



Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Short communication

Leisure time physical activity reduces the association between TV-viewing and depressive symptoms: A large study among 59,401 Brazilian adults



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ARTICLE INFO

Keywords:

Depression
Sedentary lifestyle
Affective disorder
Sedentary behavior
Exercise
Television

ABSTRACT

Background: Both physical activity (PA) and TV-viewing are associated with depressive symptoms, but the combined association with depressive symptoms is unclear. Therefore, our aim was to analyze the joint association of PA and TV-viewing with depressive symptoms among a large cohort of adults.

Methods: We used data from the Brazilian National Survey, conducted in 2013 with 59,401 adults [≥ 18 years (34,282 women)]. Information regarding exposures (TV-viewing and leisure PA), outcome (depressive symptoms) and covariates (chronological age, race, educational status, employment status, tobacco smoking, alcohol consumption) were self-reported. Body mass index was estimated through the assessment of body mass and stature. Logistic regression models were used.

Results: Engaging in >5 hours of TV viewing was associated with elevated depressive symptoms [13.1% (CI95%: 11.6%–14.7%) vs. 7.4% (95%CI:7.0%–7.8%)]. However, this association was nullified when people met guidelines and engaged in >150 min of PA per week. Specifically, among men [Active: OR = 1.16 (95%CI: 0.58–2.32) vs. Inactive: OR = 3.63 (95%CI: 2.43–5.42)] and women [Active: OR = 1.30 (95%CI: 0.80–2.11) vs. Inactive: OR = 1.84 (95%CI: 1.43–2.36)].

Conclusion: Whilst TV viewing is associated with increased depressive symptoms, meeting recommended physical activity levels reduces the association between TV-viewing and depressive symptoms.

1. Introduction

Depression is highly prevalent worldwide among adults (approximately 4.4%) and is one of the leading causes of years lived with disability (Ferrari et al., 2013; Kyu et al., 2018). Physical activity practice and low sitting time are two behaviors with recognized impact in the prevention of depressive symptoms among adults (Schuch et al., 2017; Vancampfort et al., 2017; Werneck et al., 2018). However, the combined impact of physical activity and sitting time on the occurrence of depressive symptoms remains unclear.

There is some evidences that physical activity can attenuate the harmful association between high sitting time and depressive symptoms, but these data are derived from older adults (Santos et al., 2017) and adults from developed countries (Husu et al., 2016; Liao et al., 2016), raising doubts about the existence of this phenomenon in

developing countries. Also, data from high income countries suggests that the type of sitting time may have a differential effect. A recent study found that mentally-passive sedentary activities (e.g. TV-viewing, listening music) are associated with an increased risk of depressive symptoms (Hallgren et al., 2018) but mentally active (e.g. working on a computer) were not. Thus, the role of physical activity on the association between TV-viewing and depressive symptoms is not well established. This short report aims to analyze the joint association of physical activity and TV-viewing and the association with depressive symptoms among a large cohort of Brazilian adults.

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<https://doi.org/10.1016/j.jad.2019.03.066>

Received 16 December 2018; Received in revised form 15 March 2019; Accepted 21 March 2019

Available online 22 March 2019

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2. Methods

2.1. Sample

Data from the Brazilian National Health Survey (PNS in Portuguese) (Instituto Brasileiro de Geografia e Estatística - IBGE, 2014) were used. More details of the sample process and weighting have been previously published elsewhere (Instituto Brasileiro de Geografia e Estatística - IBGE, 2014). Briefly, the Brazilian National Health Survey was a cross-sectional epidemiological study, conducted with a national representative sample of adults (+18 years old) during 2013 in Brazil. The sampling process occurred through multiple stages. Firstly, census tracts were randomly selected, next, households were randomly selected; and finally, in the households, one adult was randomly selected. The minimum sample size per federal unit ($n = 27$) was 1800 households, with a total of 64,348 households, where interviews were conducted. The sample was composed of 60,202 with complete data for all variables, except for analyses involving body mass index (BMI) that used fewer subjects ($n = 59,402$) due to missing data on stature or/and body mass. Estimates were weighted considering the weight of the household, adjusting for non-response by sex and total population by sex and age, and counting the number per household. The Brazilian Council of Ethics in Research approved all procedures according to the Helsinki declaration.

