

Physical Activity, Depression and Anxiety Among the Elderly

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Accepted: 28 May 2012
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Abstract The aim of this study was to compare by sex, physical activity, and academic qualifications the symptomatology of depression among elders. The sample consisted of 140 elderly, 70 elements were male and 70 female, aged over 62 years. The instruments used to assess the dependent variables were the Scale of Moderate to Vigorous Physical Activity, the Beck Depressive Inventory and the State-Trait Anxiety Inventory. Significant gender effects were obtained demonstrating that those who practiced physical activity had lower rates of depression and anxiety. Comparisons showed that women had higher values than men. At the level of educational attainment it was found that individuals with lower level of education tended to have higher values for both depression and anxiety. Finally, a significant correlation was identified between physical activity, depression and anxiety, and for trait anxiety, however this correlation was not statistically significant. It was concluded that physical activity is associated with lower levels of depression and anxiety.

Keywords Physical exercise · Depression · State anxiety and trait anxiety · Elderly

1 Introduction

In today's world it is virtually impossible to know how many individuals suffer from mental illness. To keep updated statistics has been particularly difficult over the past

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decades due in part to the repeated changes in diagnostic criteria that have been implemented. According to the World Health Organization (WHO), approximately 450 million people worldwide suffer from some form of mental illness, about 121 million of these present symptoms of depression and are treated by family doctors, and about one million of these will commit suicide (Organização Mundial de Saúde 2001). A more comprehensive understanding of depression and anxiety has become necessary to differentiate the usage of the terminology of depression and anxiety in its many applications in common language. Frequently, the words depression and anxiety are used to refer to as a disease, sometimes as a symptom, and also as a way to describe a personal experience (Callahan and Berrios 2005). The introduction of these concepts in secular discourse may, in part, explain the weak correspondence between the presentation of symptoms and appropriate clinical diagnosis (Ustun and Sartorius 1995).

It has been suggested that individuals with higher levels of state-anxiety and trait-anxiety tend to have a higher incidence of depression and anxiety disorders in comparison to individuals in the normal population (McLean and Woody 2001). State-anxiety represents an individual's experience of short-term anxiety but these emotional states are transitory in nature. In turn, trait-anxiety reflects a generalized tendency to experience depression that relates to personal characteristics (Kalinin 2011).

Depression among the elderly is one of the most serious public health problems that modern societies face (Chapman and Perry 2008). The appearance of depression tends to be associated with high levels of suicide in adults. In the elderly, depression is associated with a marked reduction in their cognitive abilities which, in turn, is commonly accompanied by a decrease in social and physical activities (Fiske et al. 2009).

The literature has shown that there is a strong relationship between physical activity and depression demonstrating that more active individuals have a lower incidence of depression (Chodzko-Zajko et al. 2011; Koukouvou et al. 2004; Nelson et al. 2007; Roshanaei-Moghaddam et al. 2009). Furthermore, some have argued that physical activity has therapeutic effects in relation to depression (Al-Turkait et al. 2011; Jiang et al. 2004; Mata et al. 2011; Oman and Oman 2003). Nelson et al. (2007, p. 1102) recommended that all seniors should be physically active and that given the relevance and strength of evidence, physical activity should be one of the leading areas of focus for the prevention and treatment of diseases associated with any form of disability. Still others argue that the involvement of the elderly with physical activity brings benefits in aspects of life such as wellness, fitness, and social relationships (Davis et al. 2007). According to Cardoso et al. (2008), once involved, elderly people once they adhere to a physical activity program they only tend to abandon the practice for reasons such as health problems of the spouse, or because the programs are not properly suited to their psychomotor capacities. These suggestions are based on studies that did not address mental health among the elderly.

In the literature, it is suggested that depression and anxiety should be considered concurrently when studying non-clinical populations (Stewart and Chambless 2009), since these tend to be associated with one another, namely individuals who are diagnosed with anxiety, as time passes by tend to develop depressive states, but the inverse might not be true. Recent studies show a tendency to include physical activity in therapeutic interventions, because it has beneficial effects in both depression and anxiety. These diseases have common pathophysiological processes, among them the serotonergic system (Binder and Nemeroff 2010), and for this reason both tend to respond to the same medications. However, there is a need to replicate these results in studies among the elderly.

