

Physical activity and depressive symptoms in community-dwelling elders from southern Brazil

Atividade física e sintomas depressivos em idosos sul-brasileiros da comunidade

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Abstract

Objective: To determine the existence of a relationship between physical activity and depressive symptoms in community-dwelling elders. **Method:** This is a cross-sectional, population-based study, which included 379 community-dwelling elders from Novo Hamburgo, state of RS, Brazil. The level of physical activity was estimated using the International Physical Activity Questionnaire and depressive symptoms were diagnosed according to the Yesavage Geriatric Depression Scale. The association between the level of physical activity and depressive symptoms was analyzed by logistic regression. **Results:** A tendency towards a lower prevalence of depressive symptoms was observed in individuals with higher levels of physical activity, both in the sample as a whole as well as among men, but not among women (p for linear trend 0.04, 0.03 and 0.36, respectively). The odds ratio of the presence of depressive symptoms in the very active group as compared against that of the insufficiently active group was 0.32 (95% CI: 0.12-0.86) for men and 0.76 (95% CI: 0.39-1.46) for women. **Conclusion:** In this population of aged individuals, more intense physical activity is related to a lower prevalence of depressive symptoms. As shown by gender stratification, physical activity is inversely related to depressive symptoms in men, albeit not in women.

Descriptors: Aged; Motor activity; Signs and symptoms; Depression; Geriatrics

Resumo

Introduction

Population ageing is a major human challenge. It results in changes to the epidemiological profile, with an increase in the prevalence and incidence of chronic illnesses such as heart disease, cancer and depression. The prevalence of communicable diseases is decreasing while that of the chronic-degenerative diseases is increasing, thus creating different demands in terms of population-oriented health care policies.^{1,2}

Objetivo: Avaliar a relação entre atividade física e sintomas depressivos em idosos da comunidade. **Método:** Estudo transversal de base populacional que incluiu 379 idosos da comunidade da cidade de Novo Hamburgo-RS, Brasil. O nível de atividade física foi estimado pelo Questionário Internacional de Atividade Física e os sintomas depressivos foram diagnosticados por meio da Escala de Depressão Geriátrica de Yesavage. A associação entre nível de atividade física e sintomas depressivos foi analisada por regressão logística. **Resultados:** Foi observada uma tendência a menor prevalência de sintomas depressivos em indivíduos com níveis mais altos de atividade física na amostra como um todo e entre os homens, mas não entre as mulheres ($p = 0,04, 0,03$ e $0,36$, respectivamente). O odds ratio para a presença de sintomas depressivos no grupo muito ativo, quando comparado com o grupo insuficientemente ativo, foi de 0,32 (IC 95%: 0,12-0,86) para homens e 0,76 (IC 95%: 0,39-1,46) para mulheres. **Conclusão:** Nesta população de idosos, a atividade física mais intensa está relacionada com uma menor prevalência de sintomas depressivos. Como demonstrado pela estratificação por gênero, a atividade física está inversamente relacionada com sintomas depressivos em homens, mas não em mulheres.

Descritores: Idoso; Atividade motora; Sinais e sintomas; Depressão; Geriatria

Depression, which is a chronic disorder associated to high levels of strain, requires that a significantly high amount of resources be invested in health care systems. It is currently considered the fourth cause of disability-adjusted life years for incapacity or premature death. According to World Health Organization (WHO) estimates, in 2020, major depressive disorder will be the second most important cause of incapacity

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in the world.³ Nevertheless, a high number of patients is still not properly diagnosed and frequently fail to receive adequate treatment once the disorder has been identified.⁴

Elderly individuals present certain characteristics which may frequently lead to symptoms of depression. These characteristics include biological factors, the presence of other chronic diseases and psychosocial factors such as inadequate social support, grief and mourning.^{5,6} Studies investigating the prevalence of depression in elderly populations present variable results, ranging from 4-5% to over 30%, depending on the population analyzed and the evaluation instruments employed.⁷⁻⁹

