningful positive correlations between GDS and SF-12, IPAQ, TUG and HGS and also in MMSE with SF-12 [physical and mental dimensions], right HGS, left HGS and IPAQ. A meaningful negative correlation was also found in MMSE with TUG. SF-12 presented a significant negative correlation with TUG. Left HGS revealed a significant positive correlation to SF-12 in both physical and mental dimensions. However, right HGS was only significant to the physical dimension. IPAQ had no significant correlation with SF-12. All the measures had a meaningful correlation with depression (GDS) and cognitive state (MMSE). Applying simple instruments of easy application such as TUG have shown good values of correlation with depression, cognitive state and health.

Keywords: Aging, depression, cognitive state, health status, strength, mobility, physical activity

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1. Introduction

Population aging is a worldwide phenomenon nowadays, as witnessed in Portugal with an on-growing percentage of older people (INE, 2011). This is characterized by a progressive, dynamic and irreversible process which correlates with biological, psychological and sociological factors and should be embraced both has a challenge and an opportunity.

In normal aging, older people may suffer a decline of cognitive function, which will restrain their functional independence (Abrahams et al., 2018). Cognitive function changes during life and in older ages, people might experience a decline in several of those functions, including memory, attention, executing functions and processing speed (Baudoin, Isingrini, & Vanneste, 2018). The cognitive decay leads to difficulties in performing daily activities (Baudoin et al., 2018). Therefore, maintaining or increasing older people's cognitive functions is a vitally important issue to be studied (Baudoin et al., 2018).

Gait and cognitive function are intimately related, both in normal aging as in age related dementia (Bramell-Risberg, Jarnlo, & Elmstahl, 2012). Mobility is a complex behavior which covers separable neural systems that control gait beginning, planning, execution and adaptation of movements to react to the environment and the motivation requirements (Buchman, Boyle, Leurgans, Barnes, & Bennett, 2011). Cognitive ability is crucial to the ongoing planning, decision taking and motion tracking, necessary to successful walking (Buchman et al., 2011). Thereby, cognitive abilities such as those important in performance, planning and monitoring may have an important role in mobility (Buchman et al., 2011).

Some studies support the efficiency of cognitive stimulation in elder groups as a way to maintain and even improve general cognitive ability with a significant impact in perception of quality of life (Abrahams et al., 2018; Kulason et al., 2016). Other studies support that type and intensity of physical activity have an important influence in the relationship between exercise and cognition. Furthermore, to maintain cognitive health, it is necessary to take into consideration the frequency of moderate physical activity in daily living (Kimura, Yasunaga, & Wang, 2012).

Muscle loss is another dominant characteristic of elderly (Zammit, Robitaille, Piccinin, Muniz-Terrera, & Hofer, 2018). According to the literature, after attaining the age of 40 and during the whole process of aging, there is a progressive loss of muscle tissue and consequent strength, as well as a loss of muscle quality and effectiveness (Abizanda et al., 2012; Zammit et al., 2018). The decay of muscle mass and strength in older people has been associated with several adverse occurrences; described a reduction of physical activity and global energy output, leading to higher costs to health care (Abizanda et al., 2012). Muscle loss also leads to a lower handgrip strength, which predicts a higher dependence in daily activities and a decline in cognitive functions among the oldest elderly (Zammit et al., 2018). Therefore, interventions to improve cognitive function may decrease mobility difficulties and physical fragility, decreasing the functional incapacity in older people (Buchman et al., 2011; McPhee et al., 2016).

Besides the decreasing cognitive and functional ability, aging causes other problems. For an experiential point of view, the elderly experience continuous losses, such as decreasing social-familiar support, loss of occupational status, increasing frequency diseases and reduction in social inclusion, among others, resulting in an increase of dejection, which leads to feelings of loneliness, solitude and thereafter to depressive states (Petitte et al., 2015). Depression is considered as one of the primary causes of incapacity in the world and also one of the most prevailing conditions in the elderly population (Barret et al., 2011; Ivanovs et al, 2018). The presence of depressive symptoms has significant social implications and negative consequences to the individual's quality of life. Therefore, promoting physical activity may be a protection against such negative and potentially dangerous consequences (Kvæl, Bergland, & Teleniu, 2017).

