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A COMPARATIVE STUDY ON EFFECT OF VESTIBULAR AND AUDITORY STIMULATION ON AUTONOMIC MEASURES, SLEEP QUALITY AND QUALITY OF LIFE IN COLLEGE STUDENTS

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ABSTRACT

The present study was under taken to compare the beneficial effects of vestibular and auditory stimulation. A total of 39 healthy female participants age between 18-25 years were included in the present experimental study. Vestibular and auditory stimulation was administered by standardized methods in the literature. Following vestibular stimulation significant improvement in sleep duration and significant decrease in day time dysfunction was observed. Systolic blood pressure was decreased in both vestibular and auditory stimulation groups. However, it was not statistically significant. No significant change was observed in diastolic pressure followed by either vestibular stimulation or auditory stimulation. Significant increase in the pulse rate was observed followed by auditory stimulation. Day time sleepiness was significantly decreased followed by both vestibular and auditory stimulation. However it was more profound in vestibular stimulation. No significant change was observed in quality of life followed by vestibular stimulation and auditory stimulation. Both vestibular and auditory stimulation are equally beneficial. However, they may be effective, provided the intervention is of long duration. We recommend further detailed study with higher sample size, including both the genders and with more parameters.

KEY WORDS: Vestibular Stimulation, Music, Auditory stimulation, Quality of Life.

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INTRODUCTION

Vestibular system is termed as sixth sense as it influences most of the vital functions of the body, other than its basic functions.[1] The roots for therapeutic use of vestibular stimulation can be seen from ancient times.[2] Swinging on a swing is a simple and effective method of stimulating vestibular system.[3] Optimal vestibular stimulation provides multiple benefits through its connections with most of the structures of the central nervous system.[4] The soothing effect of vestibular stimulation on sleep is well known. Vestibular stimulation provides sound sleep through hypothalamus, dorsal raphe nucleus, nucleus tractus solitaries, locus coeruleus, hippocampal formation.[5] It was reported that vestibular stimulation improves quality of life.[6] Programmed vestibular stimulation is found to decrease heart rate within normal limits.[7] Exposure to classical music presents positive effects on the cardiovascular system .[8] Autonomic functions such as breathing heart rate can be altered by music. Decrease in the respiratory rate and heart rate was observed followed by music therapy.[9] This may be due to increase in the parasympathetic activity by music.[10] Music therapy is effective in reducing the symptoms of depression, anxiety and stress .[11,12] Music therapy provides sound sleep and also improves quality of life .[13] Individual studies exist on vestibular and auditory stimulation. However literature on comparison of effects of vestibular and auditory stimulation is inadequate. Hence the present study was under taken to compare the effects of vestibular and auditory stimulation on sleep quality, quality of life and cardio-respiratory parameters in healthy female participants.

MATERIALS AND METHODS

Study design
Experimental (pre and post with control) design.

Participants
A total of 39 healthy female participants were included in the study after obtaining written, voluntary informed consent. The participants were recruited from the students of various courses conducted at our institute by following inclusion and exclusion criteria. All the students underwent standard physical examination to screen health status.

Inclusion criteria
Healthy, willing females with age of 18-25 years.

Exclusion criteria
Unwilling participants, those suffering from diagnosed cardiovascular diseases, respiratory diseases, anxiety disorders, hypertensive disorders, smokers, obese, physically handicapped and Participants with vestibular disorders/ hearing disorders were excluded from the study.

The selected participants were randomly assigned to three groups by random numbers generated by computer.

Group A: Control group (n=13) (Neither vestibular stimulation nor auditory stimulation was administered)

Group B: Vestibular group (n=13) (Only vestibular stimulation was administered for 45 days)

Group C: Auditory group (n=13) (Only auditory stimulation was administered for 45 days).

After recording baseline (pre-intervention) scores, corresponding intervention was given to the participants for 45 days and post- intervention scores were recorded and compared.

Laboratory setting
The present study was conducted at Department of Physiology, Little Flower Institute of Medical Sciences and Research Centre (LIMSAR), Angamaly, Kerala, India.