2.2. Depressive symptoms

The outcome of this study was positive screening for depression measured using the Patient Health Questionnaire-9 (PHQ-9) (Kroenke et al., 2001), which evaluated the frequency of depressive symptoms (depressed mood, anhedonia, trouble sleeping, tiredness or lack of energy, change of appetite or weight, feeling of guilt or uselessness, trouble concentrating, feeling slow or agitated and having recurrent thoughts about death or suicidal ideation), over the two weeks prior to data collection, with nine questions. Each question has four possible answers into a Likert-scale style, “Not at all”, which has a value of 0; “Several days”, which has a value of 1; “More than half the days”, which has a value of 2; and “Nearly every day”, which has a value of 3. This instrument is already validated for Brazilian adults (Santos et al., 2013). The algorithm of the test was used to identify individuals at higher risk of a major depressive episode (MDE), using a cut-point which is the most used in the scientific literature (sum of the values >9) (Mitchell et al., 2016). The classification indicates the group that is more likely to present depressive events. This questionnaire presented a good Cronbach's alpha (0.836) in this sample.

2.3. TV-viewing

Television (TV) viewing time was estimated through the question: “How many hours a day you usually pass watching TV?”, adopting 5h as a cutoff point, given that previous findings indicated a possible threshold in the association with depressive symptoms (Werneck et al. 2018).

2.4. Physical activity

PA was assessed using a specific questionnaire based on another research conducted by the Brazilian Ministry of Health (Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey). The questionnaire contains questions regarding the frequency and duration of PA during leisure, which is already described elsewhere (Instituto Brasileiro de Geografia e Estatística - IBGE, 2014). For classification, total minutes of leisure PA was considered, and the cutoff adopted was ≥ 150 min/week (World Health Organization, 2010).

2.5. Covariates

Chronological age was included as a continuous variable. Ethnicity was self-reported and dichotomized as white and not white (other races). Educational status was collected through the question: “What is your highest academic qualification?” From the responses, three categories (1 = no academic degree; 2 = at least high school; and 3 = at least college) were created as a proxy of socioeconomic status. Moreover, employment status (remunerated job in the last month) was assessed through a ‘yes’ or ‘no’ question.

Smoking was evaluated through the question “Do you use any tobacco product?” (possible answers were “yes, daily”, “yes, but not daily” and “no”). Participants who answered “yes, daily” and “yes, but not daily” were considered smokers, while other participants were identified as non-smokers. Further, participants were asked on how many days per week they usually consumed alcohol; with the classification of: (1) non-alcohol consumers; (2) weekly alcohol consumers (alcohol consumption during 1–3 times per week); (3) almost daily alcohol consumers: (alcohol consumption during 4 or more days per week) adopted as the covariate. Participants also reported on how many days per week they consumed snacks and sweet foodstuffs (eg. cake, sweets, chocolate, candies, or biscuits). We adopted the cutoff point of at least 3 days of goodies consumption. Also, body mass and stature were collected using a portable digital scale and stadiometer, respectively. After this, body mass index was calculated and categorized into three categories: eutrophic (≤ 24.99 kg/m²), overweight (25–29.9 kg/m²) and obese (≥ 30 kg/m²).

2.6. Statistical analysis

Descriptive statistics calculating the frequency and the 95% confidence intervals (95%CI) were used to summarize characteristics of sample as well as compare groups (Gardner and Altman, 1986). Binary logistic regression models were used in the analyses of the association between different PA domains and depressive symptoms, adjusting for chronological age, race, educational status, employment status, tobacco smoking, alcohol ingestion, weight status, TV-viewing and other PA domains. All analyses were conducted in STATA 15.1, considering sample weights (survey command), adopting $p < 0.05$.

3. Results

The final sample was composed by 59,401 Brazilian adults (34,282 women), with an average age of 43.3 years (CI95%:43.2 to 43.4). Characteristics of sample according to TV-viewing status are presented on Table 1. Subjects who watched more TV presented higher chronological age, alcohol consumption, tobacco smoking, goodies consumption, obesity, elevated depressive symptoms as well as lower rates of educational status and physical activity.

The joint association of TV-viewing and physical activity and the association with elevated depressive symptoms by sex are presented in Fig. 1. Physical activity reduced the association between elevated TV-viewing and elevated depressive symptoms among men [Active: OR = 1.16 (95%CI: 0.58–2.32) vs. Inactive: OR = 3.63 (95%CI: 2.43–5.42)] and women [Active: OR = 1.30 (95%CI: 0.80–2.11) vs. Inactive: OR = 1.84 (95%CI: 1.43–2.36)], in which even crossing the confidence intervals of active and inactive groups, the association between elevated sitting time and active was not different from the reference group (low sitting time and active).

4. Discussion

Our main findings were that higher TV-viewing was associated with elevated depressive symptoms, while higher leisure physical activity attenuated the association of high TV-viewing on depressive symptoms in both sexes. These associations appear to be independent of potential

Table 1
Characteristics of sample.