Quality of life determines the physical, social and health domains, which are seen as distinct fields that may be shaped by an individual's experiences, believes, expectations and perceptions (Nunes, Nakatani, Silveira, Bachion, & Souza, 2010). A better understanding of the contributing factors for health-related quality of life may help the development and application of health promotion strategies for the elderly (Nunes et al., 2010).

2. Problem Statement

All the previously mentioned restrictions and negative effects related to aging in elder people may lead to changes in functional ability, resulting in a set of functional limitations and fragilities with consequent loss of mobility and autonomy, as well as a diminishing quality of life and a major probability of increasing health problems (Formiga et al., 2010; Millán-Calenti, 2010; Yanagawa, Shimomitsu, Kawanishi, Fukunaga, & Kanehisa, 2016).

3. Research Questions

What are the relationships between levels of physical activity, strength and mobility with depression, and cognitive state and health status in elder people?

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4. Purpose of the study

This study aims to identify which measures have a better correlation with depression, cognitive state and health among the elderly.

5. Research Methods

This descriptive, cross-sectional and correlational study took place in Portugal. The sample comprised older people living in their own houses, with family members or in institutions designed for elderly people.

The convenience sample comprised 118 individuals selected through a characterization questionnaire taking into consideration the inclusion (age equal or superior to 65 years old) and exclusion criteria (presence of severe neurological dysfunctions and/or lack of mobility in lower limbs).

The independent variables in this study were the sociodemographic characterization such as gender, age, Body Mass Index (BMI), years of literacy, marital status, accommodation type, existing supports and characterization of social participation levels; and clinical characterization, such as number of drugs, number of days of hospitalization in the past 6 months, number of medical appointments in the past 6 months and number of chronic diseases mentioned. The dependent variables included mobility (measured by TUG), hand grip strength (measured through an isokinetic dynamometer), physical activity levels (measured by IPAQ), health state (measured by SF-12), depression (measured by GDS) and cognitive state (measured by MMSE).

After the sample's sociodemographic characterization questionnaire was applied and the informed consent properly signed, all the necessary questionnaires, scales and tests were applied to the subjects.

In the Timed Up and Go Test (TUG), the time taken to complete the test strongly correlates to the level of functional mobility, which is dependent of subjects' age. Interventions to improve strength, balance and/or mobility are supported when the average time exceeds 9 seconds in ages between 60 and 69 years old, 10.2 seconds in ages between 70 and 79 and 12.7 seconds in 80 to 99 years old (Bootsman et al., 2018).

The Hand Grip Strength Test (HGS) is used as a global strength indicator in which values equal or inferior to 20Kg translate a risk of future functional dependency (Bohannon, 2006).

The International Physical Activity Questionnaire (IPAQ) presents the score split into three categories: low, moderate and high. "Low" corresponds to the lowest level of physical activity; "Moderate" are individuals who perform 3 or more days of vigorous physical activity for at least 20 minutes per day, 5 or more days of moderate physical activity and/or walking at least 30 minutes per day, and 5 or more days of any combination of moderate, vigorous physical activity or walking until an amount of at least 600 Metabolic Equivalents-minute (MET-min) per week. Finally, "high" describes the highest levels of participation, considering the subjects who accomplish vigorous physical activity at least 3 days a week with at least 1500 MET-min per week or 7 or more days of any combination of moderate, vigorous physical activity or walking until an amount of at least 3000 MET-min per week (Zammit et al., 2018).

The 12-Item Short Form Health Survey (SF-12) evaluates the state of health by considering eight measures of health-related quality of life: physical function, limitations due to physical health, limitations due to emotional health, social function, body pain, general health status, vitality and mental health. This questionnaire is split into two dimensions; physical health and mental health, in which both present a score between 0 and 100 points, with 0 being the lowest level of health and 100 the highest (Charivalertsak et al., 2011).

The extended version of the Geriatric Depression Scale (GDS) is constructed in very simple language and comprises 30 yes-or-no items about feelings and behaviors that occurred in the last week (Ivanovs et al., 2018). 10 of the 30 items are scored with 1 point when the answer is "No" (items 1, 5, 7, 9, 15, 19, 21, 27, 29 and 30) and the other 20 are scored with 1 point when the answer is "Yes". Global scores between 0 and 10 indicates an absence of depression in elders; scores between 11 and 20 are predictive of a growing severity of depression; and a score equal or higher than 21 means seriously depressed elders (Utah Health Status Survey, 2001).