There is a growing body of literature that establishes the relationship between physical activity and health (Cavil et al. 2006; Hardman and Stensel 2009). Physical activity is

recommended for overall mental health in general as well as for specific mental health conditions. Recent research points to the therapeutic benefits that exercise can have when implemented as a therapeutic complement in the treatment of anxiety (Araújo et al. 2007). Physical activity, as part of a healthy lifestyle tends to improve quality of life, physical and psychological well-being, and this results in reduced levels of depression and anxiety (Courneya et al. 2000; Netz et al. 2005).

Physical activity contributes to the reduction of psychological distress among the elderly because it promotes psychosocial interaction, improves self-esteem, helps in the maintenance and improvement of cognitive functions, and serves to reduce the frequency of relapses of depression and anxiety (Stella et al. 2002). More recently, in the treatment of mental health, physical activity has become one of the formal aspects of the cognitive behavioral treatment model known as BEAST (Behaviour, Emotion, Activity, Situation and Thoughts; Gilson et al. 2009; Lawlor and Hopker 2001).

Exercise as a therapeutic tool, has several advantages, particularly in regard to reducing the sensitivity of serotonin receptors in certain brain areas which is considered to be the designated system down-regulation. In a study by Lai et al. (2006) comparing different therapeutic programs these researchers found that the subjects who participated in the program based on exercise experienced greater therapeutic benefits, namely in reducing symptoms of depression. From clinical reports we learn that literacy levels tend to be associated with the incidence of mental illness and particularly in the case of depression and anxiety (Weiss et al. 2009). Gazmararian et al. (2000) found that individuals with low literacy levels are 2.7 times more likely to develop depression. Francis et al. (2007) designed a study that aimed to test whether there was a positive relationship between levels of self-efficacy and the incidence of symptoms of depression. In this regard, higher self-efficacy was anticipated to be related to the desire of individuals with higher self-efficacy to tackle challenging situations and, concomitantly, to experience a decrease in susceptibility to stress and depression, the authors concluded that persons with low literacy and symptoms of depression that depression symptom lessen as self-efficacy scores improve scores improve during participation in adult basic literacy education programs. Although there is a considerable amount of research on depression and anxiety, studies that address more specifically the relationship between academic literacy and levels of depression and anxiety are practically nonexistent. Indeed most of the research in this domain has been done in English speaking countries.

For the purposes of the present study, the relationships among physical activity, depression, and anxiety in elderly individuals was the focus of the study. The relationship was further examined comparing the participants by sex, level of physical activity and educational background.

2 Methods

The study was a cross-sectional, descriptive and correlational study.

The sample was comprised of 140 elderly individuals (70 women and 70 men) recruited from the region of Trás-os-Montes e Alto Douro in northern Portugal and lived in residential homes or attended daily care centers for the elderly on a regular basis. Their ages ranged from 62 and 93 years old, with the average age of 74.12 (SD = 6.74) years. The sample was further divided into four groups based on education level: Group 1 ($N = 25$, 17.9 %) consisted of those who could neither read nor write; Group 2 ($N = 95$, 67.9 %) was comprised of those who that attended school until 4th grade; Group 3 ($N = 10$, 7.1 %)

involved those who attended between 5th and 9th grade, and Group 4 ($N = 10$, 7.1 %) involved those who had completed secondary school (12th grade) and continued in higher education. Comparisons by gender and educational attainment had a sample of 130 subjects ($H = 60$, 46.15 %, $M = 70$, 53.85 %), since the highest educational levels found in women was the 9th grade. Thus, males with higher levels of education were removed from the gender comparison. Based on the participants' levels of involvement in physical activity, the sample was divided into two groups: inactive (46, 32.86 %) and active (94, 67.14 %).

2.1 Instruments

A variety of instruments were included to assess the variables addressed in the study. To assess customary physical activity levels, The Physical Activity Scale (developed by Prochaska et al. 2001) was employed. To assess depression, the Beck Depression Inventory (BDI) originally developed by Beck et al. (1961) was used. State and trait anxiety were assessed through the Trait State Anxiety Inventory (STAI) developed by Spielberg et al. (1970) and which was translated and validated in the Portuguese language by Fioravanti et al. (2006).

The scale developed by Prochaska et al. (2001), was based on items from the Youth Risk Behavior Survey. The initial version consisted of items used to quantify the number of days in which individuals engaged in physical activity for at least 30 min, per session, during a normal week. Taking into consideration the age of participants for the present study, the intensity of physical activity was not considered. Only the information about the number of days and daily time of activity (if it exceeded 30 consecutive minutes) was considered and active and inactive groups were formed from this data.

