Original paper

Lifetime and recent physical activity and the risk for depression symptoms among older adults

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Abstract

Introduction: Depression significantly reduces quality of life and increases the risk of mortality, especially among older adults. Physical activity undertaken by older individuals is widely recognised as a factor that reduces the risk of developing depression; however, the impact of lifetime physical activity patterns on the risk of depression in old age remains poorly understood.
Aim of the research: The aim of this study was to assess the impact of lifetime physical activity patterns on the risk of depressive symptoms in retired individuals.
Material and methods: A cross-sectional study was conducted with 205 volunteers. Physical activity levels were assessed using the Lifetime Physical Activity Questionnaire, with metabolic equivalent of task (MET) values assigned to each activity. Depressive symptoms were measured using the Geriatric Depression Scale, physical performance was evaluated using the Short Physical Performance Battery (SPPB), and handgrip strength was measured with a handheld hydraulic dynamometer.
Results and conclusions: Univariate analyses showed that only sport-related physical activity was statistically significantly associated with Geriatric Depression Scale scores ($r = -0.150$; $p = 0.032$). However, a multiple linear regression model, accounting for sex and other variables related to Geriatric Depression Scale scores, revealed that sport-related physical activity was no longer significantly associated with depression symptoms in this comparison. The Short Physical Performance Battery (SPPB) score appeared to be the variable most closely related to depression symptoms.

Introduction

Population aging has become a global demographic phenomenon, which has generated considerable interest among researchers in an attempt to address the health concerns of senior citizens and to identify the factors that affect their quality of life (QoL). Numerous authors have investigated aspects of healthcare and lifestyle modifications that might improve the wellbeing of older adults [1, 2]. Depression, a complex affective disorder, remains one of the conditions that exert a profound effect on QoL and elevate the mortality risk [3]. The aetiology of depression is multifactorial [4, 5]. Certain factors have been demonstrated to play a protective role in depression, particularly regular physical activity (PA). PA not only has a beneficial impact on maintaining mental and physical health, but also it is helpful in the treatment as well as prevention of depression [5, 6]. Research on the impact of PA on depression typically focuses on the currently undertaken PA, assessing it either through a period of observation, e.g. using accelerometers [7] to retrospectively evaluate the past weeks or months [6], or introducing interventions aimed at increasing the activity level of the study participants [8]. Such a study design allows us to examine relationships with the current PA, but it does not provide information about how past PA may have affected the risk of developing depressive episodes in old age. To design and implement appropriate preventive measures, it is essential to investigate the impact of past PA.

Aim of the research

The aim of this study was to assess the influence of patterns of lifetime PA on the risk of developing depression in retirees.

Material and methods

Study population

A total of 205 (mean age: 70.02 ±6.53 years) volunteers from the Wielkopolska region were included in this cross-sectional study. The following recruitment strategies were used: radio and Internet campaigns, flyers, and collaboration with senior organisations, including the University of the Third Age. The inclusion criteria were as follows: age ≥ 60 years and cessation

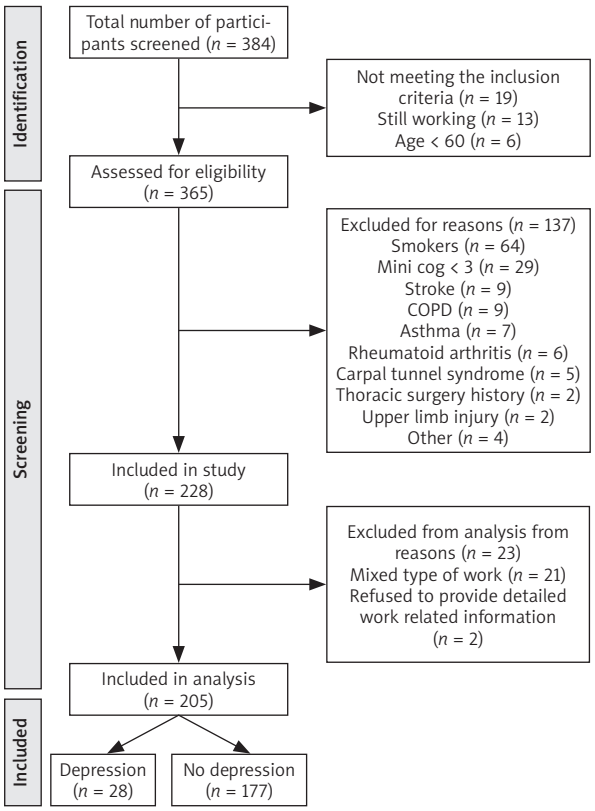

Figure 1. Participant flow diagram

of professional activity (retirement). An interview was conducted to identify potential exclusion criteria, i.e. medical conditions and injuries that might have adversely impacted upper limb performance and/or respiratory tract function (stroke, asthma, chronic obstructive pulmonary disease (COPD), history of thoracic surgery, upper limb fracture, brachial plexus injury, brachialgia, history of pulmonary surgery, smoking, and impaired cognitive function). The participant flowchart is presented in Figure 1. The sample size was determined using G*Power software for multiple linear regression, assuming an effect size of 0.15, an a level of 0.05, a power of 0.95, and 6 predictors, resulting in a sample of 74 participants.

