

Association of physical activity and stress reactivity with depression in elderly hypertensive population: A cross-sectional study from Eastern India

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ABSTRACT

Objective: Depressive disorder poses an increased risk for sudden cardiac death in elderly population with existing comorbidities. Also, few international studies suggest the association of decreased stress reactivity with symptoms of depression in old age. Our cross-sectional study has attempted to explore the relationship of daily exercise and stress reactivity with depression in elderly individuals with hypertension. **Methods:** Depression was assessed using Hamilton depression rating scale or HAM-D. The physical activity was assessed using the global physical activity questionnaire (GPAQ), developed by WHO. Stress reactivity is calculated from various cardiovascular parameters. The relationship of physical activity and stress reactivity scores on depression was explored using regression analysis. **Results:** The prevalence rate of depressive symptoms in elderly hypertension population was around 40.2%. Significantly lower reactivity scores ($P = 0.032$) to deep breathing were evident in elderly hypertension population. After proper adjustment of the confounding factors, regression analysis depicted that decreased physical activity (Odds ratio = 4.48; 95% Confidence interval = 2.32-7.69) resulted in heavy risk of developing depressive symptoms besides old age and low educational status. **Conclusion:** Our findings suggest that low physical activity leads to the development of depressive symptoms and decreased stress reactivity among elderly hypertensive patients.

Keywords: Depression, hypertension, old age, physical activity, stress reactivity

Introduction

Depressive disorder poses a risk factor for the development of cardiovascular disease (CVD), leading to sudden cardiac death in elderly population. When these symptoms are present along with other comorbidities like diabetes or hypertension in old age, the quality of life deteriorates, further leading to poor tolerance to medications, exercise, and social behaviour. It negatively affects

emotional and cognitive functions, affecting appetite, mood, sleep, and energy. Unfortunately, very few studies had been able to highlight the need for a more careful approach while diagnosing the disorder while establishing any link between mental and cardiovascular health. Accordingly, early recognition and understanding the association between cardiovascular health and depression should prompt health professionals to provide beneficial care for old patients.^[1]

Regular physical activity is effective for both depression and hypertension. On the other hand, stress reactivity, which is an exaggerated cardiovascular response to cope up with both internal and external challenges, tends to get affected both in comorbid

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conditions and old age. Deep breathing test, mediated by vagal innervations, also gets significantly affected in old age.^[2,3] So far, various studies have illustrated the relation between physical activity and mental health in adult as well as elderly population but not much work has been done to explore the relationship of both daily exercise and stress reactivity with depression in elderly population with hypertension at primary care level.

Methods

A cross-sectional study was conducted from December 2022 to January 2023 in elderly hypertensive population attending a healthcare camp organised by Dr B.C. Roy Multi-speciality Medical Research Centre, IIT Kharagpur at Malma village.

Inclusion criteria

Of the 348 participants attending the healthcare camp, 212 participants had systolic blood pressure (BP) >139 mmHg and/or diastolic BP of 90 mmHg. Out of 212 participants, patients diagnosed with hypertension as and those who were of 60 years and above were included in the study. Diagnosis of hypertension was based on minimum two BP recordings (systolic blood pressure more than 139 mm Hg, diastolic blood pressure—90 mmHg) taken by a healthcare provider of at least 1-4 weeks apart.

Sample size

Considering the prevalence of hypertension to be 40% in elderly population with hypertension in rural areas as reported by Kamble *et al.*^[6] in 2022, formula used to calculate sample size was $(Z\alpha/2)^2 PQ/L2$, with 95% confidence interval (CI). In this way, by simple random sampling, we finally recruited 154 participants for our study.

Ethical considerations

The study is part of larger research project approved by the Institutional ethics committee board (IIT/SRIC/DEAN/2023). Informed consent was obtained from all the participants belonging to the study sample.

Study tool

A semi-structured questionnaire in Bengali and Hindi language was used which included socio-demographic data including age, gender, marital status, educational standards (illiterate, below high school, high school, or college), employment, and any history of smoking. Questions pertaining to hypertension, medications, and duration were asked. Health-related characteristics like BMI and other comorbidities like diabetes, asthma, COPD, obesity, coronary artery disease, and any neurological conditions were enquired and excluded from the study accordingly.

Deep breathing test

The subjects were explained to ensure smooth, slow, and deep breathing for 6 cycles per minute where both inspiration and expiration were maintained for 5 sec each.

