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Impact of Selective Vestibular Exercises in Limiting Cognitive Decline in Hypertensive Working Women.

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ABSTRACT

The current study was undertaken to assess the impact of selective vestibular exercises in limiting the cognitive decline in hypertensive working women. The present study includes 10 cases of working women with untreated pre-hypertension to stage I hypertension and 10 healthy age matched controls (working women), after obtaining written and informed consent. Six minutes of vestibular exercises according to the Cawthron and Cooksey's protocol for 12 weeks. We have not observed significant effects of vestibular stimulation by exercises on blood pressure and cognition. Further detailed studies with higher sample size and longer duration of intervention are recommended to explore the effects of vestibular exercises.

Keywords: Vestibular exercises, working women, hypertension, cognition, blood pressure.

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INTRODUCTION

Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High BP defined that systolic BP (SBP) 130–139 mmHg or diastolic BP (DBP) 80–89 mmHg fall into the category of pre-hypertensive and SBP 140 to 159 and DBP 90 to 99 mmHg as stage I hypertension, based on the evidence of a modest increase in cardiovascular risk among individuals with such levels [1, 4]. Hypertension (HTN) is associated with headaches, restlessness, sleep disturbance, anxiety, depression, decreased attention, and also poor executive functioning [3]. Working women may experience high levels of stress [2]. Specific cognitive functions are negatively affected by hypertension. Cognition can be defined as the means by which one is aware of the processes of thinking and perceiving. It involves an awareness of sensation and usually its cause. Numerous studies show an inverse relation between blood pressure level and cognition (i.e., higher blood pressures are associated with lower cognitive function) [7]. Blood pressure in animals is found to be consistently reduced by reducing sympathetic activity through vestibular stimulation [8]. Cognition can be modulated by vestibular system through hippocampus, through HPA axis through limbic system and neo cortex. Areas of brain which are involved in learning and memory are activated by vestibular stimulation [9]. The current study was undertaken to assess the impact of selective vestibular exercises in limiting the cognitive decline in hypertensive working women.

METHODOLOGY

Study design:

The present study includes 10 cases of working women with untreated pre-hypertension to stage I hypertension and 10 healthy age matched controls (working women), after obtaining written and informed consent. The study was conducted at Little Flower Hospital and Research Centre, after obtaining approval from institutional human ethical committee and obtaining permission from hospital authorities. The selection criteria were as follows.

Inclusion criteria:

- Working women age 25-50 yrs, working for 8 working hours.
- Untreated SBP \geq 130 mmHg but $<$ 160 mmHg, and DBP $<$ 100 mmHg. Not suffering from any other disease or complications
- Willing participants

Exclusion criteria:

- pregnancy or postpartum $<$ 3 months
- Body mass index (BMI) $>$ 40 kg/m²
- current use of any medications or therapy including use of oral contraceptives
- Use of dietary supplements known to affect BP
- Any ear diseases or vestibular disorders
- unwilling participants

Group A (n=10): Healthy working women without any intervention. (Control group)

Group B (n=10): Hypertensive working women with vestibular exercises for 12 weeks.

After recording baseline values, vestibular stimulation was administered for intervention group for 12 weeks.

Post intervention values were recorded after 12 weeks and compared.

Methods:

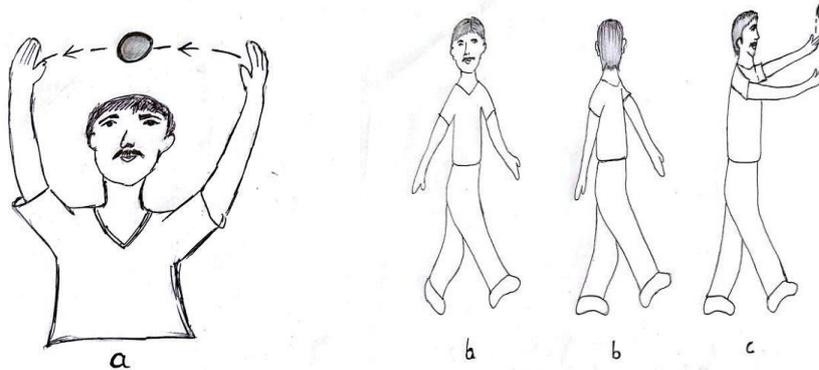
Vestibular Stimulation:

Six minutes of vestibular exercises according to the Cawthorne and Cooksey's protocol [5,6] which includes, walking in a straight line while looking sideways, throwing ball from one hand to the other by fixing gaze on the ball, walking straight and throwing ball from hand to hand by fixing gaze on the ball. Duration of

each exercise was fixed for two minutes by trial and error method.

Figure 1: Vestibular exercises

Vestibular exercises



- a-Throwing ball from one hand to the other by fixing gaze on the ball
 b-Walking in a straight line while looking sideways
 c-Walking straight and throwing ball from hand to hand by fixing gaze on the ball

Outcome measures

All the parameters were recorded before and after intervention in all the groups.

