

Physical activity in women with depression in the Spanish national health survey: a mediation analysis

Abstract

Background: Promotion of physical activity (PA) is an important public health goal to reduce depression in women. Although several studies have reported an indirect relationship between physical activity and severity of depression in women across cultures and age groups, other studies have failed to establish this relationship. In this study we aim to analyse whether certain clinical and demographic variables can explain this discrepancy.

Methods: Cross-sectional study with 1096 women aged 15 to 69 years who participated in the National Health Survey in Spain 2017. The chi-square test was used for qualitative variables and a logistic regression was used to determine association between PA and depression with sociodemographic characteristics. To assess possible mediation of each clinical and health variable in the association between depression and physical activity, we used the KHB command in Stata.

Results: Both the crude model and models adjusted for clinical and socio-demographic variables indicated a positive association between low PA and depression. The KHB decomposition indicates that 62.21% of the association between low physical activity and depression is associated with mediational variables. Self-perception of health and the polypharmacy were the primary contributors to the mediation.

Conclusion: This study supports the conclusion that depression is related to lower levels of physical activity in women. Self-perception of health and polypharmacy mediate this relationship. These results have implications for professionals who are developing interventions aimed at increasing physical activity in women experiencing depression.

Keywords: physical activity, depression, women, self-perception of health, polypharmacy, KHB method

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García Villamizar Domingo,¹ García Martínez Marta,² Dattilo John³¹Complutense University of Madrid, Spain²M.Sc. Nurse, Hospital Universitario La Paz, Spain³The Pennsylvania State University, USA

Correspondence: García Villamizar Domingo, Department of Personality and Clinical Psychology, Complutense University of Madrid, Spain, Tel 34619104107, Email villami@edu.ucm.es

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Introduction

Depression is a mental disorder that can have a major impact on quality of life and daily functioning characterized by sadness, feelings of guilt, low self-esteem, sleep, appetite disorders, loss of libido, difficulty concentrating and remembering, fatigue, and anhedonia, with severe cases leading to suicide. According to the World Health Organization, prevalence of depression exceeds 300 million people worldwide. This data demonstrates that depression is the leading cause of disability globally.¹ Depressive disorders are associated with intensified medical comorbidity^{2,3} increased health care costs⁴ and premature mortality.⁵ Recent studies have shown that prevalence of depression is higher in women. For example, Guo, Robakis, Miller, & Butwick⁶ reported that in the USA 1 in 20 women of childbearing age experiences depression and approximately one-third are taking antidepressants. In Europe, prevalence of depression in women is 7.6%.⁷ Given this prevalence of depressive disorders, high comorbidity, and high cost to society, there is an urgent need to develop strategies that have the potential to reduce prevalence of this disorder.⁸ Despite the clear benefits of physical activity for women, few women achieve recommended levels of physical activity.⁹⁻¹¹ According to accelerometer and self-report measures, adherence to physical activity recommendations is substantially lower in woman than men.¹⁰ Such a difference in physical activity may occur because women encounter more pervasive barriers compared to men, such as lack of time and anticipated lack of enjoyment as well self-consciousness about body size, shape, and physical activity ability.¹² There are numerous published studies describing the importance of physical activity for mental health¹³⁻¹⁵ and, specifically, for reducing depressive symptoms.¹⁶ Evidence from Mendelian randomization

studies indicates that physical inactivity has a bidirectional relationship with depression.¹⁷

There have been several studies in the literature reporting associations between physical activity and features of depression in both women and men, and across cultures and age groups.¹⁸ In addition, recent evidence demonstrates inverse associations between physical activity and depression scores.¹⁹⁻²¹ Studies also identify that physical activity is a protective factor for depression onset²²⁻²⁵ and has therapeutic effects.^{26,27} However, several studies show that the relationship between physical activity and depression remains unclear. Kritz-Silverstein et al.,²⁸ demonstrated that exercise does not protect against future depressed mood, although exercisers have less depressed mood. Similarly, findings by Fukukawa et al.,²⁹ did not support a relationship between depression and exercise for middle-aged adults, although they confirmed this relationship in older adults. This discrepancy in association between exercise and depression may be due to the influence of certain mediational factors such as smoking status, comorbidity, polypharmacy, and some demographic variables, such as age, education and marital status. Researchers have not explored influences of these mediating variables. Given these gaps, the purpose of this study was to examine the relationship between physical exercise and depression in women and to explore potential mediators.

