

# Physical Activity in the Prevention of Benign Paroxysmal Positional Vertigo: Probable Association

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## Abstract

**Introduction** Physical inactivity is an important risk factor for many age-related diseases and symptoms such as dizziness and vertigo.

**Objective** The aim of the study was to investigate the possible association between benign paroxysmal positional vertigo (BPPV) and regular physical activity in elderly subjects.

**Methods** This cross-sectional study included 491 elderly individuals who lived independently. Physical exercise was assessed through a questionnaire and BPPV by history and the Dix-Hallpike maneuver.

**Results** The present study indicates no significant association between BPPV with lack of physical activity in men and in the total population. We have confirmed associations between BPPV with lack of physical activity in women ( $p = 0.01$ ). Women with a sedentary lifestyle who do not practice physical activity are 2.62 more likely to have BPPV than those with regular physical activity.

**Conclusion** These results highlight the importance of identifying risk factors for BPPV that can be modified through specific interventions. Regular physical activity is a lifestyle with potential to decrease the risk of vertigo in women.

## Keywords

- ▶ dizziness
- ▶ aging
- ▶ exercise

## Introduction

Exercise is a systematic repetition of oriented movements with a consequent increase in oxygen consumption due to muscular demand, which generates energy expenditure. Exercise is a subset of physical activity planned to maintain bodily conditioning. It can also be defined as any activity that generates muscular strength and disrupts homeostasis.<sup>1</sup>

Physical inactivity and low fitness level have been considered risk factors for various metabolic and circulatory changes that cause several symptoms, including dizziness, especially among elderly individuals.<sup>2</sup> Dizziness is among the most common complaints of the elderly population. It is a very relevant issue because it increases the risk of falls, which is an important risk factor related to morbidity and mortality in this age group.<sup>3</sup> Dizziness is a change in the balance

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characterized by an illusion of movement or environment that surrounds the subject. Rotational dizziness is called *vertigo*.<sup>4</sup> This symptom is highly prevalent worldwide, affecting ~2% of young adults, 30% in the elderly over 65 years, and up to 50% in the elderly over 85 years.<sup>5</sup>

Especially in elderly individuals, lack of regular physical activity and low level of physical fitness are risk factors for several metabolic and circulatory changes that cause various symptoms, such as dizziness and even benign paroxysmal positional vertigo.<sup>2,6</sup> Current evidence shows that physical activity can improve health, maintain functional independence, and improve quality of life in the elderly.<sup>7</sup>

Loss of muscle power leads to reduction in joint motion capacity to perform rapid and necessary activities that require moderate force like rising from a chair, climbing stairs, and maintaining balance while avoiding obstacles like stairs and slopes.<sup>8</sup> The relationship between physical activity and health has been long known; it was mentioned in ancient texts from China, India, Greece, and Rome.<sup>9</sup>

A study of elderly people found that a resistance training program for 24 weeks improved balance, coordination, and agility.<sup>10</sup> Physical activity slows the deterioration of physical fitness variables such as cardiovascular endurance, strength, flexibility, and balance.<sup>11</sup>

Age can cause the heart to lose some of its functional reserves and go into heart failure. Additional capillary blood flow and consequent oxygen transport are associated with the circulatory system; the blood supply depends on the structural and functional integrity of the heart and blood vessels. Capillary blood flow decreases with hypertension, circulatory problems, diabetes, and other pathologies in the aging process. Regular physical activity slows this process.<sup>12,13</sup>

Aging also changes joint structures in a continuous manner and contributes to clinical disorders linked to function and mobility.<sup>14</sup> According to Hall,<sup>15</sup> balance is the ability to control stability. There are two types of balance, static and dynamic, with outside forces like inertia affecting the balance. According to Paes,<sup>16</sup> changes in the elderly nervous system slow the process of information to and activation of muscles, resulting in slower movements and greater reaction times.

Vertigo is the most common type of dizziness, and benign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo in adults; its prevalence is estimated at 3.2% in females and 1.6% in males. It is considered the most common cause of dizziness in the elderly, as 30% of people experience the condition at least once.<sup>17,18</sup> In the United States, BPPV has an estimated prevalence of 2.4% in the general adult population, and although this disorder can affect people of any age, it tends to affect individuals 50 to 70 years old.<sup>19</sup>

Based on the considerations presented, this study aimed to investigate the possible association between the presence of BPPV with the practice of regular physical activity in older patients of the EELO (Estudo sobre envelhecimento e Longevidade) project.