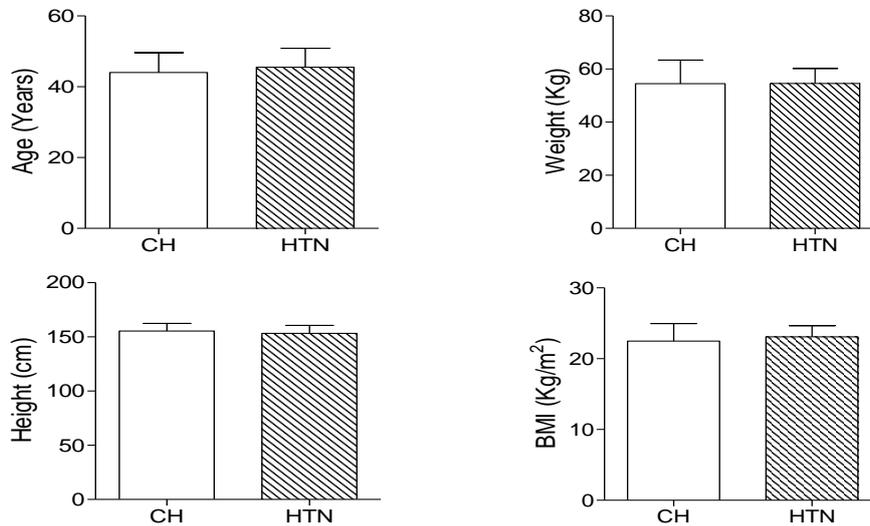
- 1. Immediate Word recall:** About 20 words were read at a constant rate of one word every 2 seconds. The participant was asked to recall immediately and write down as many words as possible from memory within 60 seconds [11, 12]
- 2. Immediate Object recall:** Subject was exposed to 20 objects that were placed on a table. The objects included animal picture cards to household. The subjects were given 15 seconds to view the objects before they were taken away. The subjects were then instructed to write down as many objects as possible from memory in the given time of 60 seconds [11, 12].
- 3. Mini Mental State Examination (MMSE):** The MMSE is a tool that can be used to systematically and thoroughly assess mental status. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall and language. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment [13].
- 4. Letter Cancellation Test:** The 26 letters of the English alphabet were jumbled and printed in black color on a white sheet of paper. All the letters were evenly spaced out. The six letter cancellation task consisted of a test worksheet which specified the six target letters to be cancelled and had a 'working section' which consisted of letters of the alphabet arranged randomly in 22 rows and 14 columns. The participants were asked to cancel as many of the six target letters as possible in the specified time, *i.e.*, 1 min, 30 sec [14].
- 5. Digit symbol substitution Test:** This is the test for sustained attention and response speed. Quick processing of information is needed to substitute the symbols accurately and quickly. A hundred numbers will be randomly printed out on a paper. The subject will be instructed to draw a circle over even numbers and a triangle over odd numbers. The time taken to substitute a symbol for all of the 100 digits will be recorded [12].

Data analysis: Data were analyzed by SPSS 20.0 version. Unpaired t test was used to observe significance of difference in demographic data. One Way ANOVA followed by Bonferroni Post hoc test were applied to test the significance. P value less than 0.05 was considered as significant.

RESULTS

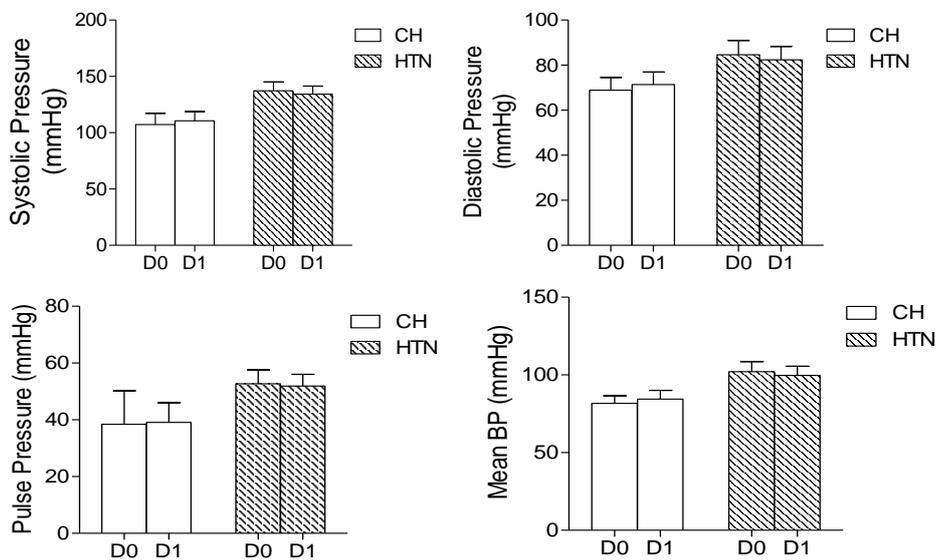
Figure 2 represents demographic data of the participants. No significant difference was observed in demographic data of control and intervention groups. Followed by vestibular exercises, no significant change was observed in blood pressure and cognitive tests (figure3-5).