The BDI consists of 21 questions and in this study was treated as a unidimensional scale to provide a general score for depression symptoms. The inventory was initially developed to serve as a guide for clinical interview, but over the decades it became one of the most widely used instruments for assessing depression in studies with non-clinical samples. The obtained responses in relation to the severity identified, were categorized from 0 to 4, where 4 represented the highest severity index. The purposes of this study did not justify the use of cutoff values suggested in the literature (see Maluf 2002), which propose that scores from 1 to 9 indicate the absence or low level of depression; scores between 10 and 29 suggest a low to moderate depression. Values above 30 suggest that subjects should be recommended to consult a professional. It should be kept in mind that scores in one test per se do not allow to establish a diagnostic of depression.

The inventory of state and trait anxiety, known as the STAI, consists of 40 questions, which include twenty state anxiety and twenty trait anxiety items. In the treatment of the data some of the items were reverse phrased. In this project, the questionnaire was presented in a Likert-type response format with possible scores ranging from 1 to 4. The higher the scores obtained indicated the higher the level of anxiety. The authors of this survey suggest the following cutoff values: 20–39 represent low levels of anxiety, 40–59 moderate anxiety, and 60–80 represent high levels of anxiety (Lam et al. 2005).

2.2 Procedures

The questionnaires were administered by research assistants specifically trained for this project and in the use of these questionnaires. Training focused, in particular, in the application and clarification of each item to the respondent without influencing the

response choice. This concern reflects the fact that this age group of individuals residing in this part of the country, presented low levels of literacy, as well as poor reading habits throughout life. Thus we prepared to provide help and clarification, without influencing any type of answer. All participants were informed of the aims of the study and how their anonymity would be protected and how confidentiality would be ensured. The participants all understood that they could discontinue their participation at any time.

This study was approved by the university scientific committee. In Portugal it is this commission that performs the same functions that ethic committees do in other universities and countries.

2.3 Statistical Analysis

Initially, descriptive statistics were calculated as mean and standard deviations followed by the analysis of data normality. To this end we included an examination of skewness and kurtosis for the univariate comparisons. Normal distributions were obtained as all skewness and kurtosis values ranged from -1 to 1 . Multivariate analysis of variance followed by univariate analysis was used when comparing the subjects of the sample according to gender, level of physical activity and educational attainment. The values of beta squared (η_p^2) were selected to highlight the effect size of the statistical comparisons that were made and in relation to the following classifications for strength of the relationship: low $>.01$, moderate $>.06$ and strong $>.25$ (Cohen 1992). Although there are proposals for higher cutoff values (Ferguson 2009), we have chosen to adhere to those that are more widely used in the scientific community.

The internal consistency of scales was calculated through Cronbach's alpha statistic and all measures revealed adequate internal consistency (depression, $\alpha = .848$; state anxiety, $\alpha = .893$, trait anxiety, $\alpha = .801$). To compare groups, a determination of whether there was homogeneity of variance and covariance was performed. The SPSS by default provides the results for Box's M test, however some reservation has been raised since this test has been recognized as being very limited for its level of tolerance, thus Dancey and Reidy (2011) argued that researchers should also take into account the relative values provided by the Levine test. In this study, in the values obtained were greater than $.50$ (for sex \times phys. act. = $.97$, and for the case of sex \times hab. literary = $.017$). Given that the dependent variables (depression, state anxiety and trait anxiety) tend to be correlated with each other and normal distribution for all variables was assumed, we used a MANOVA in order to compare the two subgroups (Dancey and Reidy 2011) and for making comparisons of the three dependent variables simultaneously. In order to maintain higher rates of parsimony in the comparisons a 2×2 design was selected, including gender \times physical activity and gender \times educational attainment. In an attempt to simultaneously treat the different independent variables, the organization of subgroups for the variable educational attainment was not equivalent in numbers. Finally we performed a correlation between the three dependent variables under study.

3 Results

This section is organized as follows: first we present descriptive statistics on the basis of the dependent variables under study. Next, the results of the tests are described in order to identify whether there were significant effects in relation to the comparisons between genders, levels of physical activity and educational attainment.

According to the values shown in Table 1, we found that participants in our sample have low values across all the dependent variables.

The overall average for the Depression was 12.22 (SD = 7.74), state-anxiety 37.91 (SD = 11.60), and trait anxiety 39.73 (SD = 9.32). The values for the skewness and kurtosis showed a normal distribution.