Although around 50% of the cases respond well to pharmacological or psychotherapy, resistance to treatment can be attributed to the disorder's chronic course. Older patients present higher risks of experiencing an adverse effect of antidepressant drugs due to the pharmacokinetic alterations associated to aging and as a result of the simultaneous use of other drugs for comorbidities, thus increasing the potential for harmful drug interaction.^{4,10}

Regular physical activity has been associated not only with a reduction in the risk of certain chronic diseases such as diabetes mellitus, cardiovascular diseases, osteoporosis and certain types of cancer, but also to lower mortality indices.¹¹⁻¹⁶ Observational and experimental studies have shown an inverse relationship between the level of physical activity and depressive symptoms but, in aged individuals, this phenomenon remains largely unclear. Studies investigating this relationship in elderly populations are scarce and often present methodological flaws.¹⁷⁻²⁹ To contribute to this discussion, the present study examined the association between depressive symptoms and the level of physical activity in community-dwelling elders.

Method

A total of 379 individuals (127 males and 252 females) were enrolled in the study. Details on the methodology used have been published previously.³⁰ In brief, we conducted a study with senior citizens from the town of Novo Hamburgo in Rio Grande do Sul, which is a state located in the southern part Brazil. According to the Brazilian Institute of Geography and Statistics (IBGE), in 2000, the town had a population of 236,000 inhabitants of which about 17,000 were over the age of 60 and 98% resided in urban areas. Gender distribution was as follows: 51% female and 49% male. Thanks to a 19th century immigration wave from Germany, the population is mainly from a German background. The sample was determined with a confidence level of 95% and an error margin of 5%, controlled for age, sex, location in the city and economic stratum according to the population distribution as reported by IBGE in 2000 and to regional data as reported by the National Association of Research Companies (*Associação Nacional de Empresas de Pesquisa*).³¹

Subjects were contacted by telephone or letter, invited to participate in an interview and undergo a metabolic-functional evaluation at the Feevale University Center. All participants agreed to participate in the study and signed an informed consent form. The project was approved by the

Ethics Committee of the São Lucas Hospital (docket number 04/02232), *Pontifícia Universidade Católica do Rio Grande do Sul*, RS, Brazil.

All data were collected by trained investigators. Height and weight were measured using an anthropometric scale (Welmy®, SP, Brazil). Body mass index (BMI) was defined as weight (kg) divided by the square of the height (m). The blood pressure (BP) of subjects who had rested for 10 minutes was measured one time on each arm using a standard mercury sphygmomanometer, and the mean number between the two readings was used for analyses.

Participants filled out the short version of the International Physical Activity Questionnaire (IPAQ).³² The weekly energy expenditure was calculated according to international standards and was expressed as metabolic equivalent task (MET/week) or converted to kcal/wk using the relationship $\text{kcal} = \text{MET} \times \text{weight} \div 60$. Depending on the weekly energy expenditure expressed in MET, individuals were classified as insufficiently active (up to 600 MET/week), sufficiently active (between 601 and 1500 MET/week) and very active (over 1500 MET/week).³³ The short version (15 questions) of the Yesavage Geriatric Depression Scale (GDS) was used.³⁴ The presence of depressive symptoms was determined based on the use of antidepressant medications or a score of five or more points in the GDS. Participants also answered the CAGE questionnaire and two or more positive answers were indicative of the presence of alcohol-related problems.³⁵

Continuous variables are presented as means (standard deviations) and categorical variables as numbers and percentages. Comparisons of the demographic, anthropometric and clinical characteristics of participants with or without depressive symptoms were performed using the chi-square test for categorical variables while the Student's t test or the Mann-Whitney test were used to compare numerical variables.

The prevalence of depressive symptoms at the three levels of physical activity was analyzed using the chi-square test. The odds ratio of the presence of depressive symptoms in each level of physical activity was calculated by logistic regression based on a model adjusted for age, sex and smoking. An analysis stratified by gender was performed. The significance level was established at 0.05 (two-tailed). The statistical analyses were performed using version 13 of the SPSS software (Chicago, IL).

