Effectiveness of 6 weeks vestibular exercises practice on depression, anxiety, stress, and memory in hypertensive working women

Paramasivam Velu¹, Bhanu Prakash Gangupalli², Neelkanth Kote³, Sai Sailesh Kumar Goothy⁴, Joseph Kurien Mukkadan⁵

¹Assistant Professor, Department of Anatomy, Government Karur Medical College, Karur, Tamil Nadu, India, ²Assistant Professor, Department of Physiology, Melmaruvathur Adiparasakthi Institute of Medical Sciences (MAPIMS), Melmaruvathur, Tamil Nadu, India, ³Assistant Professor, Department of Physiology, The Oxford Medical College Hospital and Research Centre, Bengaluru, Karnataka, India, ⁴Associate Professor, Department of Physiology, RD Gardi Medical College, Ujjain, Madhya Pradesh, India, ⁵Research Director, Little Flower Medical Research Centre, Angamaly, Kerala, India

ABSTRACT

Background: There is a raise in the psychological problems globally. Depression, anxiety, and stress are the negative psychological emotions that have to be diagnosed and managed at earlier stages. Vestibular stimulation was known to manage the negative psychological emotions. Aims and Objectives: The aim of the study was to observe the effectiveness of selective vestibular exercises on depression, anxiety, stress, and memory in hypertensive working women. Materials and Methods: A total of 20 working women with untreated pre-hypertension to Stage I hypertension and 20 healthy age-matched controls (working women), after obtaining written and informed consent. Results: There was a significant improvement in the depression, anxiety, and stress scores followed by the practice of vestibular exercise. Spatial memory was significantly improved followed by practice of vestibular exercise for 6 weeks. Although there was an improvement in the verbal memory, it was not statistically significant. Conclusion: The study results present significant improvement in the depression, anxiety, and stress scores and significant improvement in spatial memory followed by the vestibular exercises for 6 weeks. The study recommends further detailed study with higher sample size to recommend vestibular exercise in the management of negative emotions and to improve memory.

Key words: STOPS; Neonatal intensive care unit; Newborn; Prognosis

INTRODUCTION

There is a raise in the psychological problems globally.¹ Depression, anxiety, and stress are the negative psychological emotions that have to be diagnosed and managed at earlier stages. Conditions like COVID-19 have worsened the scenario. Vestibular system was known to maintain the posture and equilibrium. However, it was also reported that there is a need to stimulate vestibular system throughout the life for proper homeostasis. Considering this important role, vestibular system was celled as the sixth sense.² The negative emotions are regulated by two important axes that is hypothalamo pituitary adrenal axis and sympathetic adreno medullary axis. It was reported that vestibular stimulation inhibits both the axis by direct and indirect pathways provided the stimulation was optimal stimulation.³ Excessive stimulation of vestibular system results in adverse effects whereas under stimulation has no effect. Optimal vestibular stimulation is associated with more beneficial effects. Vestibular system is well connected with different brain areas associated with memory. It has been used as a therapy for management of anxiety in earlier days.⁴ The negative emotions are associated with decrease in the memory if not managed effectively.⁵,⁶ Vestibular stimulation was known to improve memory effectively. Considering these earlier reports, three set of standard
Vestibular exercises were adopted from the standard protocol to manage the negative psychological emotions. The studies in this area are sparse. Hence, the present study was undertaken to observe the effectiveness of selective vestibular exercises on depression, anxiety, stress, and memory in hypertensive working women.

Aims and objectives
The aim of the study was to observe the effectiveness of selective vestibular exercises on depression, anxiety, stress, and memory in hypertensive working women.

MATERIALS AND METHODS

Study design
This was an experimental study. After recording the baseline parameters, vestibular exercises were administered as exercise for 6 weeks to intervention group and no intervention to the control group for 6 weeks. Post-intervention values were recorded after 6 weeks from both the groups and compared.

Study setting
This study was conducted at Department of Physiology, LFMRC, Angamaly, Kerala, India.