Vestibular stimulation
Vestibular stimulation was administered every day, at 11am by making the participants to swing on a swing, according to their comfort. (Back to front direction), as standardized by previous methods .[14]

Auditory stimulation
Auditory stimulation was administered by vocal music as standardized in the literature. The music was played from iPod (MEDION) through headphones, every day, at 11 am for 3.22 minutes .[15]

Assessment of sleep quality
Sleep quality was assessed by using The Pittsburgh Sleep Quality Index (PSQI). Permission obtained to reproduce the questionnaire .[16]

Assessment of day time sleepiness
The Epworth Sleepiness Scale (ESS) was used to assess abnormal excessive day time sleepiness.[17]

Assessment of cardio-respiratory parameters
Blood pressure was recorded by using Diamond digital sphygmomanometers (BPDG024) and pulse rate was recorded by using pulse oxymeter (EDAN H100B) .[18, 19]

Assessment of Quality of Life
The WHO-QOL BREF was used to assess quality of life. Permission obtained to use the questionnaire in our research.[20]

Ethical consideration
The present study was approved by Institutional Ethics committee of Little Flower Hospital and Research Centre, Angamaly, Kerala. (EC/2/2015)

Statistical analysis
Data was analysed by SPSS20.0. Results were presented as Mean ± SD. Statistical tests applied are Two-Way ANOVA and Bonferroni post tests. The p-value <0.05 was taken as significant.

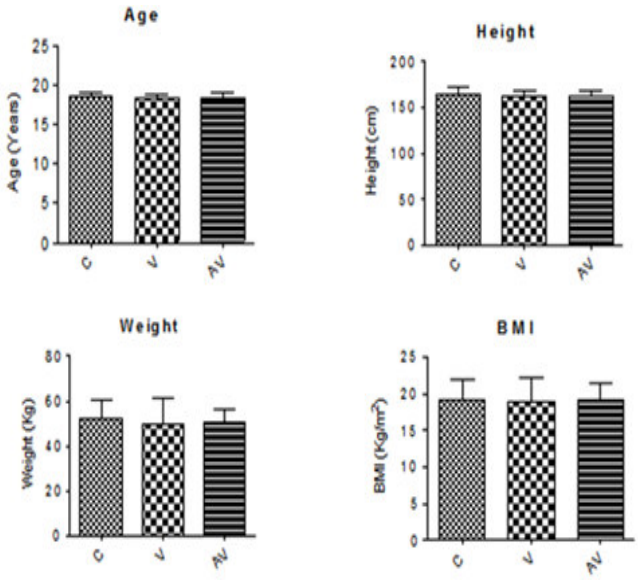
RESULTS

The demographic parameters were not significantly different among the groups (Figure no:1). Sleep duration (Component 3) was significantly improved on 15th day followed by vestibular stimulation (P<0.05) (Figure no:2). Day time dysfunction was significantly decreased followed by vestibular stimulation on 30th day (P<0.05)

(Figure no:3). Systolic blood pressure was decreased in both vestibular and auditory stimulation groups on 45th day. However, it was not statistically significant. No significant change was observed in diastolic pressure followed by either vestibular stimulation or auditory stimulation. Significant increase in the pulse rate was observed followed by auditory stimulation. (P<0.05) (Figure no:4). Day time sleepiness was significantly decreased followed by both vestibular and auditory stimulation. However, it was more profound in vestibular stimulation (P<0.01). No significant change was observed in quality of life followed by vestibular stimulation and auditory stimulation.

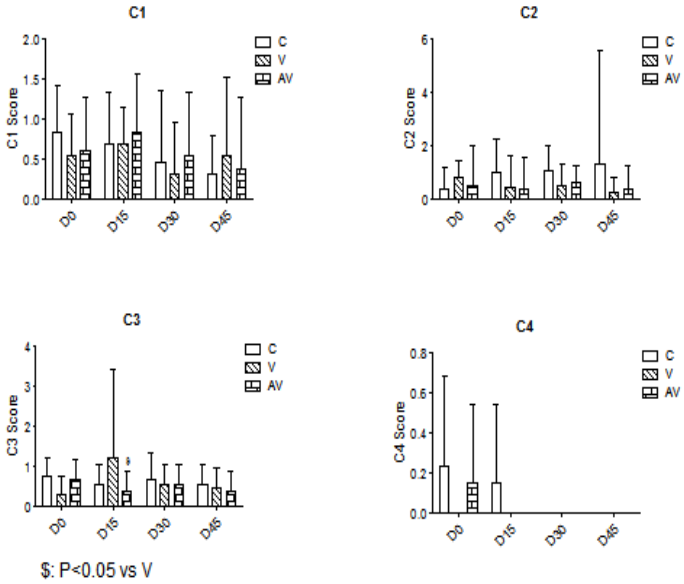
Table/Figure 1

Age, Body weight, height and BMI of participants. (C-control group, V-vestibular group, AV-auditory group) (*P value <0.05 is significant. **P Value<0.01 is significant, ***P Value<0.001 is significant.)