The Mini-Cog test [9] was used to asses cognitive functioning. It consists of a short-term recall of three words and a clock-drawing test. The participants receive one point for each recalled word and two points for a correctly drawn clock and marked time. The total maximum score is 5 points, with a score of < 3 points indicative of cognitive impairment. Any score below 3 points constituted an exclusion criterion in this study. Permission to use the Mini-Cog test was obtained.

The study was conducted between March 2019 and October 2019. This work adheres to the STROBE guidelines [10].

Measurements

Lifetime PA patterns were assessed using the Lifetime PA Questionnaire (LTPAQ). For the purposes of this study, lifetime PA was defined as the average weekly level of physical exertion. These values were calculated based on data from the LTPAQ. The LTPAQ was developed for epidemiological studies evaluating the association between PA and the incidence of cancer. It is one of the rare tools which allow for a retrospective analysis of lifetime PA patterns. During the study, the interviewer assisted the participants in recalling various types of PA undertaken throughout their lives. The questionnaire records activities within four different PA domains (work-, sport-, household-, and transportation-related) and engagement duration, with a minimum level of PA specified by the authors of the questionnaire (i.e. min. 128 hours/year or 2.5 hours/week for a year for work-related PA). The participants self-evaluated the intensity of each activity. Next, using the 2011 PA Compendium [11], the Metabolic Equivalent of Task (MET) was assigned to each activity. If a respondent commuted to work (walking, biking, rollerblading, or running), that specific type of PA was also coded as Exercise and Sports Activities. The procedure for conducting this study using the LTPAQ questionnaire, as well as the coding of PA types and the calculation of their metabolic equivalents, was presented in a previous study [12]. For the purposes of this study, the PA patterns were calculated as the average amount of MET/week/year. These calculations were done for the overall lifetime PA and PA over the last 12 months before the study. MET/week/year was calculated both, for the individual types of PA and in total. For each participant, the results for work-, exercise-, sport-, and household-related PA, and the total score were analysed and labelled respectively as: MET Occupation, MET Sport, MET Household, and MET Total.

A shortened, 15-point version of the Geriatric Depression Scale (GDS) was used [13] to evaluate the risk of depressive disorder. The participants responded to questions about their wellbeing over the past 2 weeks by providing a 'yes' or 'no' answer. Depending on the question, the responses were scored as 1 point (if indicative of depression symptoms) or 0 (if not suggestive of depression symptoms). A score of over 4 points was indicative of depression. In this study, all individuals with a score of > 4 points were considered at risk for depression, which is consistent with other sources [13].

Given that the strength of one's hand grip is correlated with the occurrence and severity of depression symptoms [5, 14], hand grip strength (HGS) was measured using a hydraulic hand dynamometer (JAMAR). The assessment was conducted following the American Society of Hand Therapists gold standard [15]. Physical performance was evaluated using the Short Physical Performance Battery (SPPB) [16]. The test, which consists of three parts that assess the lower

Table 1. Comparison of participants with and without depression symptoms

Variable	Depression (n = 28)	No depression (n = 177)	P-value
Age	71.25 ±7.21	69.94 ±6.37	0.458
BMI	28.31 ±3.66	28.02 ±3.56	0.516
HGS	29.21 ±12.14	28.99 ±10.20	0.636
Quebec*	11 (0;63)	5 (0;61)	0.005
SPPB*	10 (2; 12)	12 (3;12)	< 0.001
MET Occupation	76.16 ±33.02	80.79 ±53.60	< 0.001
MET Household	41.68 ±29.16	37.39 ±30.70	0.541
MET Sport	5.80 ±6.40	8.43 ±9.75	0.050
MET Total	123.64 ±38.35	126.61 ±54.11	< 0.001
MET Occupation last year	0 ±0	9.38 ±40.79	0.434
MET Household last year	57.75 ±56.73	51.22 ±43.05	< 0.001
MET Sport last year	10.96 ±12.23	15.03 ±15.82	0.362
MET Total last year	68.71 ±60.85	76.25 ±62.14	< 0.001

**Data expressed as median (range), otherwise data were expressed as mean ± SD. Age expressed in years. BMI – body mass index [kg/m^2]. HGS – hand grip strength [kg]. Quebec – The Quebec back pain disability scale, SPPB – Short Physical Performance Battery, MET represents MET/week/year. MET Occupation: PA related to work. MET Household: PA related to household chores. MET Sport: PA related to sports and exercise. MET Total: pattern of PA, which is the sum of MET Work, MET Household, and MET Sport.*

limb strength by rising from a chair, walking speed, and the ability to maintain balance, is widely used in studies involving older adults.