	TV-viewing ≤ 4.99 h (n = 54,182)	≥ 5 h (n = 5,219)
Sex (female)	51.5 (50.7–52.2)	62.3 (60.0–64.5)
Age		
18–39	47.3 (46.5–48.0)	46.8 (44.4–49.2)
40–59	34.9 (34.2–35.6)	30.5 (28.4–32.7)
60 +	17.8 (17.3–18.4)	22.7 (20.8–24.6)
Educational status		
No academic qualification	15.9 (15.4–16.5)	13.5 (12.2–15.1)
High school	69.5 (68.8–70.2)	78.5 (76.6–80.2)
More than high school	14.6 (14.1–15.1)	8.0 (6.8–9.3)
Employment status (yes)	60.1 (59.3–60.8)	64.8 (62.5–67.0)
Skin color		
White	48.0 (47.3–48.8)	41.5 (39.2–43.9)
Other	52.0 (51.2–52.7)	58.5 (56.1–60.8)
Alcohol drinking		
No	76.0 (75.3–76.6)	74.2 (72.0–76.3)
1–3 times / week	20.4 (19.8–21.1)	20.6 (18.6–22.7)
≥ 4 times / week	3.6 (3.3–3.9)	5.2 (4.2–6.5)
Goodies ingestion (≥ 4 times / week)	26.8 (26.1–27.4)	30.8 (28.6–33.1)
Tobacco smoking	14.3 (13.8–14.8)	20.5 (18.6–22.5)
Body mass index		
Eutrophic	43.2 (42.5–44.0)	41.6 (39.3–44.0)
Overweight	36.3 (35.6–37.1)	33.7 (31.5–36.0)
Obese	20.4 (19.8–21.0)	24.7 (22.7–26.8)
Elevated depressive symptoms		
Leisure PA (150 min/week)	19.9 (19.2–20.5)	15.1 (13.4–17.0)

Note. Values are presented in frequencies (95% CI). PA, physical activity.

confounders we could account for, including chronological age, race, educational status, employment status, tobacco smoking, alcohol ingestion and weight status.

Sitting time is notably a risk factor for depressive symptoms (Schuch et al., 2017; Vancampfort et al., 2017; Werneck et al., 2018). Among domains of sitting time, mentally-passive activities such as TV-viewing appear to be deleterious to mental health (Hallgren et al., 2018). On the other hand, physical activity is a protective factor for depressive symptoms (Ashdown-Franks et al., 2018; Schuch et al., 2017; Vancampfort et al., 2017). Although leisure physical activity and sitting time constitute widely two explored physical activity domains in the literature, the simultaneous impact of both on depressive symptoms is unclear (Blough and Loprinzi, 2018; Husu et al., 2016; Liao et al., 2016;

Santos et al., 2017). Thus, we have found that higher physical activity may attenuate and even eliminate the association between TV-viewing and depressive symptoms.

In terms of the pathways linking TV-viewing with depressive symptoms, the lack of movement caused by sitting time is a pro-inflammatory aspect, which has been linked to the development of depressive symptoms (Endrighi et al., 2016) and appears to be a core feature of major depression (Köhler et al. 2017). Moreover, decreased physical activity, sitting and depression are all related to greater social isolation which could play an important role (Loprinzi and Crush, 2018). On the other hand, higher physical activity, especially leisure-time physical exercise has been associated with a better inflammatory profile (Paolucci et al., 2018) as well as a higher social engagement and inclusion (Chang et al., 2014). Therefore, our study adds to the calls to promote leisure time physical activity to help reduce the risk of depressive symptoms. In this sense, lifestyle interventions should be focused in both improvement of physical activity level and mitigation of sitting time (Ashdown-Franks et al., 2018), leading to potential improvements in mental health.

The possible sex differences in the decrease of the association between elevated TV-viewing and depressive symptoms among subjects engaged in ≥ 150 min/week of physical activity, in which the reduction is clearer among men, could be partially explained by a possible higher level of physical activity among active men than women. In our sample, active men presented a mean of 391 (95%CI:372–410) min/week vs. 336 (95%CI:325–346) min/week of active women. Moreover, the prevalence of depression is higher among women, which also present a more complex range of possible predictors of depression, including a complex interaction of social, biological, affective and cognitive vulnerability factors, plus higher rates of negative life events (Hyde et al., 2008).