Study participants
A total of 20 working women presented with untreated pre-hypertension to Stage I hypertension and 20 healthy age-matched controls (working women), after obtaining written and informed consent. The study was approved by the Institutional Human Ethical Committee (IEC/LFHRC/27-01-2016) (mention the EIC number with dates). The participants were recruited using the following criteria.

Inclusion criteria
Willing working women within the age group of 25–50 years and minimum 8 working hours, untreated SBP ≥130 mmHg but <160 mmHg, DBP <100 mmHg, and not suffering from any other diseases were included in the study.

Exclusion criteria
Pregnancy or postpartum <3 months, body mass index >40 kg/m², using any medications including use of oral contraceptives or under any therapy, having ear, or vestibular disorders were excluded from the study.

Control group: (n=20): Vestibular exercises were not administered

Intervention group: (n=20): Vestibular exercises were practiced for 6 weeks.

Vestibular exercises
The exercise comprises of 6 min with three different types of exercises. These exercises were adopted from the standard protocol of e Cawthrone and Cooksey. Each exercise comprises of 2 min. First 2 min, the subject has to walk in a straight line moving the head corresponding to the leg that is forwarded. Next 2 min, he should throw a ball from one hand to other and fixing the gaze of the eye on the ball. Last 2 min, he should walk in the straight line and throwing the ball and fixing the gaze on ball. The total duration of intervention is 6 weeks with five sessions per week. Each session duration is 6 min. All the participants were trained about the exercises by expert physiotherapist for 2 days before, they start practicing.

Assessment of depression, anxiety, and stress
DASS 42 was used to assess the depression, anxiety, and stress. This is a standard questionnaire and self-administered questionnaire.

Assessment of spatial and verbal memory
Standard spatial and verbal memory test was used to assess the spatial and verbal memory. The minimum score was zero and maximum score was.

Ethical considerations
The present study protocol was approved by the Institutional Human Ethical Committee of LFMRC, Angamaly.

Statistical analysis
Data were analyzed using SPSS 21.0 version. Student t test was applied to observe the significance of difference between the groups. Probability value <0.05 was considered as significant.

RESULTS
The mean age of the participants in the control group is 32±1.34 (mean and standard error of the mean), 34±1.79 in the intervention group. Table 1 presents the comparison of depression, anxiety, and stress scores among control and intervention groups before intervention. Table 2 presents the comparison of depression, anxiety, and stress scores among control and intervention groups after the intervention. Depression scores were not significantly different before the intervention (Table 1). There was a significant decrease in the depression scores followed by the intervention (Table 2). Anxiety scores were not significantly different before the intervention (Table 1). There was a significant decrease in the anxiety scores followed by the intervention (Table 2). Stress scores were not significantly different before the intervention (Table 1). There was a significant decrease in the stress scores followed by the
Table 1. Comparison of depression, anxiety, and stress scores among control and intervention groups before intervention

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control (n=20)</th>
<th>Intervention (n=20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>22±1.34</td>
<td>23±1.57</td>
<td>0.6304</td>
</tr>
<tr>
<td>Anxiety</td>
<td>14±0.89</td>
<td>13±1.34</td>
<td>0.5388</td>
</tr>
<tr>
<td>Stress</td>
<td>23±1.79</td>
<td>21±1.34</td>
<td>0.3767</td>
</tr>
<tr>
<td>Spatial memory</td>
<td>5±0.22</td>
<td>4±0.45</td>
<td>0.9527</td>
</tr>
<tr>
<td>Verbal memory</td>
<td>4±0.22</td>
<td>4±0.45</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Data were presented as mean and SEM.

