

# Effectiveness of 8 weeks of vestibular exercises on stress, sleep, and cognitive parameters in hypertensive patients



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## ABSTRACT

**Background:** It was hypothesized that vestibular stimulation causes beneficial effects in hypertensive patients as so as in diabetic individuals. **Aims and Objectives:** The present study was undertaken to observe the effectiveness of 8 weeks of vestibular exercises on stress, sleep, and cognitive parameters in hypertensive patients. **Materials and Methods:** A total of eighty male and female stage 1 hypertensive individuals were part of the study after obtaining voluntary, written informed consent. Vestibular exercises comprising three steps with a time period of 45 min per session were administered to the participants of the intervention group. Two sessions per week were administered as mentioned in the literature. Stress levels were assessed by the perceived stress scale. Sleep was assessed by the insomnia severity index. A spatial and verbal memory test was used to assess the spatial and verbal memory scores. **Results:** There was no significant difference in the demographical parameters of the control and intervention groups. There is no significant difference in stress, sleep scores, and spatial and verbal memory scores among the control and intervention groups. There was a significant decrease in the stress scores and insomnia scores, and a significant improvement in the spatial and verbal memory scores in the intervention group after the intervention when compared with the control group. **Conclusion:** The present study results suggest that vestibular exercises have a positive impact on reducing stress and improving sleep and cognition in hypertensive individuals. The study highlights the need for further detailed studies in this area to recommend the inclusion of vestibular exercises as adjunctive therapy in the management of hypertension.

**Key words:** Adjunctive therapy; Hypertension; Vestibular exercises

## INTRODUCTION

Throughout the world, hypertension is the prime cause of premature death.<sup>1</sup> In India, hypertension is directly linked with stroke and coronary heart disease and leads to death.<sup>2</sup> In India, the burden of hypertension is on the raise and needs effective management methods to control the raise.<sup>3</sup> Although, pharmacological therapy is effective, there is a need for adjunctive therapy that boosts the outcome of

the pharmacological therapy. Vestibular exercises are an adjunctive therapy that can help manage hypertension effectively.<sup>4</sup> These exercises are found to be effective in diabetic patients to reduce stress and improvement of cognitive parameters.<sup>5</sup> They were also effective in improving the sleep of diabetic individuals. Further, there is an improvement in the regulation of autonomic functions.<sup>6</sup> Vestibular system is well connected with the brain centers that regulate autonomic functions. The dorsal motor nucleus

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of the vagus was reported to stimulate followed by the vestibular stimulation. Thus, stimulating the vestibular system optimally causes vagal activation. At the same time, vestibular inputs inhibit the locus coeruleus which is a sympathetic nucleus. Hence, parasympathetic dominance was expected followed by the practice of vestibular exercise.<sup>7</sup> Vestibular system is also connected with the brain areas related to sleep and hence, rocking causes individuals to fall asleep.<sup>8</sup> There exist literature supporting the increase in cognitive functions in healthy and diseased individuals followed by vestibular stimulation.<sup>9,10</sup> Similar studies are not available in the case of hypertensive patients. It was hypothesized that vestibular stimulation causes beneficial effects in hypertensive patients as so as in diabetic individuals. Hence, the present study was undertaken to observe the effectiveness of 8 weeks of vestibular exercises on stress, sleep, and cognitive parameters in hypertensive patients.

### Aims and objectives

The present study was undertaken to observe the effectiveness of 8 weeks of vestibular exercises on stress, sleep, and cognitive parameters in hypertensive patients.

## MATERIALS AND METHODS

### Study design

The present study was an experimental study.

### Study setting

The present study was conducted at R. D. Gardi Medical College in collaboration with Government Vellore Medical College, Adukkamparai, Vellore-11.

### Study participants

A total of eighty male and female stage 1 hypertensive individuals were part of the study after obtaining voluntary, written informed consent. The following inclusion and exclusion criteria were used to recruit the participants.

### Inclusion criteria

Willing participants of both genders within the age group of 35–50 years, with stage 1 hypertension, were included in the study.

### Exclusion criteria

Participants with severe complications, undergoing some other adjunctive therapies already were excluded from the study.

After recruiting the participants were grouped into two groups with forty participants in each group.

- Group 1 (n=40): Intervention group: Regular therapy + vestibular exercise for 8 weeks
- Group 2 (n=40): Control group: Only regular therapy.