The Mini-Mental State Examination (MMSE) scores are strongly influenced by the subject's literacy levels. Hence, the current Portuguese population is considered to display a cognitive deficit when scores are equal or lower than 22 points in 0 to 2 years of literacy, 24 points in 3 to 6 years of literacy and 27 points in 7 or more years of literacy (Morgado, Rocha, Maruta, Guerreiro, & Martins, 2009). Individuals with 0 to 2 years of literacy are considered to have minimal formal exposure to education in reading and writing with being some being able to write only their own name while most of them do not have any reading or writing habits (Morgado et al., 2009). The next level comprises the individuals who completed 5th to 6th grade and/or 7th to 9th grade and know how to read and write (Morgado et al., 2009). The third group probably presents those with well-automatized reading and writing skills, reaching the highest scores of MMSE (Morgado et al, 2009).

The data was statistically analyzed using the software IBM SPSS (Statistical Package for the Social Sciences) Statistics version 21 for Windows 7.

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For the descriptive analysis, descriptive statistical parameters were used; central tendency (mean) and dispersion measures (standard deviation), as well as the calculation of simple and relative frequencies. The sample's normality of distribution was tested by the Kolmogorov-Smirnov Test. Parametric statistic tests were used, namely the Pearson's test and ANOVA were used for a normal distribution of the sample. The significance level was established at 5%.

6. Findings

The sample subjects had an average of 79.5 ± 7.8 years old (table 1) with prevalence of females (71.2%). The most frequent marital status was widow (54.2%) followed by married (36.4%) while (6.8%) were single and (2.5%) were divorced. In accommodation type, 55.1% were living in an institution for elderly people, 43.2% on their own or rented premises and 1.7% in the family residence. In terms of social activity, most of the subjects (43.2%) didn't mention any; 10.2% used to "hang out with friends" and another 10.2% "go out to a coffee shop". Only 2.5% said they used to "go out with friend and go to a coffee shop, church and cinema/theater".

Table 1. Sample Characterization

Characterization	TOTAL (N=118)
Age (years)	79,53 ± 7,8
Gender	
Female	N=84 (71,2%)
Male	N=34 (28,8%)
Marital status	
Single	N=8 (6,8%)
Married	N=43 (36,4%)
Widow	N=64 (54,2%)
Divorced	N=3 (2,5%)
Family situation	
With a partner	N=25 (21,2%)
With partner and daughter(s)/son(s)	N=5 (4,2%)
With daughter(s)/son(s)	N=4 (3,4%)
Alone	N=19 (16,1%)
Nursing home	N=65 (55,1%)
Type of accommodation	
Institution for elder people	N=65 (55,1%)
Own or rented residence	N=51 (43,2%)
Family's residence	N=2 (1,7%)

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Social activity	
None	N=51 (43,2%)
Hang out with friends	N=12 (10,2%)
Go to a coffee shop	n=12 (10,2%)
Hang out with friends, go to church, coffee shop and/or cinema/theatre	N=3 (2,5%)
Category of diseases	
None	N=14 (11,9%)
Cardiovascular	N=30 (25,4%)
Metabolic	N=15 (12,7%)
Osteoarticular	N=11 (9,3%)
Others	N=3 (2,5%)
More than one set	N=31 (26,3%)
More than two sets	N=14 (11,9%)
Medication	
Yes	N=108 (91,5%)
No	N=10 (8,5%)
Literacy	
0-2 Years	N=39 (33,1%)
3-6 Years	N=62 (52,5%)
≥ 7 Years	N=17 (14,4%)
Occupational activity	
Primary sector	N=30 (25,4%)
Secondary sector	N=7 (5,9%)
Tertiary sector	N=81 (68,6%)

In this sample, 33.1% of the subjects had 0 to 2 years of literacy, 52.5% had 3 to 6 years and 14.4% had 7 or more years of literacy. The anterior professional activity was classified into three sectors: primary (25.4%), secondary (5.9%) and tertiary (68.9%). The diseases where also divided into different categories, where 11.9% said they did not have any disease 25.4% said they have cardiovascular diseases, 12.7% had metabolic diseases and 9.3% osteoarticular diseases. Another 2.5% did not fit in any of the previous categories. Some of the subjects presented a combination of two (26.3%) or more (11.9%) categories of diseases. 91.5% of the subjects usually take medications while 8.5% did not. The average of different medications was 4.9 ± 3.2 per day (table 1).