Table 2. Comparison of depression, anxiety, and stress scores among control and intervention groups after the intervention

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control (n=20)</th>
<th>Intervention (n=20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>22±1.34</td>
<td>15±0.89</td>
<td>0.0001***</td>
</tr>
<tr>
<td>Anxiety</td>
<td>13±0.89</td>
<td>9±0.89</td>
<td>0.0031**</td>
</tr>
<tr>
<td>Stress</td>
<td>22±1.12</td>
<td>14±1.12</td>
<td>0.001***</td>
</tr>
<tr>
<td>Spatial memory</td>
<td>5±0.45</td>
<td>7±0.67</td>
<td>0.0177*</td>
</tr>
<tr>
<td>Verbal memory</td>
<td>5±0.22</td>
<td>6±0.67</td>
<td>0.1654</td>
</tr>
</tbody>
</table>

Data were presented as mean and SEM. ***P<0.001 is significant. **P<0.01 is significant. *P<0.05 is significant.

Vestibular training methods were reported to reduce the anxiety levels significantly by inhibiting the stress axis directly and indirectly. 1,3,16 The present study results support earlier studies as we have observed significant decrease in the depression, anxiety, and stress scores in the participants after the 6 week practice of vestibular exercise. Vestibular system was reported to improve both spatial and verbal memory. 17 Vestibular system is closely associated with the hippocampus that has a pivot role in memory. Stimulation of place cells was observed followed by the vestibular stimulation. 18,19 Both animal and human studies reported improvement in the memory followed by the vestibular stimulation. 19,20 Connections from vestibular system were reported to limbic system and neocortex of the brain that has a role in memory. 21-23 The present study results support earlier studies as we have observed significant improvement in spatial memory but not verbal memory in the participants after the 6 week practice of vestibular exercise.

Limitations of the study
As the study was conducted at one center, the results may not be generalized.

CONCLUSION
The study results present significant improvement in the depression, anxiety, and stress scores and significant improvement in spatial memory followed by the vestibular exercises for 6 weeks. The study recommends further detailed study with higher sample size to recommend vestibular exercise in the management of negative emotions and to improve memory.

ACKNOWLEDGMENT
The authors were thankful to the participants for their support and cooperation throughout the study.

REFERENCES
4. Pasquier F, Denise P, Gauthier A, Bessot N and Quarch G. Impact of galvanic vestibular stimulation on anxiety level in...
https://doi.org/10.3389/fsysn.2019.00014
https://doi.org/10.1038/nrn1555
https://doi.org/10.1038/s41598-019-45757-0
https://doi.org/10.1097/00005537-199904000-00012
https://doi.org/10.1037/t01004-000
https://doi.org/10.2466/pr0.1997.81.2.555

Authors Contribution:
PV- Concept, and design of the study, results interpretation, review of the literature, and preparing the first draft of the manuscript. BPG- Concept, and design of the study, results interpretation, review of the literature, and preparing the first draft of the manuscript. NK and SSKG- Concept, and design of the study, statistical analysis and interpretation, and revision of the manuscript, and MJK- Revision of the manuscript and review of the literature.

Work attributed to:
Department of Physiology, Little Flower Medical Research Centre, Angamaly, Kerala, India.

Orcid ID:
Paramasivam Velu - https://orcid.org/0000-0002-7696-9331
Dr. Bhanu Prakash Gangupillai - https://orcid.org/0000-0002-0749-8281
Dr. Neelkanth Kole - https://orcid.org/0000-0003-4772-4922
Dr. Sai Sailesh Kumar Goothy - https://orcid.org/0000-0002-5838-3994
Dr. Joseph Kurien Mukkadan - https://orcid.org/0000-0003-4032-4301

Source of Funding: None, Conflicts of Interest: None.

https://doi.org/10.3389/fsyst.2014.00016
https://doi.org/10.1016/j.bbr.2007.07.032
https://doi.org/10.4103/0970-258x.239077
https://doi.org/10.1016/0304-3940(95)11918-m
https://doi.org/10.1016/j.nlm.2010.08.007
https://doi.org/10.1586/eam.10.79
https://doi.org/10.1007/bf00227958

https://doi.org/10.3389/fnhum.2014.00016