Electrocardiography (ECG) and BP was measured at the time of assessment using digital sphygmomanometer. Delta heart rate (HR) was calculated from the average difference between the maximal and minimal HRs during inspiration and expiration, respectively.^[4,5]

Depression assessment

Depression was assessed using Hamilton depression rating scale or HAM-D. It is a validated 17-item instrument that was designed to measure frequency and intensity of depressive symptoms in individuals with depression. HAMD scores are classified as normal (<9), mild depression (10 to 13), mild to moderate depression (14 to 17), and moderate to severe depression (>17). It is said to be one of the best screening tools used in older adults with depression, with sensitivity in the range of 86%-91% and specificity in the range of 84%-90%.^[6-8]

Physical activity

The physical activity was assessed using the global physical activity questionnaire (GPAQ), developed by WHO. It measures physical activity in 3 separate dimensions which includes work, transport, and leisure time. Based on WHO criteria on global physical activity, adults between age group of 18-64 years and above must be doing at least 150 minutes of moderate or 75 minutes of vigorous physical activity, throughout a week, thus adding up to 600 MET –minutes of work. Those who working with less than 600 MET –min/week were considered as “inactive”, whereas more than ≥ 600 MET-min/week were considered “active”. From previous literature, one MET is considered to be 1 kcal/kg/hour. Thus, calculation was done using GPAQ data, 4 METs equivalent to moderate activities, whereas 8 METs to vigorous activities.^[9,10]

Data analysis

Data analysis was done using SPSS software version 22.0. Quantitative data were compared using unpaired *t*-test. To explore the association of physical activity and stress reactivity scores with depression, logistic regression analysis was used. A *P* value less than 0.05 was considered to be significant.

Results

The mean depressive symptom score of the 154 participants was 12.68 (± 3.82). Higher prevalence rate of 40.2% ($n = 62$) was observed among elderly individuals with hypertension who were having symptoms of depression. In Table 1 the mean age of both the groups with and without depressive symptoms was statistically not significant, yet significant differences in gender ($P < 0.001$) were noticed. Increased number of individuals was observed having a better educational status ($P < 0.001$) and thus having less symptoms of depression. Significant differences were observed in marital status ($P = 0.002$), and socio-economic conditions ($P = 0.03$) between the groups with and without symptoms of depression. However, our study did not report any significant differences in duration related to diagnosis of

Table 1: Socio-demographic characteristics between two elderly hypertensive groups with and without depression

Characteristics	Numbers (n) (Total=154)		P
	Depression (yes) n=62 (40.3%) n/Mean±SD	Depression (no) n=92 (59.74%) n/Mean±SD	
1. Age Group (Years)			
60-69	46	68	
70-79	16	24	
Mean age	66.24±10.42	67.12±8.44	0.062
2. Gender			
Male	48	66	<0.001
Female	14	26	
3. Marital Status			
Married	38	54	0.002
Widow/widower	24	36	
Unmarried	0	2	
4. Education			
Illiterate	22	34	<0.001
Primary School	26	41	
High School	9	11	
Secondary School	5	6	
5. Socio-economic Class			
Upper -I	0	0	
Upper middle-II	0	0	
Middle-III	14	28	0.034
Lower middle-IV	31	45	
Lower-v	17	19	
6. Body Mass Index	26.14±7.2	24.67±3.8	0.674
Underweight (<18.5)	8	10	
Normal (18.5-22.9)	12	24	
Overweight (23-24.9)	16	36	
Obese (≥25)	26	22	
7. Systolic BP (mmHg)	126.12±15.74	124.68±16.82	0.442
Diastolic BP (mmHg)	84.63±9.72	83.24±6.43	0.154
8. Duration of Hypertension (in years)	5.02±1.76	4.79±5.13	0.052
9. Regular in medication	44	56	0.215

Table 2: Comparison of physical activity between two elderly hypertensive groups with and without depression

Variables	Depression (yes) n=62	Depression (no) n=92	P
	n/Mean±SD	n/Mean±SD	
Physical activity (MET-min/week)	442.67±101.44	1167.27±366.48	<0.001
Low PA	52	33	
Moderate or vigorous PA	10	59	
Delta HR	12.47±2.16	15.13±1.84	0.032

hypertension, regularity in medications, BMI, mean systolic BP, or mean diastolic BP between the groups with and without depression.

In Table 2, the mean physical activity scores of both groups with and without depressive symptoms were 442.67 (±101.44) and 1167.27 (±366.48), respectively. Significant low physical activity (33.8%) was reported in elderly hypertensive population

with depressive symptoms, compared to those having no symptoms ($P < 0.001$).

The delta HR was significantly reduced ($P = 0.032$) in elderly hypertensive population with depressive symptoms compared to those having no symptoms.

From the regression analysis, it is revealed that low physical activity (OR = 4.48; 95% CI = 2.32–7.69) could pose a high risk in developing depressive symptoms after adequate adjustment of variables related to social background, among old age individuals with hypertension as shown in Table 3. In addition, decreased stress reactivity, older age, low educational status, and absence of spouse were significantly related to the development of depressive symptoms in hypertensive population (OR = 1.88 95% CI = 1.26–9.64) as shown in Table 3.

Discussion

At present time, it is very important and need of the hour to identify various risk factors for depression, seen when specifically in elderly population with hypertension. These patients are at risk for cerebrovascular challenges like stroke and thus affecting the mortality rates among the elderly population.