A MANOVA was performed with the purpose of comparing the effects of gender on the three dependent variables. The analysis showed that at the level of multivariate comparisons no statistical differences between the sexes were found ($F_{(3,122)} = .844, p = .472$; Wilks' $\lambda = .980$). But when the groups were compared by level of educational attainment there was a significant difference ($F_{(6,244)} = 2982, p = .008$; Wilks' $\lambda = .868$). For the combined effect of the independent variables no significant differences were present between groups ($F_{(6,244)} = .398, p = .880$; Wilks' $\lambda = .981$). Then univariate measures were calculated, and a decision was made to present the F values at the expense of t tests, since there were three conditions in our dependent variables and a normal distribution was obtained.

When analyzing the MANOVA (sex \times physical activity) for the variables of depression, state-anxiety and trait-anxiety, the combined comparisons produced a low effect for depression ($F_{(3)} = 2.152, p > .05$; $\eta_p^2 = .016$, power = .308), and state-anxiety ($F_{(3)} = 3.855, p > .05$; $\eta_p^2 = .028$, power = .496) and a moderate effect for trait-anxiety ($F_{(3)} = 5.769, p < .05$; $\eta_p^2 = .041$, power = .665). When we examined the isolated effects of each independent variable, results showed that sex comparisons presented moderate effects for the three dependent variables under study: Depression ($F_{(1)} = 12.953, p < .05$; $\eta_p^2 = .087$, power = .992), state anxiety ($F_{(1)} = 7.770, p < .05$; $\eta_p^2 = .054$, power = .790), trait anxiety ($F_{(1)} = 10.900, p < .05$; $\eta_p^2 = .074$, power = .906). When the individual effects were calculated as a function of physical activity moderate effects were found for physical activity on depression ($F_{(1)} = 19.284, p < .05$; $\eta_p^2 = .124$, power = .992), state-anxiety ($F_{(1)} = 10.796, p < .05$; $\eta_p^2 = .074$, power = .904) and trait-anxiety ($F_{(1)} = 5.305, p < .05$; $\eta_p^2 = .038$, power = .628; Table 2).

It was found that women had higher values for all dependent variables, compared to men in all three dependent variables of depression, state-anxiety and trait-anxiety (Table 3).

The gender by educational background interaction was further examined but no effect was found for depression ($F_{(2)} = .115, p = .892$; $\eta_p^2 = .002$, power = .067) or trait-anxiety ($F_{(2)} = .195, p = .823$; $\eta_p^2 = .003$, power = .080), but a small effect in state anxiety ($F_{(2)} = .870, p = .421$; $\eta_p^2 = .014$, power = .197) was identified. When the effects were calculated separately by gender a low but not significant effect both in terms of depression ($F_{(1)} = 1.449, p = .231$; $\eta_p^2 = .012$, power = .223) and for the case of trait anxiety ($F_{(1)} = 1.331, p = .251$, $\eta_p^2 = .011$, power = .208) with no effect on state anxiety ($F_{(1)} = .195, p = .659$; $\eta_p^2 = .002$, power = .072). When comparisons were made only at the level of academic attainment, depression values reflected a moderate effect ($F_{(2)} = 4.851, p = .009$; $\eta_p^2 = .073$, power = .793) of difference between the groups. As for the case of state anxiety ($F_{(2)} 2.000 = .942, p = .056$; $\eta_p^2 = .045$, power = .564) a moderate

Table 1 Descriptive and univariate normality

Variable	Range	Mean	SD	Skewness	Kurtosis
Depression	0–40	12.22	7.74	.937	1.011
State-anxiety	20–75	37.91	11.60	.827	.645
Trait-anxiety	23–69	39.73	9.32	.531	–.100

Table 2 Mean, standard deviation and confidence interval analysis of gender \times level of physical activity

Variable	Ind. var.	Men		Women		G-mean (SE) and CI (95 %)
		Mean	SD	Mean	SD	
Depression	Active	8.89	± 5.09	11.59	± 6.16	13.02 (± 6.33), CI = 11.76–14.27
	Inactive	12.59	± 8.14	19.00	± 9.36	
State-anxiety	Active	34.60	± 5.71	36.24	± 8.82	38.69 (± 9.95), CI = 36.73–40.66
	Inactive	37.24	± 13.48	46.68	± 13.12	
Trait-anxiety	Active	37.45	± 7.57	38.90	± 8.15	40.03 (± 8.06), CI = 38.44–41.63
	Inactive	37.29	± 9.12	46.48	± 10.97	