Results

Table 1 summarizes the demographic and clinical characteristics of the subjects according to gender. Females had a body mass index of 28.7 and males of 27.1 ($p = 0.001$). At 68%, hypertension, which was higher in females than in males (74% and 56%, respectively $p = 0.001$) was highly prevalent. Smoking was more frequent in males (20% vs. 7%, $p = 0.001$). Analysis of the alcohol consumption according to the CAGE questionnaire showed a prevalence of 11% among males, 3% among females ($p = 0.004$) and 6% in the sample as a whole. The level of physical activity was homogeneously distributed in the studied population (34% were insufficiently active, 35% were sufficiently active and 31% were very active).

Table 1 - Demographic and clinical characteristics of the sample according to sex

Characteristic*	All (n = 379)	Men (n = 127)	Women (n = 252)	p
Age, years, mean (SD)	69 (6)	69 (6)	68 (6)	0.19
Body mass index, mean (SD)	28.2 (4.9)	28.7 (5.2)	27.1 (4.2)	0.001
Diabetes mellitus, n (%)	39 (10)	12 (9)	27 (11)	0.68
Hypertension, n (%)	257 (68)	71 (56)	186 (74)	0.001
Smoking, n (%)	43 (11)	25 (20)	18 (7)	0.001
Physical activity, median (IRQ)				
MET per week	918 (480-1802)	905 (461-1915)	918 (482-1789)	0.87
Kcal per week	1098 (533-2079)	1077 (590-2320)	1107 (519-1984)	0.32
Level of physical activity [†] , n (%)				
Insufficiently active	127 (34)	42 (33)	85 (34)	0.30
Sufficiently active	133 (35)	37 (29)	95 (38)	
Very active	119 (31)	47 (37)	72 (28)	
Positive answer to two or more CAGE questions, n (%)	22 (6)	14 (11)	8 (3)	0.004
Points in the Geriatric Depression Scale \geq 5, n (%)	115 (30)	34 (27)	81 (32)	0.17
Use of antidepressants, n (%)	12 (3)	1 (1)	11 (4)	0.07

IRQ: 25th percentile to 75th percentile; [†] Insufficiently active (\leq 600 MET/wk); sufficiently active (601 to 1500 MET/wk); very active (\geq 1500 MET/wk).

The frequency of activity in very active individuals was higher among males (37% vs. 28%). Based on the GDS, around 30% of the population i.e., 27% of males and 32% of females experienced depressive symptoms.

Demographic and clinical characteristics of individuals with or without depressive symptoms are shown in Table 2. Smoking was the only variable whose prevalence in both groups was significantly different i.e., 17% and 9%, respectively ($p = 0.03$).

When analyzing the prevalence of depressive symptoms, we verified a substantial linear trend across the different levels of physical activity, having found a lower prevalence in the group with the highest level of physical activity (Figure 1). This linear trend was present in the population as a whole and among men, albeit not in women.

Considering both genders, the group with the highest level of physical activity (very active) was 42% less likely

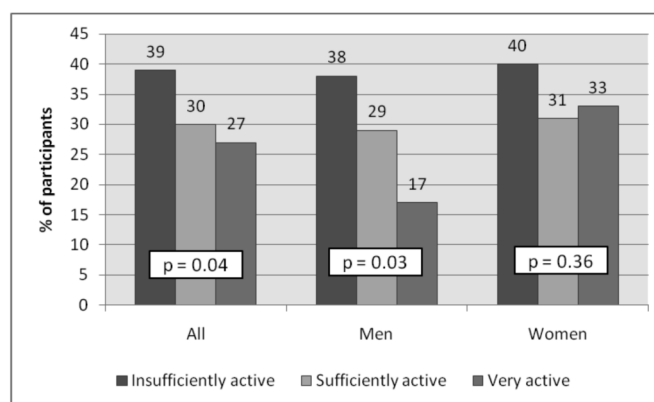


Figure 1 - Prevalence of depressive symptoms in groups with different levels of physical activity in all participants and by gender (all p for linear trend).