According to Table 2 the average results for right HGS scores were 21.34 ± 8.2 Kg and for the left was 20.14 ± 7.4 Kg, which means that average scores do not indicate the existence of risk to a future functional dependency. The IPAQ scores shown that 33.9% of the sample fell in "low" category, 38.1% in "moderate" and 28% in "high", highlighting a bigger percentage of individuals in the mid category. For the SF-12, physical dimension had mean scores of 37.1 ± 10 points and mental dimension of 44.5 ± 11.4 points, which indicates lowest level of health state for the elderly.

Table 2. Mean Scores for SF-12, GDS, Right and Left HGS and TUG

Measure Instruments	N	Minimum	Maximum	Mean	Standard Deviation
SF-12 (physical dimension)	117	15,96	57,21	37,0883	10,03602
SF-12 (mental dimension)	117	17,58	65,76	44,5267	11,42971
GDS	118	1	25	13,69	5,934
Right Hand Grip Strength (Kg)	116	1,0	50,0	21,337	8,2170
Left Hand Grip Strength (Kg)	116	6,0	47,0	20,138	7,4301
TUG Test (seconds)	117	5	96	18,67	14,085
N valid	112				

Interpretation of TUG scores differ within ages, so the results must be evaluated according to pre-established ranges of age (Table 3). Thus, individuals with ages ranging from 65 to 69 years old (n = 17) presented an average of 8.65 ± 1.6 seconds, from 70 to 79 years old (n = 41) had an average of 15.87 ± 15.5 seconds and between 80 and 99 years old (n = 60) had an average of 23.8 ± 13.2 seconds. Therefore, is possible to conclude that only individuals between 65 to 69 years old presented a good level of functional mobility, once the 9 seconds threshold was established according to the evidence presented. The rest of the sample in both the other two age ranges exceeded the threshold in 10.2 and 12.7 seconds respectively. As so, interventions to improve mobility, balance and/or strength in those two last groups of individuals are supported, such as in the first ones (65 to 69 years old) in order to promote and preserve the individual's abilities, once they show results very close to the threshold and could benefit from it.

Table 3. Mean times for TUG (seconds) according with ages

Age Range	Mean	N	Standard Deviation
60 to 69 years old	8,65	17	1,618
70 to 79 years old	15,87	40	15,502
80 to 99 years old	23,38	60	13,177
Total	18,67	117	14,085

After the GDS scores were analyzed according to the pre-established categories (Table 4), it was found that 28.8% of the elderly do not suffer from depression, 55.9% have an on-growing severity of depression and 15.3% are severely depressed.

Table 4. Subjects divided into GDS categories

GDS Categories	Frequency	Valid Percentage	Accumulated Percentage
Elders with growing severity of depression	66	55,9	55,9
Elders seriously depressed	18	15,3	71,2
Elders without depression	34	28,8	100,0
Total	118	100,0	

Connecting family situation with GDS scores revealed that subjects living with a partner and daughter(s)/son(s) are the ones with a better average of GDS scores (7.80 points), followed by the ones living with a partner (11.32). The subjects living alone presented an average score of 13.37 points, the ones living with daughter(s)/son(s) 14.75 and the ones living in a nursing home obtained the worst results of 15.08 points in average. Since those categories had a small number of subjects, non-parametric tests were used to obtain the p value. The results show a statistically significant difference between categories ($p = 0.016$).

The relationship between GDS and social activities verify that individuals without any social activity present in average the worst values for GDS (15.78 points) and the ones with the most number of social activities (hangout with friend, go to church, to coffee shop and cinema/theater) had the best scores for GDS (8 points). As with family situation, non-parametric tests were used to obtain the p value, verifying the existence of statistically significant differences between groups of different activities ($p = 0.009$).

The GDS scores do not present a significant correlation with diseases categories as it was established that there are no statistically significant differences between categories in the average scores of GDS ($p = 0.815$).