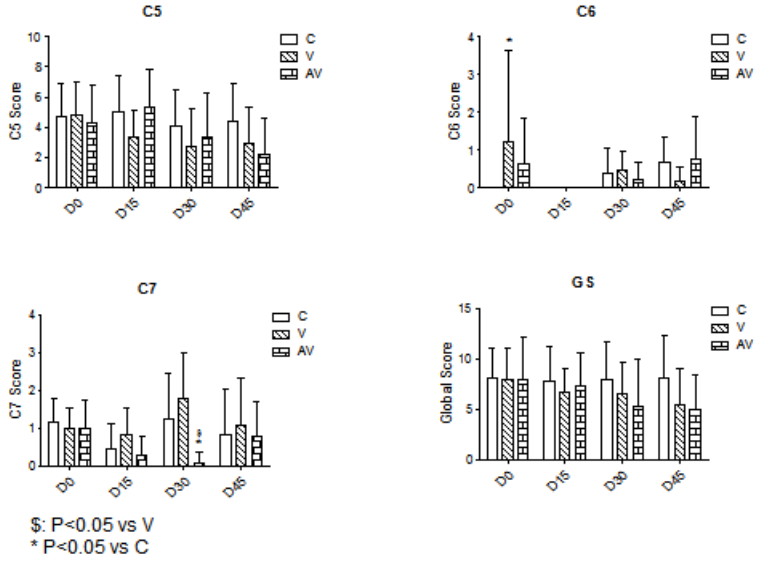
Table/Figure 2

Components of Pittsburgh sleep quality index before and after intervention.. (C-control group, V-vestibular group, AV-auditory group) C1- Component 1 (Sleep quality) ,C2-Component2(Sleep latency), C3-Component3(Sleep duration), C4-Component4(Habitual sleep efficiency). (D0-Pre intervention values, D15- post intervention values after 15 days,D30-post intervention values after 30 days,D45- post intervention values after 45 days) (*P value <0.05 is significant. **P Value<0.01 is significant, ***P Value<0.001 is significant.)



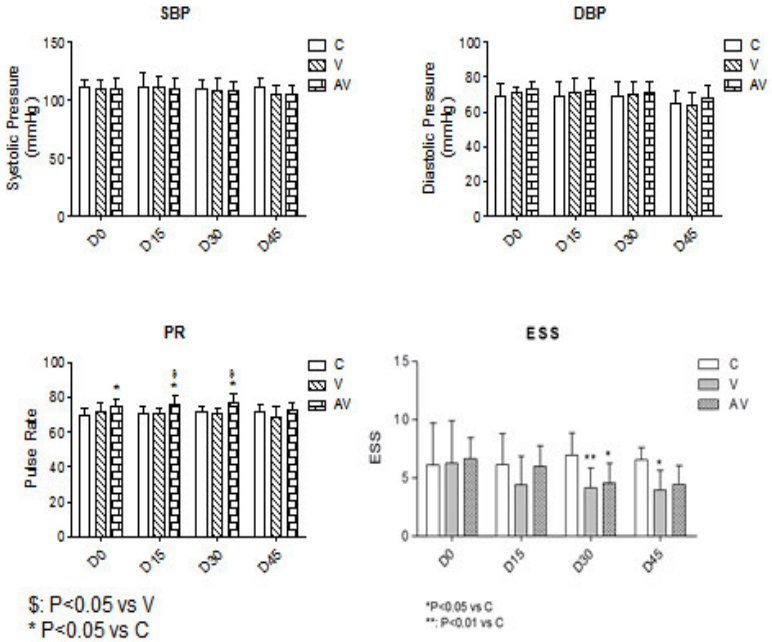
Table/Figure 3

Components and global score of Pittsburgh sleep quality index before and after intervention. (C-control group,- V-vestibular group, AV-auditory group) (C5-Component5(Sleep disturbance),C6-Component6 (Use of sleeping medication),C7-(Day time dysfunction),GS-Global score). (D0-Pre intervention values, D15- post intervention values after 15 days,D30-post intervention values after 30 days, D45- post intervention values after 45 days). (*P value <0.05 is significant. **P Value<0.01 is significant, ***P Value<0.001 is significant.)