Methods

The survey

We obtained data from the Spanish National Health Survey 2017 (ENSE 2017), a regular survey assessing general health among

Spanish adults every 5 years. Details of survey methods are published elsewhere (Ministerio de Sanidad Servicios Sociales e Igualdad & Instituto Nacional de Estadística, 2017). Researchers administered this survey in Spain between October 2016 and October 2017. Data are anonymous and are available from an institutional web server. The sample was representative of the adult population residing in Spain and consisted of 23,089 participants (9,248 women), aged 16-103 years. Adults aged ≥ 70 years were not included in this study because they did not complete the short form of the International Physical Activity Questionnaire (IPAQ). A computer-assisted personal interview was conducted in the homes of selected participants who were assisted by trained interviewers. All participants signed an informed consent form before responding to the survey. As we used public anonymized secondary data, approval of an ethics committee was not necessary, according to Spanish legislation.

Participants

A total of 1096 adult women with a diagnosis of depression residing in Spain participated in the present study. To be included in the study, the women, ages between 15 and 69 years, needed to provide an affirmative answer to the question “Have you been diagnosed for depression by a doctor within the last 12 months?”

Variables

Depression condition (outcome)

Depression condition was assessed by an affirmative response to the question regarding diagnosis of a depression disorder in the last 12 months.

Physical activity (exposition)

Physical activity was assessed using the short form of the International Physical Activity Questionnaire.³⁰ The IPAQ consists of 7 self-reported questions that assess intensity (low, moderate, or vigorous), frequency (days and hours per week), and time spent doing each activity. The summary indicator of the IPAQ was used to categorize the sample into three levels of physical activity:

- a) Low: Participants who did not register physical activity or did not meet the criteria for moderate and high categories;
- b) Moderate: Participants who met one of these criteria:
 - i. 3 or more days of vigorous PA for at least 20 min/day;
 - ii. 5 or more days of moderate PA or walking for at least 30 min;
 - iii. 5 or more days of any combination of walking, moderate or vigorous PA, achieving at least 600 MET-minutes/week;
- c) High: Participants who met one of the following criteria:
 - i. 3 or more days of vigorous PA or accumulating at least 1500 MMS;
 - ii. 7 or more days of any combination of walking, moderate or vigorous PA, achieving a minimum of at least 3000 MET-minutes/week.

One MET is 1 kcal/kg/h reflecting energy cost of sitting quietly.³⁰

Mediating variables

The potential mediating variables were selected based on previous studies demonstrating that they are associated with depression and physical activity.^{19,24,31}

Self-perception of health

Self-perception of mental health status was measured by the question ‘How would you currently classify your health status in the last twelve months?’ which had five possible answers: ‘Very good’; ‘Good’; ‘Fair’; ‘Poor’; and ‘Very poor’. Answers were grouped into three categories, with ‘Very good’ and ‘Good’ in one group, fair in the other and the remainder in the other.

Chronic health problems

Assessed by a positive answer to the question ‘do you have long-term illnesses or health problems?’

Comorbidity

The presence of other comorbidities was also treated as a dichotomous variable: yes (if they had one or more comorbidities) and no (if they had no comorbidities).

Polypharmacy

Polypharmacy was calculated with participant response to a single question: “I will now read you a list of medication types, please tell me which of them, if any, you consumed in the last two weeks”. Twenty-three different medications were presented, including medicine for flu or cold, pain, fever, laxatives, antibiotics, sedatives, allergies, cholesterol, diabetes, and thyroid. The Polypharmacy was treated as a dichotomous variable (yes/no). Participants were classified as experiencing polypharmacy if they identified them consuming medication from five different groups of medicines in the last two weeks. Although there is no standardized approach to evaluate polypharmacy, identification of consuming five or more medications was considered polypharmacy in recent studies.³²⁻³⁴ Body Mass Index (BMI) was categorized as follows: < 24.9 kg/m² = normal; 25.0–29.9 kg/m² = overweight; and ≥ 30 kg/m² = obese. Control variables. Age, marital status, education and occupation were treated as control variables. Age was categorized by 16–34, 35–49, 50–64, and 65–69 years; marital status was categorized as single, married, widowed, and separated/divorced; and education was categorized as: no formal education, primary education, secondary or high school completed, or university education completed. Occupations were categorized as: occupational class I (executive managers and professionals with university degrees); occupational class II (middle managers, technicians with college diplomas); occupational class III (white-collar and self-employed workers); occupational class IV (workers in qualified technical occupations); occupational class V (primary sector workers); and occupational class VI (unskilled workers).