In our study, it is observed that the prevalence rate of depression was high of about 40.2%. Our observation was based on Hamilton depression score scale cut off of more than 9. This finding was in accordance with previous study by Chadler *et al.*^[11] who found that depression is highly prevalent in hypertensive subjects as compared to healthy population. Among various depression assessment tools, HMD-17, a self-reported questionnaire, is considered to be accurate, valid, and reliable for measuring depressive symptoms among elderly population. In a study done by the Korea National Health and Nutrition Examination Survey, 6.7% prevalence rate was reported using patient health questionnaire (PHQ-9) assessment tool in adult patients with hypertension. Thus, the discrepancy in the prevalence rates might be due to a different assessment tool used to quantify depressive symptoms as well as the age and socio-economic background of the sample population.^[11-13]

The next important finding was that low physical activity is highly related to developing depressive symptoms than those involved in moderate to vigorous physical activity among the elderly population with hypertension. This observation is in accordance with previous studies demonstrating that decreased amount of daily exercise could lead to depression adult population. Win *et al.* also reported the relationship between significant low physical activity and development of cardiovascular disease irrespective of age. Similarly there are few studies which emphasized that stable mental health could be achieved from moderate to vigorous physical activity, irrespective of age and gender. Thus, every healthcare professional should encourage subjects with hypertension particularly of old age, to engage themselves in some sort of physical activity, rather than sitting at home and

Table 3: Predictors of depressive symptoms in patients with hypertension (n=154)

Predictors	Depressive symptoms			
	Unadjusted OR (95% CI)	Unadjusted P	Adjusted OR (95% CI)	Adjusted P
1. Age Less than 60 years (reference)				
>60 years	5.48 (2.39–11.27)	<0.001	1.88 (1.26–9.64)	0.002
2. Gender (Ref. Male)				
Female	1.86 (1.42–4.28)	0.342	0.92 (0.62–3.19)	0.172
3. Spouse (Ref. No)				
Yes	0.46 (0.28–0.67)	0.004	0.76 (0.52–1.32)	0.026
4. Educational level (Ref. primary school)				
Illiterate	5.46 (2.32–14.68)	<0.001	3.14 (1.21–9.62)	0.042
High school	1.92 (0.63–6.14)	0.162	1.74 (0.54–5.84)	0.237
Secondary school	1.23 (0.52–3.64)	0.434	1.84 (0.78–5.27)	0.519
5. Physical activity (Ref. Moderate or vigorous PA)				
Low PA	5.72 (3.14–10.54)	<0.001	4.48 (2.32–7.69)	<0.001
6. BMI (Ref. Normal ≤ 22.9)				
Overweight or Obese (≥ 23)	1.36 (0.72–2.54)	0.128	1.28 (0.68–2.86)	0.561
7. Regularity in taking Medication (Ref. Regular)				
irregular	2.32 (1.3–3.64)	0.053	1.44 (0.86–2.45)	0.162
8. Delta HR (Ref: normal >15)	5.48 (2.39–7.28)	0.006	3.64 (1.58–5.72)	0.044

CI=confidence interval; PA=physical activity; OR=odds ratio. BMI=Body Mass Index; HR=Heart rate

using high levels of mobile phones activity which increases the sedentary behaviour and likelihood of developing various ailments. It is very important to identify the various levels of physical activities and daily routine necessary to prevent in elderly population particularly with comorbidities like hypertension.^[14]

In the present study, we also observed that education plays an important role in maintaining mental wellbeing. As such, old age population with hypertension who did not even attend primary schools suffered from depressive symptoms compared to those who had minimum level of primary education. This finding is at par with the results of few studies that correlated symptoms of depression with aging, marital status, literacy levels, and other socio-demographic factors. Sometimes, the older population with hypertension tends to get bewildered with the symptoms of depression thinking they are having sleep issues and low energy. Lack of knowledge makes an individual insecure and lonely, and this insecurity gets increased with age and existing comorbidities.^[15] Thus, it is absolutely necessary for healthcare providers as well as the family members to empathize with the old age for lifestyle modification changes, particularly in terms of physical activity in depressed patients with hypertension.

In our study, reduced stress reactivity to deep breathing test was observed in elderly population with hypertension exhibiting depressive symptoms. Previous few studies mentioned the decrease in delta HR in old age, whereas basal HR increases due to improper parasympathetic tone.^[16,17]

The major limitation of our study was the measurement of stress reactivity solely based on one test that is deep breathing test rather than a battery of autonomic function tests, which could have given more accurate results. At a primary care level, a battery of autonomic function tests (AFT) is not feasible; thus, the researchers of this study recommend the same in a tertiary

care institute free of cost. Also we had used highly sensitive and specific scale in quantifying depressive symptoms; yet, further research is necessary to establish an accurate screening scale to detect clinical depression and it is a causal relationship with physical activity in elderly population with hypertension.

Conclusion

Our findings suggest that prevention of depression is possible if we could identify the level of physical activity in elder population with hypertension. Depression and hypertension together lower the stress reactivity in old age and thus factors responsible for the same need to be avoided to prevent sudden cardiac death in old age. In future, focus should be executed further on development of robust primary healthcare to cater the long-term needs of the elderly population suffering from hypertension.

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Conflicts of interest

There are no conflicts of interest.

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