Based on Pearson's correlations, a significant negative correlation was verified between GDS and SF-12, such in physical dimension ($p = 0.000$) and in mental dimension ($p = 0.000$). Thus, whenever lower scores in GDS, were found, the higher were the SF-12 scores, which means a higher health status for the subject.

The correlation analysis between GDS and IPAQ (Table 5) revealed a statistically significant negative correlation ($p = 0.000$) meaning that lower GDS scores are related to better IPAQ scores; in other words, the better the levels of physical activity. A statistically significant

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positive correlation (p = 0.000) was verified between GDS and TUG, which means that when subjects attain lower scores in GSD, the time necessary to perform the TUG test is also lower which corresponds to a better functional mobility. Between GDS and HGS, there was a statistically significant negative correlation (p = 0.000) in right as in left, which means that the lower the scores are in GDS, the higher are the scores in HGS.

Table 5. Correlation between GDS with SF-12, IPAQ, TUG, Right and Left HGS and number of daily medication

Scale		**SF-12 (physical dimension)**	**SF-12 (mental dimension)**	**IPAQ**	**TUG (seconds)**	**Right HGS (Kg)**	**Left HGS (Kg)**	**Number of daily medication**
GDS	Correlation Coefficient	-,462*	-,635*	-,331*	,410*	-,384*	-,413*	,266*
	p value	,000	,000	,000	,000	,000	,000	,005
	N	117	117	118	117	116	116	110

* Correlation is significant at the 0.01 level (2-tailed).

GDS presents a statistically significant positive relationship with the daily intake of different medication (p = 0.005), which means that individuals with lower GDS scores have a lower intake of medication per day. It also shows a statistically significant positive relationship with the subject's age (p = 0.048), which means that the older the subject, the higher the GDS scores.

The MMSE scores analyses are dependent on the subject's literacy levels and the analysis should be considered with that in mind (Table 6). Subjects with 0 to 2 years of literacy presented an average of 20.81 ± 4.3 points, being below the reference values for the Portuguese population of 22 points. The score average for subjects with 3 to 6 years of literacy was 25.66 ± 3.6 points, being above the reference value of 24 points. For the subjects with seven or more years of literacy the average scores were 27.76 ± 2.4, exceeding the reference value of 27 points. Therefore, is possible to conclude that elderly people with only 0 to 2 years of literacy present cognitive impairment. In the evocation item, 24 subjects (20.3%) did not evoke any word, 19 (16.1%) evoked only one single word, 39 (33.1%) two words and 36 (30.5%) recalled all the words. This item is a marker of memory loss so a poor performance in this item is associated with a high risk of progression to dementia (Buchman et al., 2011). For this item, subjects were required to perform a task requiring some short-term memory capacity, essential for evocation ability, and low levels of response may indicate signs of dementia.

Table 6. Mean scores for MMSE according to the subject's years of literacy

Years of Literacy	Mean	N	Standard Deviation
0-2 years	20,82	39	4,346
3-6 years	25,66	62	3,612
≥ 7 years	27,76	17	2,386
Total	24,36	118	4,525

Pearson's correlations found a statistically significant positive relationship between MMSE and SF-12 [both in physical (p = 0.015) and mental (p = 0.0006) dimensions], HGS [both right (p = 0.001) and left (p = 0.026)], IPAQ (p = 0.003) and literacy (p = 0.000). Therefore, subjects with higher scores in MMSE presented a higher perception of health status (with a more significant correlation to the mental dimension), higher levels of strength, higher levels of physical activity and more years of literacy. At the same time, a statistically significant negative correlation was found between MMSE and TUG (p = 0.000) and age (p = 0.001). Therefore, subjects with higher MMSE scores completed the TUG test in less time and were younger (Table 7).

Table 7. Correlation between MMSE with SF-12, IPAQ, TUG and Right and Left HGS

Scale		SF-12 (physical dimension)	SF-12 (mental dimension)	IPAQ	TUG (seconds)	Right HGS (Kg)	Left HGS (Kg)
MMSE	Correlation Coefficient	-,190*	,057	-,462**	-,385**	,288**	,271**
	p value	,048	,539	,000	,000	,002	,003
	N	109	117	117	116	115	115

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

It was noted through ANOVA analysis that gender does not have a significant influence in MMSE scores. A statistically significant negative correlation (p = 0.011) between literacy and age was found, meaning that subjects with more years of literacy are younger than the others.