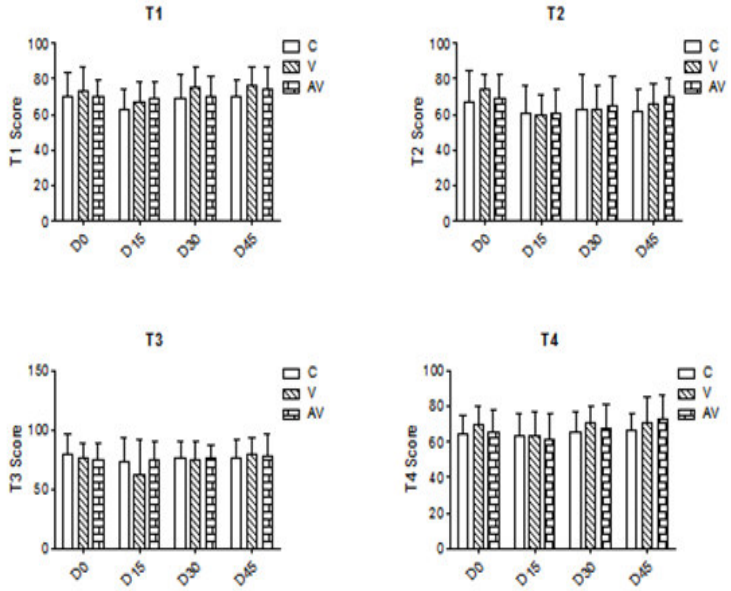
Table/Figure 4

Systolic (SBP), Diastolic pressure (DBP) and pulse rate (PR) and Epworth Sleepiness Score (ESS) before and after intervention. (C-control group,- V-vestibular group, AV-auditory group), (D0-Pre intervention values, D15- post intervention values after 15 days,D30-post intervention values after 30 days,D45- post intervention values after 45 days) (*P value <0.05 is significant. **P Value<0.01 is significant, ***P Value<0.001 is significant.)



Table/Figure 5

Transformed scores of WHO QOL BREF quality of life before and after intervention. (C-control group,- V-vestibular group, AV-auditory group), (D0-Pre intervention values, D15- post intervention values after 15 days,D30-post intervention values after 30 days,D45- post intervention values after 45 days). (T1- Transformed score of physical health domain, T2- Transformed score of psychological domain, T3- Transformed score of social relationship domain, T4- Transformed score of environment domain) (*P value <0.05 is significant. **P Value<0.01 is significant, ***P Value<0.001 is significant.)



DISCUSSION

Optimal vestibular stimulation was found to decrease the cardio-respiratory parameters with in normal limits.[21,18] This may be due to decrease in the sympathetic activity.[22, 23] Music therapy is found to reduce blood pressure in hypertensive patients. [24] Our study agrees with the earlier studies as we have observed decrease in systolic blood pressure followed by both vestibular and auditory stimulation. The decrease is not statistically significant. This may be due to short duration of the intervention. Interestingly, we have observed increase in pulse rate followed by auditory stimulation. This may be due to use of same vocal music for all participants, rather than preferential music. Apart from its basic function, vestibular system also contributes in relief of pain and stress, and promotes sleep and improve cognition and balance food intake.[3,26] Moreover, it is our everyday experience that we feel sleepy in busses, trains and boats, which testifies that motion promotes sleep.[27] Vestibular stimulation promotes sleep through its extensive interactions with hypothalamus, dorsal raphe nucleus, nucleus tractus solitarius, locus coeruleus, hippocampal formation and promotes sleep.[28] It was reported that music will improve sleep quality of patients with acute and chronic sleep disorders.[29] Our study agrees with earlier studies as we have observed improvement in sleep duration and decreased day time dysfunction followed by vestibular stimulation. However, no significant change was observed followed by auditory stimulation. This may be due to administering same song to all participants rather than using preferential music. Vestibular stimulation and auditory stimulation was reported to improve quality of life.[13, 30] However, in the present study we have not observed significant change in quality of life followed by both auditory and vestibular stimulation.

Limitations

As this is a pilot study, we have included fewer participants. Duration of stimulation was less and only female participants were included in the study.

CONCLUSION

Both vestibular and auditory stimulation are equally beneficial. However, they may be effective, provided the intervention is of long duration. We recommend further detailed study with higher sample size and including both the genders and with more parameters.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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