## Methods

This cross-sectional study was approved by the Human Research Ethics Committee.<sup>20</sup> It is part of a broader investigation, the "Aging and Longevity Study," which has been conducted in Londrina since 2009. The city of Londrina (~500,000 inhabitants) is situated in the north region of Paraná state in Brazil.

A population of 43,610 elderly people are enrolled in the 38 primary care units in the urban city area. The sample was a randomly stratified set, considering the gender and the five regions of the city (15% from the central region, 27% from the northern region, 23% from the southern region, 19% from the eastern region, and 16% from the western region). The study included individuals aged 60 years and over, of both genders, who were living independently and were classified at level 3 or 4 as proposed by Spidurso.<sup>21</sup> This classification evaluates the independence level of elderly subjects, with level 1 indicating a lack of self-mobility and level 5 indicating athletes. Elderly people who had any illness or limitation that would prevent the testing, such as physical or mental disabilities, were excluded from the sample. All the participants signed an informed consent form. A total of 491 elderly patients were included in this part of the study.

The Dix-Hallpike maneuver was performed in all the subjects.<sup>22</sup> Regular physical exercise was verified with the following questions: Do you participate in regular physical activity? If yes, how long, and how often and how long do you exercise?

The presence of vertigo was established through questions about vertigo (attacks, symptoms, and familiar history of vertigo), and the diagnosis of BPPV among study participants with vertigo was established with the Dix-Hallpike maneuver and answered the questionnaire about Vertigo.

In the first stage (raw analysis), the chi-square test noted associations between BPPV and the variables. A  $p$  value of  $\leq 0.05$  was considered statistically significant, and the significance of variables such as physical exercises, gender, and age were all considered. In the next stage, we selected the variables that had significant values for the descriptive level. Multiple logistic regression was used to investigate the interactions between the variables, controlling for the effects of the previously selected factors. The statistical modeling process was performed using the stepwise selection method.

## Results

BPPV was found in 118 elderly people and 53 of them had recurrent BPPV confirmed by the questionnaire.

We did not observe a significant association ( $p = 0.7641$ ) between physical activity and BPPV in the total population OR = 0.9169. We did not observe a significant association ( $p = 0.2636$ ) between physical activity and recurrent BPPV in the total population OR = 1.4628 (– **Table 1**). We found no evidence of significant association ( $p = 0.1038$ ) between physical activity and recurrent BPPV in men, (OR = 0.3182 (– **Table 2**).

We have confirmed associations between current BPPV with lack of physical activity and regular BPPV in women

**Table 1** Distribution of patients according to the practice of physical activity and BPPV

Physical activity	BPPV				Total
	Yes		No		
	<i>n</i>	%	<i>n</i>	%	
Yes	19	3.87	197	40.12	216
No	34	6.92	241	49.08	275
Total	53	10.79	438	89.2	491

Abbreviation: BPPV, benign paroxysmal positional vertigo.

Note: Odds ratio = 1.4628; confidence interval = 0.8091–2.6444; chi-square  $p = 0.2636$ ; right ear / number needed to cause one adverse event in time = 29.

( $p = 0.01$ ). Women who do not practice physical activity were 2.62 more likely to have BPPV than those who practice regular physical activity (►Table 3).

We then performed a logistic regression analysis between BPPV in women and the associated factors from the final model, which included age and physical activity as covariates. This logistic regression analysis showed that the lack of physical activity in elderly women is an independent risk factor for BPPV (►Table 4).

## Discussion

Reduction of physical and motor skills, coupled with a sedentary lifestyle, can lead the elderly to a condition of extreme weakness, threatening their physical independence.<sup>2</sup> According to Mann et al,<sup>23</sup> physical exercise has been suggested as an alternative in improving quality of life and decreasing the risk of falls and fractures in the elderly. This improves several factors, including the postural balance.