Table 2 - Demographic and clinical characteristics of the sample according to the presence of depressive symptoms

Characteristic*	With depressive symptoms (n = 122)	Without depressive symptoms (n = 257)	p
Age, years (SD)	69 (60)	69 (60)	0.79
Male, n (SD)	35 (29)	92 (36)	0.17
Body mass index	28.1 (5.4)	28.2 (4.7)	0.79
Diabetes mellitus, n (SD)	13 (11)	26 (10)	0.83
Hypertension, n (SD)	86 (71)	171 (67)	0.44
Smoking, n (SD)	20 (17)	23 (9)	0.03
Physical activity, median (IRQ)			
MET per week	738 (397-1674)	972 (521-1142)	0.06
Kcal per week	980 (465-1795)	1142 (601-2274)	0.08
Positive answer to two or more CAGE questions, n (SD)	5 (4)	17 (7)	0.33

IRQ: 25th percentile to 75th percentile.

Table 3 - Odds ratio of depressive symptoms (GDS > 5) according to the Level of physical activity, stratified by sex

	Level of physical activity		
	Insufficient (n = 127)	Sufficient (n = 133)	Very active (n = 119)
All (n = 379) *	1.0	0.65 (0.39-1.10)	0.58 (0.34-0.99)
Men (n = 127) **	1.0	0.65 (0.25-1.66)	0.32 (0.12-0.86)
Women (n = 252) **	1.0	0.67 (0.37-1.24)	0.76 (0.39-1.46)

Odds ratio (95% CI) calculated from a logistic regression model; using the insufficiently active group as a reference: * adjusted for age and body mass index; ** adjusted for age and body mass index.
GDS: Geriatric Depression Scale.

to have depressive symptoms (95% IC 1% to 66%) than the group consisting of insufficiently active individuals. A gender-specific analysis showed that this association was seen only among males, and that very active males were 68% less likely to present depressive symptoms when compared to males from the insufficiently active group (95% IC 14% to 88%); Table 3.

Discussion

This study showed that more intense levels of physical activity were related to a lower prevalence of depressive symptoms among a population of elderly individuals, and that the association occurred among men but not among women. The probability of having symptoms of depression was 42% lower in elders classified as very physically active compared, to those who were insufficiently active. When men were analyzed separately, this probability rose to 68%.

Other studies report similar results where there is an inverse relationship between physical activity and depressive symptoms. Population-based observational studies such as the Alameda County Study, which included 1,900 subjects between the ages of 25 and 77, showed that a low level of physical or recreational activity was an independent predictor of depressive symptoms.²⁸ The Rancho Bernardo Study reported similar results after evaluating a cohort of 2,375 individuals between 1984 and 1987. An additional follow-up evaluation of the 1,180 surviving members was conducted between 1992 e 1995.^{17,27} In certain cohort studies, however, no relationship has been observed between the level of physical activity and depressive symptoms. In another study, performed in Germany, the association between risk for depression and physical inactivity initially detected among 1,536 individuals was not observed when the same population was analyzed again after 5 years.²⁹ Similarly, a cohort study with a follow-up of 973 physicians for 15 years found no association of exercise and risk of depression.²²

Experimental studies have also shown decreased depressive symptoms among individuals with high physical activity, although different types of methodological flaws have not allowed an accurate definition of the issue. In a clinical study of 43 individuals aged between 17 and 60 years, Martinsen and colleagues observed a reduction in depression scores among subjects performing systematic aerobic exercise, but the impossibility of performing blind analyses of the results was seen as a potential source of bias.²⁰ Blumenthal and colleagues

have randomly assigned 156 depressive patients over 50 years of age to a program of aerobic exercise, antidepressant drugs or a combination of both. At the final evaluation, the groups did not differ statistically on the Hamilton Rating Scale for Depression and the Beck Depression Inventory scores, although patients receiving medication alone exhibited the fastest initial response.²¹ The results of a meta-regression analysis of 14 clinical trials showed important methodological weaknesses that make the assessment of the effectiveness of exercise in reducing symptoms of depression unfeasible.¹⁹ The most frequent problems observed were absence of a control group, inadequate randomization process and lack of intention to treat analysis. Other problems observed refer to the follow-up, which should be longer for a chronic disease, and to the fact that participants in most studies were community volunteers, which could result in an overestimation of results.