The level of disability due to back pain was assessed using the Quebec scale [17]. The scale evaluates the impact of back pain on 20 daily activities, e.g. getting out of bed, sleeping through the night, driving a car, climbing one flight of stairs, throwing a ball, reaching for food in the fridge, bending to wash the bathtub, and lifting and carrying a heavy suitcase. The participants were supposed to determine whether they found it difficult to perform the listed activities due to back pain complaints by selecting one of the six predefined responses: 'Not difficult at all', 'Minimally difficult', 'Somewhat difficult', 'Fairly difficult', 'Very difficult', or 'Impossible to do'. The score for each of the responses ranged from 0 ('Not difficult at all') to 5 ('Impossible to do'). Higher total score corresponded to higher level of disability due to back pain.

Each participant was assessed once.

Statistical analysis

To prepare the data for statistical analysis, GDS results were grouped into two categories: normal range and indicative of a risk for depression (GDS > 4). Statistical analysis was performed using Statistica (StatSoft, Krakow). Since all quantitative variables deviated from the normal distribution (Shapiro–Wilk test, $p < 0.05$) and the groups were unequal in size, nonparametric tests were consistently applied. The comparison of two groups of independent variables was conducted using the Mann-Whitney U test. The relationship between the GDS score and different domains of physical activity in the last year was assessed using Spearman's rank correlation. Subsequently, multivariate regression analysis was performed. The relationship between the GDS score and different domains of PA in the last year was assessed using Spearman's rank correlation. A p-value of < 0.05 was considered as statistically significant.

Results

A total of 205 participants (93 men and 112 women) were examined. The mean age of the participants was 70.12 ±6.49 years. Among the study participants, 28 met the criteria for depression symptoms (GDS > 4). A comparison between participants with and without depression symptoms revealed statistically significant differences in total PA, lifetime work-related activity, SPPB results, and Quebec scores. The depression group presented higher scores on the Quebec scale (indicating a higher level of disability related to pain), lower scores on the SPPB (indicating lower physical performance), and lower levels of total PA, both lifetime and in the last year. Additionally, their lifetime PA score related to work and sports was lower, but they achieved higher scores of PA related to household chores in the past year (Table 1).

Even though the comparison of the groups showed significant differences, univariate analyses showed that only MET Sport last year was associated with GDS (Table 2).

Table 2. Correlation analysis of associations between GDS and PA patterns

Pairs of variables	*r*	*P*-value
GDS & MET Occupation	–0.026	0.708
GDS & MET Household	0.137	0.050
GDS & MET Sport	–0.093	0.186
GDS & MET Total	0.021	0.762
GDS & MET Occupation last year	–0.135	0.054
GDS & MET Household last year	0.036	0.610
GDS & MET Sport last year	–0.150	0.032
GDS & MET Total last year	–0.056	0.428

r – Spearman's rank correlation coefficient. GDS – Geriatric Depression Scale. MET represents MET/week/year. MET Occupation: PA related to work. MET Household: PA related to household chores. MET Sport: PA related to sports and exercise. MET Total: pattern of PA, which is the sum of MET Work, MET Household, and MET Sport.

A multiple linear regression model was created with the GDS score as the dependent variable. Based on prior correlation analyses, only MET sport was included among the physical activity domains, because it was the only one significantly correlated with GDS. In addition, sex, age, handgrip strength (HGS), SPPB, and Quebec score were entered as independent variables due to their potential influence on depressive symptoms. The overall model was significant ($R^2 = 0.256$, $p < 0.001$). In this multivariate context, MET sport was no longer significantly associated with GDS, whereas SPPB emerged as the variable most strongly related to depressive symptoms (Table 3).