Statistical analysis

We used descriptive statistics to describe the sample. We performed a binary logistic regression analysis to establish the association between the outcome variable (depression) and exposure variable (physical activity), both crude and adjusted for clinical and demographic variables. Finally, we performed a logistic regression analysis to study the association between the outcome variable (depression) and exposure variable (physical activity) with different groups of variables as mediators. To assess possible mediation of each clinical and health variable in the association between depression and physical activity, we used the KHB (the acronym refers to surnames of the three authors: Karlson, Holm, and Breen) command in Stata^{35,36} designed for application in logistic regression. The KHB command estimates separately total effect (i.e., unadjusted for the mediator) of the independent variable (physical activity) on the dependent variable (depression). Total effect was divided into direct effect of the

independent variable (physical activity) and the indirect effect of the mediating variables. All models were adjusted for age, marital status, and educational level (control variables). We conducted statistical analyses using Stata/SE version 15.0 for Windows (Stata Corp LP, College Station, Texas).

Results

Results of this study indicate that there are significant differences among subgroups of depression and no depression for most demographic variables: physical activity, age, marital status, educational level, and occupational class. Also, differences were observed with respect to health and clinical variables: self-perception of health, chronic health problems, comorbidity, polypharmacy, and BMI (Table 1).

Table 1 Descriptive statistics of the sample under study

Characteristics	No depression		Depression		Total		χ ²
	N	%	N	%	N	%	
Physical activity							p < .001
Low	2454	30,4%	479	44,0%	2933	32,0%	
Moderate	4259	52,7%	488	44,9%	4747	51,8%	
High	1361	16,9%	121	11,1%	1482	16,2%	
Age group							p < .001
16-34	1949	23,9%	81	7,4%	2030	22,0%	
35-49	2911	35,7%	277	25,3%	3188	34,5%	
50-64	2569	31,5%	534	48,7%	3103	33,6%	
64-69	723	8,9%	204	18,6%	927	10,0%	
Marital status							p < .001
Single	2381	29,3%	188	17,2%	2569	27,8%	
Married	4578	56,3%	552	50,4%	5130	55,6%	
Widowed	415	5,1%	163	14,9%	578	6,3%	
Separated/divorced	757	9,3%	193	17,6%	950	10,3%	
Educational level							p < .001
Without studies	54	0,7%	15	1,4%	69	0,7%	
Primary	3375	41,4%	673	61,4%	4048	43,8%	
Secondary	2629	32,2%	294	26,8%	2923	31,6%	
Higher education	2094	25,7%	114	10,4%	2208	23,9%	
Occupational social class							p < .001
I	971	12,2%	59	5,6%	1030	11,4%	
II	729	9,1%	51	4,8%	780	8,6%	
III	1669	20,9%	175	16,6%	1844	20,4%	
IV	947	11,9%	117	11,1%	1064	11,8%	
V	2518	31,5%	427	40,6%	2945	32,6%	
VI	1151	14,4%	223	21,2%	1374	15,2%	
Self perception of General health							p < .001
Very good/good	6261	76,8%	312	28,5%	6573	71,1%	
Regular	1531	18,8%	474	43,2%	2005	21,7%	
Bad/Very bad	360	4,4%	310	28,3%	670	7,2%	
Chronic health problems*							p < .001
No	3210	39,4%	23	2,1%	3233	35,0%	
Yes	4938	60,6%	1073	97,9%	6011	65,0%	

Characteristics	No depression		Depression		Total		χ ²
	N	%	N	%	N	%	
No	1935	35,3%	82	7,7%	2017	30,8%	
Yes	3547	64,7%	984	92,3%	4531	69,2%	
Polipharmacy ≥5 drugs							p < .001
No	4725	92,7%	635	61,7%	5360	87,5%	
Yes	373	7,3%	395	38,3%	768	12,5%	
BMI							p < .001
Normal	4638	59,0%	391	37,3%	5029	56,5%	
Overwigt	2156	27,4%	381	36,4%	2537	28,5%	
Obesity	1063	13,5%	276	26,3%	1339	15,0%	

Table 2 Cross-sectional associations between physical activity and depression and 95% confidence intervals (CI) from linear regression analyses with incremental adjustment for covariates

Physical activity	OR	95% IC	p
Crude Model			
Low	2.26	1.78-2.71	0
Moderate	1.29	1.05-1.59	0.017
High	Base model	-	-
Model A			
Low	1.34	1.03-1.76	0.02
Moderate	0.99	.77-1.29	0.99
High	Base model	-	-
Model B			
Low	1.35	1.31-1.76	0.02
Moderate	1.02	.773-1.39	0.98
High	Base model	-	-

Model 1 adjusted with self perception of health, health chronic problems, comorbidity, and polypharmacy and body mass index.

Model 2 adjusted with model 1 and demographic variables: age, status marital, educational level, and professional category.

Table 2 presents results of the logistic regression analysis. The crude model shows a positive association between depression and low physical activity (odds ratio [OR] = 2.26; 95% confidence interval [CI]: 1.78-2.71). In the Model 1, adjusted with clinical variables, the association of depression and low physical activity was also significant (OR = 1.34; 95% confidence interval [CI]: 1.03-1.76). This association was similar in Model 2, by adding demographic variables to Model 1 (OR = 1.35; 95% confidence interval [CI]: 1.31-1.76).