Correlation analysis between SF-12 and IPAQ verified that there is no statistically significant correlation for IPAQ with neither physical (p = 0.539) nor mental (p = 0.101) dimensions of SF-12 (Table 8).

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Table 8. Correlations between SF-12 with number of daily medications, IPAQ, GDS, TUG, Right and Left HGS and MMSE

SF-12 Dimension		**Number of different daily medication**	**IPAQ**	**GDS**	**TUG (seconds)**	**Right HGS (Kg)**	**Left HGS (Kg)**	**MMSE**
Physical dimension	Correlation Coefficient	-,190*	,057	-,462**	-,385**	,288**	,271**	,224*
	p value	,048	,539	,000	,000	,002	,003	,015
	N	109	117	117	116	115	115	117
Mental dimension	Correlation Coefficient	-,228*	,152	-,635**	-,328**	,182	,265**	,251**
	p value	,017	,101	,000	,000	,052	,004	,006
	N	109	117	117	116	115	115	117

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Between SF-12 and TUG, there was a statistically significant negative correlation in both dimensions (p = 0.000), meaning the higher the SF-12 scores, the less time is needed to perform the TUG test. There is also a statistically significant negative correlation with the intake of daily medication both in physical (p = 0.048) and mental dimensions (p = 0.017), meaning that the higher the SF-12 scores, the less is the intake of medication taken daily by the subject (with a most significant correlation with the mental dimension). Finally, a statistically significant positive correlation was found both in physical (p = 0.003) and mental (p = 0.004) dimensions for the left HGS, meaning that higher scores on SF-12 are related to higher values of GHS. However, the correlation with right HGS is only positively significant (p = 0.002) in the physical dimension, but it is not significant in the mental one, although the values are close to it (p = 0.052).

7. Conclusions

The results of this study verified lower levels of depression in subjects with better health perception and quality of life, corresponding to Chang-Quan et al. (2010), which states the evaluation of a state of bad health is a predictor to increasing depression confirms that subjects with a poor health state have higher levels of depression (Morgado et al., 2009; Chang-Quan et al., 2010). The correlation analysis between GDS and TUG and between GDS and HGS found that subjects with lower scores for GDS (low levels of depression) needed less time to perform the TUG test and had higher levels of HGS, higher physical performances, hand grip strength and mobility for the subjects with higher levels of depression, with an evident and significant gradient between the averages of depression scores and physical performance

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levels. Vilagut et al. (2016) noted the disability in daily-life activities (in which strength and mobility are very important) as a predictor for depression.

Between GDS and IPAQ scores, the results concurred that the lower the GDS, the higher the IPAQ scores. Elderly presenting best levels of physical activity have lower levels of depression. According to Kvæl et al. (2017), promoting physical activity may be a protection against end-of-life depression, which underscores the vital importance of physical activity for the elderly.

The results of this study state a significant correlation between GDS and social activity, intake of daily medication and family situation. Changes in older people's life, with a decreasing social-familiar support, loss of occupational status and decrease of social inclusion, are often a reason to trigger feelings of solitude and loneliness, leading to depressive states (Petitte et al., 2015). A state of good mental health is associated with better social networks (Ivanovs et al., 2018).

The study suggested that subjects with higher scores on MMSE presented a better perception of health status, had bigger levels of strength, higher levels of physical activity and more years of literacy. These results are in accordance with the evidence, once the same correlations are observed in other studies. Kulason et al. (2016) showed an improvement of cognitive abilities through a cognitive stimulation program, which had a significant effect in quality of life perception, as shown at the health state and social inclusion scale, meaning for instance an improvement in neighbor relationships.

The hand grip strength measure may be a useful tool in geriatric practice to identify a risk of functional and cognitive decline in older people (Zammit et al., 2018). A lower HGS predicts a cognitive function decline in the oldest elders (Zammit et al., 2018). A study developed by McPhee et al. (2016) verified that higher levels of physical fragility based on four components – gripping strength, gait time, body composition and tiredness – are related to an increase in global cognitive decline rate in five cognitive systems (episodic memory, semantic memory, operating memory, perceptual speed and space-visual abilities) (McPhee et al, 2016). Gripping strength and gait time were more strongly associated with light cognitive impairment.