Table 3 Mean, standard deviation and confidence interval analysis of gender \times level of qualifications

	Men	Women	G-mean (SE) and CI = (95 %)
Depression			
Group 1	16.00 (± 2.83)	19.09 (± 10.37)	12.84 (± 1.056), CI = 10.75–14.93
Group 2	9.54 (± 6.67)	12.98 (± 6.66)	
Group 3	9.16 (± 6.41)	10.25 (± 7.85)	
State-anxiety			
Group 1	39.25 (± 12.83)	42.05 (± 12.83)	36.13 (± 1.657), CI = 32.85–39.41
Group 2	35.28 (± 10.98)	41.04 (± 12.24)	
Group 3	31.66 (± 8.47)	27.50 (± 4.28)	
Trait-anxiety			
Group 1	41.14 (± 10.57)	44.14 (± 10.57)	39.14 (± 1.313), CI = 36.54–41.74
Group 2	36.80 (± 8.13)	41.58 (± 9.96)	
Group 3	34.83 (± 3.66)	36.25 (± 7.41)	

effect was obtained, but not significant. With regard to trait anxiety a low effect ($F_{(2)} = .780$, $p = .172$; $\eta_p^2 = .028$, power = .367) with a non-statistically significant difference was found. Differences between groups were obtained from subjects in group 1 and 2 (difM = 7.432, SE = 1.635, $p = .001$, CI = 3.46–11.40) and between 2 and 3 (difM = 9.00, SE = 2722, $p = .004$, CI = 2.39–15.60). The other difference was found at the level of state anxiety and between group 1 and 3 (difM = 8.28, SE = 3387, $p = .048$, CI = -0.32 –9.55). Finally, statically significant correlations between the dependent variables under study were obtained: depression, state anxiety and trait anxiety. The results showed a correlation between depression and state anxiety ($r = .661$, $p = .001$), depression and trait anxiety ($r = .668$, $p = .001$) and state anxiety and trait anxiety ($r = .763$, $p = .001$). All presented strong effects.

4 Discussion

This study examined patterns of relationships among physical activity, depression, state anxiety and trait anxiety in a sample of 140 elderly subjects with lower levels of educational attainment in the north of Portugal. This is one of the most impoverished regions in Europe, where men were never encouraged to practice sports and women were practically

forbidden to do so. Both multivariate and univariate analyses were conducted to identify the combined and individual effects of each independent variable.

The results provided some support for the expectation that physical activity would be associated with a more favorable profile across the depression and anxiety variables. However, it seems to contradict some clinical literature that suggests that among retired people one would expect to find higher levels of depression (Abou-Saleh et al. 2011).

Comparative analysis were used to identify multivariate and univariate effects of gender, level of physical activity and educational attainment in the dependent variables depression, state-anxiety and trait-anxiety. In some aspects, the results support what was established in the literature, particularly in regard to gender differences (Hamen 2003; Licinio and Wong 2005; Maluf 2002) since women presented higher scores than men in both in depression and anxiety. It is worth mentioning that the mean values of the groups revealed low to moderate depression, but that does not require any kind of concern in terms of clinical interventions since the active individuals had mean depression scores below the cutoff values suggested by the authors of the questionnaire.

The results provided additional support to the existing body of knowledge in that women presented higher depression scores than men. This outcome may be attributable in part to cultural traditions that are gradually changing. On the other hand, considering that all participants are retired, it could be anticipated that men would be expected to present higher values of depression. According to the arguments advanced by Parker (2005) individuals who were the primary financial contributors to the household should be expected to experience higher levels of depression. Taking into account that retirement takes place at 65 years of age, the data suggests that the involvement of older people in active life, even living in nursing homes, serves to contradict any adverse effects resulting from the fact that they have been retired for some years (Rothermund and Brandtstadter 2003), and that time per se might play a key role in the adaptation process to a new lifestyle as retired people, thus elevated scores in depression might diminish as time goes by.

This finding reinforces the arguments of Nelson et al. (2007) who suggested that physical activity should be implemented as a complement to, or as a preventive treatment for, diseases associated with aging. According to Parker and Parker (2005) the transition to the situation of being retired during the first months tend to be associated with states of satisfaction, followed by an increased incidence of depressed states, and consequently a return to normality. In part, the appearance of depressive states, according to Parker and Parker (2005) may be related to fears associated with concerns about disease and death, and loss of meaning in life, to the extent that the elderly can develop a sense that it is no longer worthwhile to set goals for life, and because upon retirement they lose money and resources such as social support, among others considerations. The results of our study support the view that regular physical activity is effective in preventing deleterious feelings and moods, and therefore corroborated the arguments of Nelson et al. (2007) who advocated for the involvement of the elderly in programs of physical activity.