Whilst our results provide novel information in the context of a developing country, a number of limitations should be considered. First, the lack of adjust for other potential confounders such as income, isolation, loneliness and family history of depression is noteworthy. Second, due to cross-sectional design, the directionality of the relationships is unclear. Moreover, we used subjective measures of physical activity and TV-viewing, what can present potential bias, even presenting good estimates for the leisure domain. On the other hand, there are multiple strengths to this paper. Our survey used a valid questionnaire for depressive symptoms (Mitchell et al., 2016; Santos et al., 2013), which presented a good Cronbach's alpha (0.836) in our

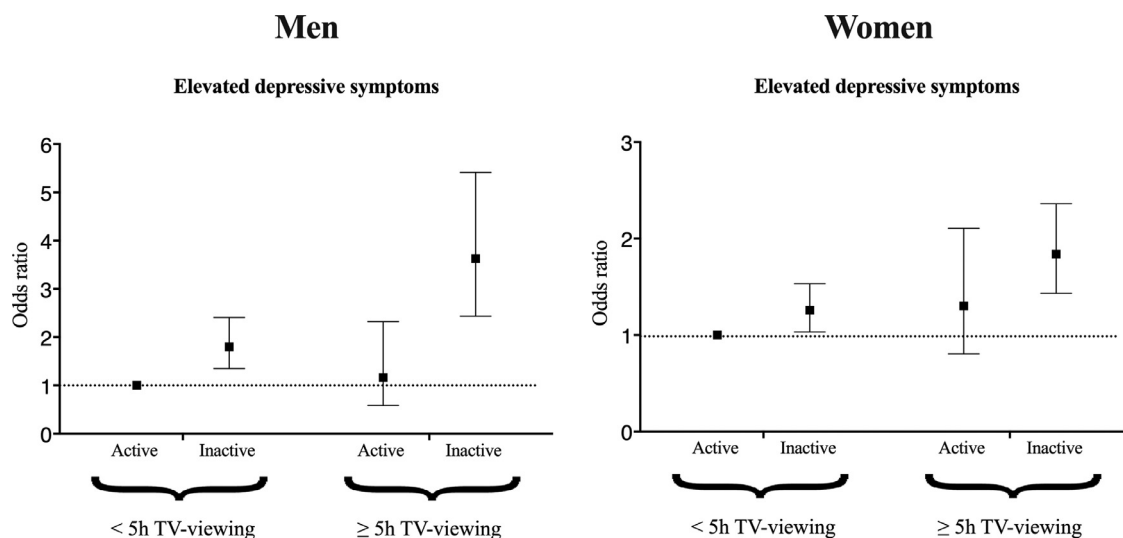


Fig. 1. Joint association of leisure physical activity and TV-viewing in the prediction of elevated depressive symptoms.

Note. Values are presented in odds ratio (95% confidence interval). Adjusted by sex, chronological age, race, educational status, employment status, tobacco smoking, alcohol ingestion, goodies ingestion and weight status.

sample (Werneck et al., 2018) as well as a valid questionnaire of physical activity / TV-viewing (Instituto Brasileiro de Geografia e Estatística - IBGE, 2014). Furthermore, we provided data coming from large representative sample of Brazilian adults, which, in our knowledge, is the first study of this kind using a large cohort of adults from middle-income countries.

In conclusion, our study suggests that the association between TV-viewing and depressive symptoms decreases when engaging in ≥ 150 min/week of physical activity. Future studies should investigate the longitudinal interactional pathways of physical activity and sedentary behavior in the prediction of depressive symptoms.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. BS is supported by the Health Education England and the National Institute for Health Research HEE/ NIHR ICA Programme Clinical Lectureship (ICA-CL-2017-03-001). The views expressed in this publication are those of the author(s) and not necessarily those of the NHS, the National Institute for Health Research or the Department of Health and Social Care.

Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethics approval

All procedures performed in the original studies involving human participants were approved by national council of ethics in research (CONEP: 10853812.7.0000.0008) in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all participants.

CRediT authorship contribution statement

André O. Werneck: Methodology, Writing - original draft. **Brendon Stubbs:** Validation, Writing - original draft, Writing - review & editing. **Rômulo A. Fernandes:** Validation, Writing - review & editing. **Célia L. Szwarcwald:** Conceptualization, Writing - review & editing. **Danilo R. Silva:** Methodology, Writing - original draft, Writing - review & editing.

Acknowledgments

We gratefully acknowledge the contributions of all participants of the present research as well as the IBGE staff for the data collection. Moreover, we acknowledge São Paulo Research Foundation (FAPESP) for the master's degree scholarship of AOW (FAPESP process: 2017/27234-2).

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