The prevalence of depressive symptoms in the present study ranged from 17% (in very active males) to 40% (in insufficiently active females). Although such large variation has already been described in other studies, the prevalence observed is higher compared to the prevalence found in other investigations. An epidemiologic study that included 18,571 participants from five different states in the US showed a prevalence of 3% for major depression and 15% for depressive symptoms among community elders.³⁶ As stressed by Snowdon, different countries present a highly variable prevalence of depression and depressive symptoms, with over a ten-fold difference among them.⁹ In Brazil, Veras and Murphy have observed a prevalence of up to 37% of symptoms of depression in poorer communities.³⁷ In northeastern Brazil, the analysis of a population of 1,120 elders showed a prevalence of 23% for depression.⁶

The higher prevalence of depressive symptoms observed in Brazilian elders may be explained by the country's poor social and health system structures. The fact that, in the present study, the sample was composed of individuals who agreed to participate may also have influenced the rates observed since they may be patients who are more used to receiving medical care. Because the sample selection was performed by telephone and a large number of males declined to participate, we cannot rule out the possibility that they failed to agree to participate because of their depressive symptoms, which could, in theory, make them less prone to accepting to take on tasks such as participating in medical research. This fact may have influenced the results and does not allow a generalization of these results.

Another consideration relates to the sample's proportion of females, which, numerically, were twice as numerous as men, possibly bearing an influence on the results. Similar results, however, have been reported in other populations with a higher frequency of females, which, in turn, may be explained by their higher life expectancy or predisposition to participate as volunteers in studies involving medical consultation and clinical and laboratory evaluations.³⁸ Another important point that needs mentioning concerns a bias, which may have affected our results, and is related to the social interaction that results from physical activity, which has already been shown to be associated to a lower prevalence of symptoms of depression.³⁹ It is thus possible that elders identified as more active and with fewer depressive symptoms are actually benefited by social interaction. A further possible bias may be related to the questionnaires used to evaluate the level of physical activity, which tend to overestimate these activities.⁴⁰

Finally, cross-sectional studies represent an appropriate approach to raise a hypothesis about the relationship between physical activity and depressive symptoms, as well as to search for other factors that may be associated to these symptoms in the elderly. The inverse association between physical activity and symptoms of depression observed should, however, be analyzed within the context of this type of design, where a positive association does not necessarily mean a causal relationship. Therefore, this study should be interpreted as a hypothesis-generating study, thus suggesting the need for further studies.

Conclusion

The present population-based study showed an inverse relationship between the level of physical activity and the prevalence of symptoms of depression in elderly individuals. The results indicate the need for studies with different designs

to identify a causal relationship, affording the opportunity to establish physical activity as a therapeutic alternative for a depressive disorder.

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Authors' contribution

CLR: search for subjects and data, analysis and interpretation of data and preparation of the manuscript. CLD: study's concept and design and preparation of the manuscript. JLV: study's concept and design, statistical analysis and interpretation of data, and critical review of the manuscript for important intellectual content. RRD: study's concept and design, search for subjects and data and preparation of the manuscript.

Disclosures

Writing group member	Employment	Research grant ¹	Other research grant or medical continuous education ²	Speaker's honoraria	Ownership interest	Consultant/ Advisory board	Other ³
César L. Reichert	Centro Universitário Feevale	-	-	-	-	-	-
César L. Diogo	PUCRS	-	-	-	-	-	-
José L. Vieira	Instituto de Cardiologia do Rio Grande do Sul	-	-	-	-	-	-
Roberta R. Dalacorte	PUCRS	-	-	-	-	-	-

* Modest

** Significant

*** Significant: Amounts given to the author's institution or to a colleague for research in which the author has participation, not directly to the author.

Note: PUCRS = Pontifícia Universidade Católica do Rio Grande do Sul.

For more information, see Instructions for Authors.

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