### Vestibular exercises

Vestibular exercises comprising of three steps with the time period of 45 min per session were administered to the participants of the intervention group. Two sessions per week were administered as mentioned in the literature.<sup>4</sup>

### Assessment of stress

Stress levels were assessed by the perceived stress scale. This is a standard questionnaire to assess stress levels.<sup>11</sup>

### Assessment of sleep

Sleep was assessed by the insomnia severity index. This is a standard questionnaire to assess insomnia severity.<sup>12</sup>

### Assessment of cognition

Spatial and verbal memory test was used to assess the spatial and verbal memory scores. These are standard tests to assess cognitive functions.<sup>13</sup> The numbers and words used in our test were 20 and different numbers and words were used before and after the intervention.

### Ethical considerations

The present study protocol was approved by the institutional human ethical committee. Confidentiality of data was maintained. Voluntary, informed consent was obtained from all the participants.

### Statistical analysis

Data were analyzed using SPSS 20.0 version. Student t-test was applied to assess the significance of the difference between the groups. The probability value of <0.05 was considered significant.

## RESULTS

Table 1 presents the demographic data of the participants. There was no significant difference in the demographical parameters of the control and intervention groups. Table 2 presents the Stress, sleep, and cognitive parameters of the participants before the intervention. There is no significant difference in stress, sleep scores, and spatial and verbal memory scores among the control and intervention groups. Table 3 presents the stress, sleep, and cognitive parameters of the participants after the intervention. There was a significant decrease in the stress scores and insomnia scores, and a significant improvement in the spatial and verbal memory scores in the intervention group after the intervention when compared with the control group.

## DISCUSSION

The current study determined the effect of vestibular exercise on stress, sleep, and cognition. There was a

**Table 1: Demographic data of the participants**

Parameter	Intervention group (n=40)	Control group (n=40)	P-value
Age (years)	39±0.79	40±0.63	0.3263
Height (cm)	168±6.64	170±8.22	0.8504
Weight (kg)	78±4.43	84±5.69	0.4079

Data were presented as mean and SEM.

**Table 2: Stress, sleep, and cognitive parameters of the participants before the intervention**

Parameter	Control group (n=40)	Intervention group (n=40)	P-value
Stress Score	28±1.26	29±0.95	0.5289
Insomnia severity index	22±0.95	24±0.95	0.1401
Spatial memory	3±0.16	3±0.16	1.000
Verbal memory	4±0.32	4±0.16	1.000

Data were presented as mean and SEM.

**Table 3: Stress, sleep, and cognitive parameters of the participants after the intervention**

Parameter	Control group (n=40)	Intervention group (n=40)	P-value
Stress score	28±0.63	19±1.26	<0.0001***
Insomnia severity index	22±0.95	14±0.63	<0.0001***
Spatial memory	4±0.16	6±0.32	<0.0001***
Verbal memory	5±0.32	7±0.47	0.0008***

Data were presented as mean and SEM. \*\*\*P&lt;0.001

significant improvement in sleep quality and cognition and a significant reduction in stress scores. Stress, sleep, and cognition are closely related. Lack of adequate sleep can increase stress and cause a decline in cognitive functions.<sup>14</sup> Stimulating the vestibular system is necessary throughout life for homeostasis. It has been used from age-old to manage various neurological disorders.<sup>15</sup> Sleep-causing effect of the vestibular system is well known. In fact this effect we experience before birth itself. Likewise when the mother is walking, due to the movement of the amniotic fluid, there will be a rocking effect on the fetus and a similar rocking effect will be administered after birth also for calming effects.

It was clearly mentioned that those with vestibular dysfunction will undergo higher levels of stress than those with normal vestibular functions.<sup>16</sup> There are several studies that testified the relation between vestibular and stress interactions.<sup>17</sup> Vestibular stimulation when done optimally, causes inhibition of the stress axis both the HPA and SAM axis. Due to this action, the cortisol levels will be limited and also with the autonomic acceleration. Several studies explained that the vestibular system has connections with the hippocampus which is very essential

for spatial memory.<sup>18</sup> Further, there is impairment of memory followed by vestibular stimulation.<sup>18</sup> Improvement in spatial and verbal memory was reported followed by vestibular stimulation in healthy and diseased individuals.<sup>13</sup>

### Limitations of the study

The major limitation of the study was its lower sample size.

## CONCLUSION

The present study results suggest that vestibular exercises have a positive impact on reducing stress and improving sleep and cognition in hypertensive individuals. The study highlights the need for further detailed studies in this area to recommend the inclusion of vestibular exercises as adjunctive therapy in the management of hypertension.

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**YSS, SP, and AK-** Concept, and design of the study results interpretation, review of the literature and preparing the first draft of the manuscript.

**SSKG and AC-** Concept, and design of the study, results interpretation, review of the literature, and preparing the first draft of the manuscript.

**RSC, PPA and PGG -** Concept, and design of the study, statistical analysis and interpretation, revision of the manuscript.

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