In the specific situation of depression interpretative cautions area needed. Among other things, older adults are more prone to deny their depressive states, as well as to minimize their lack of interest and satisfaction with the activities they engage in (Shanmugham and Alexopoulos 2005). These symptoms tend to occur in conjunction with the avoidance of social interactions and the absence of signs of sadness. Geriatric depression is in many ways similar to other diseases (Alexopoulos et al. 2007). Associated with mood changes, suicidal thinking and other behaviors, geriatric depression tends to be associated with peripheral bodily changes, including the vegetative syndrome, hypercortisolemia, increased abdominal fat, decreased bone density and risk of developing Type II diabetes

and hypertension (Brown et al. 2004). Among other advantages of the involvement of older people in physical activity programs it is suggested that regular participation in such programs have a moderate effect in combatting the losses of physical condition, and psychosocial adversities which in turn can have an impact on the integrity of various brain structures such as front-striatal, the amygdala and hippocampus, giving way to a greater vulnerability of older adults to depression and anxiety. In the case of women's involvement in physical activity there are other benefits such as a proactive means of preventing depression (Ayala 2011), as well as to reduce the incidence of osteoporosis and to improve the physical condition (Kenny et al. 2010).

The analysis of the combined effect of gender and physical activity produced statistically significant differences. The univariate analysis showed differences in all dependent variables being studied in relation to both gender and physical activity. In the case of depression it was found that low to moderate effects were present for physical activity and for state and trait anxiety a weak and nonsignificant effect was obtained. Joint comparisons produced small effects for depression and state anxiety and moderate trait anxiety. Results from the univariate comparisons, by levels of physical activity, showed strong effects for depression, anxiety, and weak to moderate effects for state and trait-anxiety. These results suggest that physical activity should be considered beneficial for the improvement of these variables, but their effects tend to be experienced differently by men and women.

The present study found statistically significant differences between the different levels of educational attainment, and comparisons showed mild effects on depression and state-anxiety. Through descriptive analysis on depression, trait and state-anxiety, it was found that women had higher values than men on depression as well as on state and trait-anxiety. Our results corroborated other proposals (Netz et al. 2005; Vasconcelos-Raposo et al. 2009; Walsh 2011), that have argued in favor of the beneficial influence of physical activity in reducing symptoms of depression and anxiety. The data obtained showed that active individuals had lower depression and anxiety levels when compared to inactive older adults.

The literature has suggested a relationship between educational levels and the incidence of depression and anxiety among older adults with greater educational attainment providing a preventive effect in the same way that higher socio-economic status and greater involvement in interest activities and religious practice would be beneficial (Fiske et al. 2009; Gallo et al. 2005; Haringsman et al. 2006; Klebbers et al. 2010; McKenzie et al. 2010). Higher levels of depression were anticipated, taking into account the educational attainment of the sample. Apparently the sample presented effective coping mechanisms to deal with such pressures, despite the low levels of education found.

For the correlational analysis among the dependent variables, the results showed a significant and strong effect in the associations between the variables included. The size of the effects of these associations, in some way, reinforced the arguments of those who advocate for the need to rethink the existing diagnoses in which depression and anxiety are presented as separate entities (Das-Munshi et al. 2008), and even supported the incorporation into the ICD-10 the term "mixed anxiety-depression-states" (Al-Turkait et al. 2011; Jankins et al. 2011). The results, in part, reflect the impact of the management policy to implement physical activity programs in residential homes and day centers for older adults.

Given the results we conclude that regular physical activity has a beneficial effect on mental health of older adults. Individuals who engage in regular physical activity presented lower levels of depression, state and trait anxiety. Comparisons by sex revealed that women have higher levels of depression, state anxiety and trait anxiety. Finally, we

observed strong effects on statistical relationships among the dependent variables studied suggesting further theoretical interpretation for the comorbidity of depression and anxiety.

Future studies should try to overcome some of the limitations of this study and could include data relative to the length of time older adults have been retired; their marital status; widowhood status; history of physical activity and characterization of professional activities; and their levels of religiosity and spirituality.

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