Discussion

Our study analysed the impact of patterns of physical education undertaken throughout life and the last 12 months on the risk of developing depression in old age. PA patterns expressed in MET/week were not statistically significantly associated with the occurrence of depression symptoms in our population. In light of the fact that numerous studies demonstrated beneficial effects of PA on reducing the risk of depression [6, 18–20], and improvement in the condition of patients with depression who engaged in regular PA [21, 22], our results are surprising. A systematic review and meta-analysis by Pearce *et al.* [18] demonstrated that current PA reduces the risk for developing depression. Depending on the study, PA was often assessed using questions about the duration of PA in general, or engagement in specific activities such as swimming or jogging. In several cases, the questionnaires for assessing the current PA, such as the International PA Questionnaire (IPAQ), were also used. Discrepancies between the results of our study and those analysed by Pearce *et al.* may stem from the differences in the investigated time frame and the methods used to determine PA levels. Da Oliveira *et al.* [6] found in their study that participants engaged in regular PA showed more favourable outcomes as far as depression symptoms were concerned. Their results are in contrast with our findings. Notably, in their study PA was assessed using the 36-Item Short Form Health Survey (SF-36), which allows for evaluation up to one month prior. Despite the large body of data indicating the positive impact of PA on depression, there are also conflicting reports. Chalder *et al.* [23] investigated a group of adults with depression symptoms who were encouraged to engage in PA. Despite increasing PA levels, no improvement in the mood was observed. However, the authors note that they assessed the effectiveness of encouraging individuals with depression symptoms to engage in PA rather than the direct impact of PA on the symptoms.

According to the literature, the assessment of the impact of PA on the risk of developing depression symptoms is typically limited to current PA. Attempts to investigate past PA and its impact on the risk of depression later in life have been scarce [18, 24]. One of the reasons why it is challenging, if not impossible, to compare the findings of different studies on the engagement in PA and risk of depression is the lack of uniform tools to measure PA. It is common to unify the presentation of the results in the study groups by categorizing the participants into high- or low-PA groups, depending on their PA scores. However, such simplified analysis may prevent detection of the po-

Table 3. Multiple linear regression predicting GDS

Variable	β	β standard error	β CI –95%	β CI + 95%	*P*-value
Age	0.073	0.070	–0.065	0.211	0.297
Sex	0.311	0.098	0.118	0.503	0.002
HGS	0.311	0.097	0.120	0.502	0.002
Quebec	0.094	0.071	–0.047	0.234	0.189
SPPB	–0.435	0.080	–0.593	–0.277	< 0.001
MET Sport last year	0.043	0.064	–0.083	0.169	0.500

HGS – hand grip strength, Quebec – Quebec Back Pain Disability Scale, SPPB – Short Physical Performance Battery, MET represents MET/week/year. MET Sport represents the pattern of PA related to sports and exercise.

tential differences within the same group [18]. LTPAQ allows for a retrospective assessment of the PA patterns. Specifically, it enables the representation of these patterns using specific average MET/week/year values for each participant. Another important reason is that various tools used to assess PA only evaluate specific domains related to sports, exercise, or occupational activities. Researchers often overlook activities related to household chores, which seems particularly important in the case of women [25]. Men typically score higher for work-related PA, while women engage more in household-related activity, resulting in comparable overall activity levels [25]. Therefore, exclusion of household-related activity from the analysis may have significantly impacted the interpretation of data.

In our study, physical fitness, measured with the SPPB test and HGS, proved to be the only factor that was significantly associated with the risk of developing depression. A relationship between depression symptoms and patient mobility and physical condition has been reported [26]. Considering the above, it seems safe to hypothesise that maintaining a satisfactory level of physical fitness plays a more important role in the reduction of the risk for developing depression than maintaining a specific level of PA. The concept of so-called 'exercise snacks', which has appeared in the literature recently, seems particularly applicable in this context. 'Exercise snacks' are defined as short bouts of high-intensity exercise, often lasting less than 1 minute, and reported as improving fitness and endurance, and reducing mortality. These activities appear to be safe and well-tolerated by older adults [27].

To the best of our knowledge, this has been the first study to assess the correlation of both lifetime and recent (last year) PA on the development of depression symptoms. The study was not without limitations, chief among them the fact that the scores of only 13.66% of the participants were within the range indicative of depression. That finding is consistent with other authors, who reported that depression affects between 10.4% and 14.4% of older adults [28]. According to Zenebe *et al.* [29], the mean prevalence of depression among the older population is 31.74%, while the WHO reports a prevalence rate of approximately 5–8% in the age group of > 60 years [30]. In our study, individuals with cognitive impairment were excluded because a retrospective interview had to be conducted with the participants. The subjectivity of PA assessment was the final limitation of our study. Because the study was retrospective in nature, the use of objective methods such as accelerometers or pedometers was not feasible.

Conclusions

No statistically significant relationships between PA patterns, either during one's lifetime or in past year, and the development of depression symptoms were found. However, a statistically significant relationship was detected between depression and overall physical fitness, which indicates that maintaining physical fitness, rather than prominent levels of PA, might play a crucial role in depression prevention.

Funding

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Ethical approval

The requirements of the Declaration of Helsinki were followed. The Local Ethics Committee approved the study protocol (No. 250/19). Informed consent was obtained from all participants.

Conflict of interest

The authors declare no conflict of interest.

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