According to Giacomini et al, BPPV due to intense physical activity is a rare condition (9 from 430 subjects studied had BPPV), and it may be caused by repeated vibratory vertical accelerations of a minor degree associated with metabolic variations during strenuous exercise.<sup>24</sup>

Physical activity exerts a beneficial effect in health conditions and may contribute to a lower incidence of falls in the

**Table 2** Distribution of male subjects according to the practice of physical activity and BPPV

Physical activity	BPPV				Total
	Yes		No		
	<i>n</i>	%	<i>n</i>	%	
Yes	9	5.49	63	38.41	72
No	4	2.44	88	53.66	92
Total	13	7.93	151	92.07	164

Abbreviation: BPPV, benign paroxysmal positional vertigo.

Note: Odds ratio = 0.3182; confidence interval = 0.0938–1.0793; chi-square  $p = 0.1038$ ; right ear / number needed to cause one adverse event in time = 13.

**Table 3** Distribution of female subjects according to the practice of physical activity and BPPV

Practice of physical activity	BPPV				Total
	Yes		No		
	<i>n</i>	%	<i>n</i>	%	
Yes	10	3.06	134	40.98	144
No	30	9.17	153	46.79	183
Total	40	12.23	287	87.77	327

Abbreviation: BPPV, benign paroxysmal positional vertigo.

Note: Odds ratio = 2.6275; confidence interval = 1.2382–5.5753; chi-square  $p = 0.0156$ ; right ear / number needed to cause one adverse event in time = 11.

elderly population.<sup>11</sup> Individuals over 60 years of age studied in the EELO project were similar to the population studied by Andre et al (range: 60 to 91, mean 67.2 years).<sup>25,26</sup>

A potential limitation of our study stems from its observational nature and the self-reported survey that may not capture the subject's actual amount of regular physical activity.

Women are more willing to adhere to physical activity. There was a prevalence of women in study the by Andre et al.<sup>25</sup> Other studies also report a higher prevalence of BPPV with balance disorders with female predominance.<sup>27,28</sup> In the present study, we observed an association ( $p = 0.01$ ) between lack of physical activity and regular BPPV in women. A woman with lack of physical activity is 2.62 times more likely to have BPPV than those who practice regular physical activity. However, we found no evidence of significant association ( $p = 0.1038$ ) between physical activity and BPPV in men.

These results highlight the importance of identifying risk factors for BPPV that can be modified through specific interventions,<sup>27,28</sup> which is essential in the prevention of future episodes and in the management of the rehabilitation process in elderly patients in general and especially for elderly females with vertigo.

Physical inactivity is an important risk factor for many aging-related diseases. Sedentary lifestyle may accelerate the aging process. This provides a powerful message that could be used by clinicians to promote the potentially antiaging effect of regular exercise.<sup>29</sup>

**Table 4** Multiple logistic regression between BPPV and associated factors of physical activity and age in female subjects

Multiple logistic regression			
Variables	<i>p</i> value	Odds ratio	95% CI
Intercept–vertigo			
X2–physical activity	0.0117	0.3798	0.18–0.81
X3–age	0.6698	1.0114	0.96–1.07

Abbreviations: BPPV, benign paroxysmal positional vertigo; CI, confidence interval.

Regular physical activity is a lifestyle with the potential to decrease the risk of vertigo in women. The results of this research can serve as a basis for health professionals. In a study with the same population, presence of vertigo was lower in elderly practitioners of regular physical activity. A significant association ( $p = 0.001$ ) between the lack of regular physical activity and vertigo showed that people who not practice physical activity were 2.38 more likely to have vertigo than those who engaged in regular physical activity.<sup>30</sup>

This study showed that the lack of physical activity in elderly women is an independent risk factor for BPPV, and the importance of preventive processes is highlighted.

Several avenues exist for further research in this area, most notably examining the relationship between BPPV and types of regular physical activity.

## Conclusion

The present study indicates no significant association between BPPV with lack of physical activity in men and in the total population. We confirmed associations between BPPV with lack of physical activity in women. Certainly sedentary lifestyle has an effect on BPPV in women.

Women who do not practice physical activity are 2.62 more likely to have BPPV than those who practice regular physical activity. These results highlight the importance of identifying risk factors for BPPV that can be modified through specific interventions. Regular physical activity has the potential to decrease risk of vertigo in women.

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