Table 3 reports the results of the decomposition of the total effect on direct and indirect effect of mediators included in the model. According to these analyses, the indirect effect was significant in the mediation between depression and low physical activity (OR = 1.51; 95% confidence interval [CI]: 1.32-1.71). The KHB decomposition indicates that 62.21% of the association between low physical activity and depression is associated with mediational variables.

Table 4 reports contribution of each mediator separately to the association between Physical Activity and Depression (outcome). Self-perception of health and polypharmacy represent the major contribution to the mediation.

Table 3 Logistic regression analyses of the association between physical activity and depression (outcome) with distinct groups of variables as mediators (KHB method)

Physical activity		ORI	95% IC2	p	% Mediated
PA-Low	Total	1.93	1.48-2.51	0	
	Direct	1.28	0.98-1.67	0.066	
	Indirect	1.51	1.32-1.71	0	62.21%
PA-Moderate	Total	1.15	0.89-1.49	0.292	
	Direct	0.99	0.77-1.28	0.944	
	Indirect	1.16	0.99-1.31	0.282	NA3
PA-High	-	-	-	-	

¹OR = Odds Ratio

²CI = Confidence interval.

³Mediated percentage was only calculated when indirect effect was positive and significant (P<0.05).

Table 4 Contribution of each mediator separately to the association between Physical Activity and Depression (outcome)

Variables	P_Diff 1	P_Reduced2
Self-perception of health	49.96	31.08
Chronic Health Problems	9.12	5.67
Comorbidity	15.38	9.57
Polipharmacy	22.33	13.89
BMI3	3.21	2

1. P_Diff: Contribution of each mediator to indirect effect

2. P_Reduced: How much of the total effect is due to confounding of the respective mediator.

3. Body Mass Index.

Discussion

In this large representative sample of adult Spanish women, as predicted and in line with previous research, this study reveals adult women with depression are less physically active in comparison to their non-depressed counterparts. Furthermore, results of this study indicate that among women experiencing depression, a poor self-perception of health and more medication mediate the association of depression with a lower level of physical activity. Other potential barriers such as BMI, comorbidity, and chronic health problems have less weight in the mediation process. Our data are consistent with previous studies¹⁹⁻²¹ that demonstrates an inverse association between physical activity and depression. Findings of the present study suggest that women with depression are prone to low physical activity and sedentary lifestyles. These results are consistent with previous research and lend credence to the importance of considering depression in the context of physical activity. According to a recent meta-analysis¹⁹ increasing levels of moderate to vigorous physical activity are inversely associated with incidence of depression and onset of subclinical depressive symptoms with effect sizes ranging from moderately large to small depending on the presumed rigour used to judge method bias in the studies. In this study, effect of depression and physical activity was significantly mediated by self-perceived health and polypharmacy. The general health status perceived by participants mediated the association between depression and low physical activity in the sense that poor self-rated health was significantly associated with a high probability of depression and low physical activity. This result is consistent with previous research.^{37,38} Polypharmacy is commonly defined as the concurrent use of multiple medications or use of medication inappropriateness.³⁹ A possible explanation is that

polypharmacy is associated with depression according to a recent meta-analysis.⁴⁰ To our knowledge, this is the first study describing correlates of physical activity in women experiencing depression. Previous studies demonstrate that lower frequency, shorter duration, and moderate amount of physical activity is associated with lower risk of depression in women⁴¹ or that reduction in physical activity significantly increases depression and anxiety in the perinatal period.⁴² Based on a meta-analysis, Schuch et al.,²⁵ concluded that physical activity can inhibit emergence of depression, regardless of age and geographical region. Finally, there is a need to identify limitations of this study. The main limitation is that we used a cross-sectional design; therefore, we advise caution when interpreting the reported associations because conclusions cannot be drawn regarding the direction of the associations and causality. Another limitation is the measurement of physical activity levels, because in this study we used a self-reported measure without objective measures. In addition, due to negative self-perception associated with depression, women experiencing depression could possibly underestimate their physical activity. One major strength of this study is that our results are based on a large sample of women having clinical depression with a standardized distribution throughout diverse regions of Spain, making it nationally representative. Furthermore, we included many known potential determinants and confounders of the relation between physical activity and depression in women.

In conclusion, this study supports the supposition that depression is related to lower levels of physical activity in women and that self-perception of health and polypharmacy mediate this relationship. These findings identify the value in developing interventions aimed at increasing physical activity of women experiencing depression.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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