Kimura et al. (2012) show the introduction of moderate physical activity (equivalent to vigorous walking) in daily life as a simple, inexpensive way to help prevent age related cognitive decline. A study by Li et al. (2012) observed a significant correlation between the highest levels of physical activity in the beginning of the study with a slower decline of cognitive performance when compared with lower levels of physical activity. The changes in

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physical activity rate had a significant association with the cognitive performance variation rate (Li et al., 2012).

Nonetheless, subjects with high scores in MMSE are younger. The scores are affected by demographic variables, decreasing with age and lowest education but have no significant influence from gender (Morgado et al., 2009) as shown by the ANOVA analysis. The younger elderly also completed TUG in less time; thus gait should not be considered as an automatized simple motor activity independent of cognition (Engeroff, 2018). Ayan et al. (2013) noted that gait speed is strongly influenced by cognitive levels (Engeroff, 2018). In fact, not only significant differences were observed between patients with and without cognitive impairment; it was also proven that the severity of the degree of cognitive impairment is directly related with TUG's final scores (Engeroff, 2018). High scores of TUG were significantly associated with higher age and level of cognitive impairment (Engeroff, 2018). According to a study by Bramell-Risberg et al. (2012) with 2115 individuals to investigate if different lower limb physical tests – measuring the movement speed and postural control – are associated with cognitive deficit in older people, the study found a significant correlation in these elements. A slower speed and low postural control were correlated to a higher risk of cognitive impairment (Bramell-Risberg et al., 2012). Gait is usually seen as a highly automatized motor assignment which requires a cognitive input from a minimal superior level (Bramell-Risberg et al., 2012). This point of view may be considered quite simplistic and, actually, gait can be a very complex motor task, which needs attention and higher superior cognitive functions, such as executive functions (Bramell-Risberg et al., 2012). Buchman et al. (2011) shown a temporal correlation between low levels of a long set of cognitive abilities and the succeeding development of mobility difficulties, suggesting the existence of common pathophysiological processes playing a role both in cognitive decline and mobility among the elderly.

Higher scores in the physical dimension of health were reflected in the mental dimension and better scores in both dimensions were related to higher levels of strength. A low hand grip strength predicts a quicker decline in daily life activities (functional health domain) (Zammit et al., 2018). At the same time, subjects with higher scores both in physical and mental dimensions of health completed TUG in less time and with a lower intake of medication per day. These findings concur with that of Henchoz et al. (2008) who outline a correlation between perception of health decay (strongly connected with health status) with functional ability decay and growing usage of medication (Ayan et al., 2013).

Another goal of this study was to identify which instruments better correlate with depression, cognitive state and health status. The results concluded that TUG is the measure that presents the best correlational coefficient with depression, cognitive state and health status (both in physical and mental dimensions). Therefore, through TUG's performance (a simple test for functional mobility (Bramell-Risberg et al., 2012) it is possible to collect information about the needs of cognitive and health status evaluation, in accordance to the obtained results.

Hence, it is possible to conclude that all the measures have significant correlations with depression and cognitive state. Thus, its evaluation should be a recurrent practice in physical therapy, as depression and/or cognitive deficits may hamper the treatment process and compromise the results. The application of simple and easy measures like TUG have been revealed to have good correlation levels with depression, cognitive state and health, allowing a faster global evaluation with a good ability to identify individuals with more needs.

The key role of physiotherapy is, in the general sense, related with maximization of the patient's functionality. Through the results of this study, it is possible to observe a need for intervention to be based in a bio-psychic-social environment. In other words, it's important to consider the elder person in all of his/her dimensions and not only in the one that is intended to improve. As this study suggests, depression and cognitive state seem to have a strong correlation with strength and mobility levels, affecting the elderly health status. Physical activity may also be seen as a measure that generates positive effects in cognitive performance, thereby making it a possible way to decrease incapacity in older people.

In conclusion, when intervening with older populations, it is important to take into account larger perspectives of functionality than in other populations, since aging is clearly related to cognitive function deterioration.

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