Figure 2: Demographic data of the participants



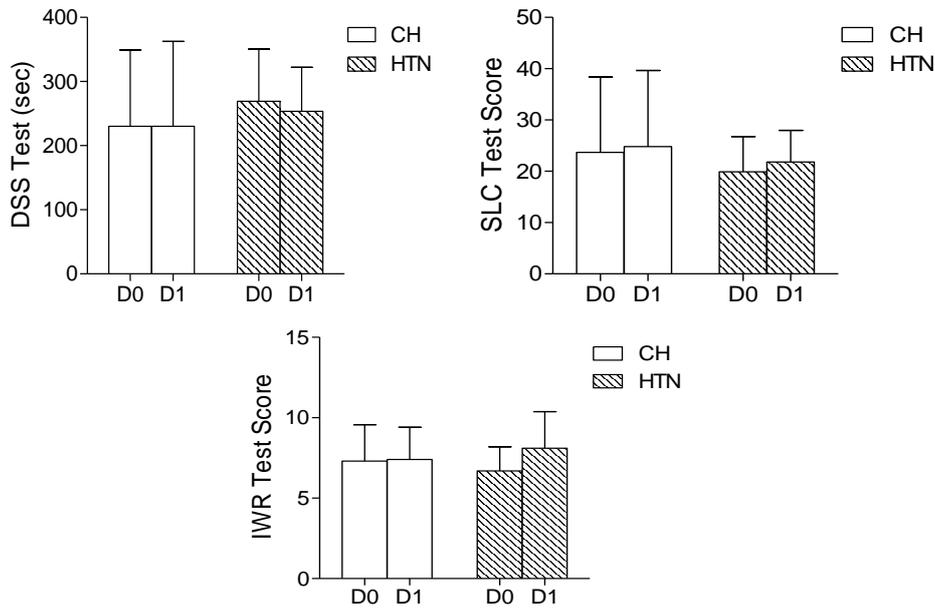
Data was presented as mean ±SD. (*P<0.05 is significant, **P<0.01 is significant, ***P<0.001 is significant).

Figure 3: Systolic, diastolic, pulse pressure and mean arterial blood pressure before and after vestibular exercises.



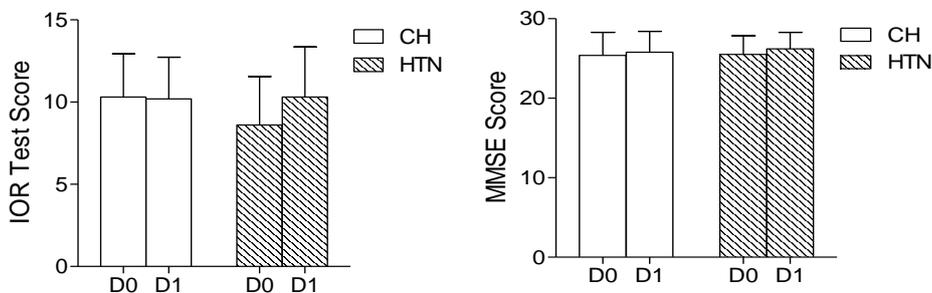
Data was presented as mean ±SD. (*P<0.05 is significant, **P<0.01 is significant, ***P<0.001 is significant).

Figure 4: Digit symbol substitution Test (DSST), Letter Cancellation Test (SLC), Immediate Word recall test scores before and after vestibular exercises.



Data was presented as mean ±SD. (*P<0.05 is significant, **P<0.01 is significant, ***P<0.001 is significant).

Figure 5: Immediate Object recall, Mini Mental State Examination (MMSE) scores of participants before and after vestibular stimulation



Data was presented as mean ±SD. (*P<0.05 is significant, **P<0.01 is significant, ***P<0.001 is significant).

DISCUSSION

The present study was undertaken to observe the impact of selective vestibular exercises in limiting the cognitive decline in hypertensive working women. We have not observed significant changes in blood pressure and cognitive functions followed by vestibular exercises. Earlier studies reported decrease in systolic and diastolic blood pressure in healthy females [15]. It was reported that disturbance to otolith system causes instable blood pressure [16]. It was reported that vestibular stimulation alters blood pressure through influencing sympathetic activity [17]. Anatomical connections were reported between vestibular nuclei and autonomic nuclei [18, 19]. Vestibular stimulation also influences autonomic functions through parabrachial nucleus [20]. In the present study we have not observed significant changes in blood pressure followed by

vestibular stimulation.

Vestibular system was connected with brain structures mainly hippocampus, limbic system, neocortex [21,22]. In fact for normally functioning vestibular system is essential for healthy hippocampus. Earlier studies reported that vestibular stimulation improves cognitive functions. However, in the present study we have not observed significant changes in cognitive functions [23]. This may be due to short term intervention and long term intervention may be beneficial which need to be studied further.

CONCLUSION

We have not observed significant effects of vestibular stimulation by exercises on blood pressure and cognition. Further detailed studies with higher sample size and longer duration of intervention are recommended to explore the effects of vestibular exercises.

CONFLICTS OF INTEREST: Nil

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