Indian Journal of Clinical Anatomy and Physiology 2019;6(4):430–432

Content available at: iponlinejournal.com

Indian Journal of Clinical Anatomy and Physiology

Journal homepage: www.innovativepublication.com

Original Research Article

Effect of white noise and traffic noise on heart rate variabilty in young adult males

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ARTICLE INFO

Article history:
Received 30-11-2019
Accepted 07-12-2019
Available online 31-12-2019

Keywords:
White noice
Traffic noice
LF/HF
Cardiac activity
AFT

ABSTRACT

Introduction: The humans are extensively affected by noise, ranging from slight annoyance to hearing loss. The direct and indirect health-related effects of noise on humans are hearing impairment, speech disturbance, dysfunction of the ANS and cardiovascular system etc.
Aim: To determine the effect of white noise and traffic noise on HRV in young adult males.
Materials and Methods: 50 young male volunteers are taken for study and are randomly divided into two groups according to the type of noise they were exposed to white, traffic noise. Also measured HRV parameters before and after exposure t o noise. The HRV parameters are evaluated while patients seated for 5 minutes and frequency domain analysis were then performed with the help of (Instrument) RMS polyrite – D version 3.0.11.
Results: There was a significant ($p<0.05$) decrease in HF nu in traffic noise when compared to white noise, and a significant($p<0.05$)increase in LF nu and LF-HF ratio in traffic noise when compared to white noise. Thus indicating increased sympathetic activity and reduced parasympathetic activity in traffic noise.
Discussion: In this study there was a significant ($p<0.05$) decrease in HF nu in traffic noise when compared to white noise, and a significant ($p<0.05$)increase in LF nu and LF-HF ratio in traffic noise when compared to white noise. Thus indicating increased sympathetic activity and reduced parasympathetic activity in traffic noise. These results are in accordance with those of previous studies, which showed that classical music increased comfort and decreased the LF level.
Conclusion: These results suggest that with appropriate noise exposure levels, we could observe activated ANS function and an improved degree of overall balance between the sympathetic and parasympathetic nervous systems. These results suggest that an appropriate noise level can positively affect the ANS.

1. Introduction

The humans are extensively affected by noise, ranging from slight annoyance to hearing loss.[1] The direct health-related effects of noise on humans are hearing impairment, speech disturbance, performance issues, mental problems, sleep disturbance, and annoyance, while indirect health-related effects are dysfunction of the autonomic nervous system (ANS) and cardiovascular system.[2]

2. Aim

To determine the effect of white noise and traffic noise on HRV in young adult males.

3. Materials and Methods

50 young male volunteers were taken in this study and were randomly divided into two groups and they were exposed to two different types of white, traffic noise. We also measured HRV parameters before and after exposure to noise.[3–6] The HRV parameters were evaluated and frequency domain analysis were then perform ed with the help of RMS polyrite – D version 3.0.11.

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https://doi.org/10.18231/j.ijcap.2019.093

3.1. *Ethical clearance*

Ethical clearance was obtained from our institution ethical committee and informed consent was obtained from all the subjects.

3.2. *Inclusion criteria*

Healthy 50 males of young adult group of 18-21 years were included in the study.

3.3. *Exclusion criteria*

Subjects who are obese or with history of diabetes mellitus, hypertension, respiratory illness, cardiac diseases and endocrinal disorders were excluded. Subjects on any medications were also excluded.

4. Statistical analysis

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis. [7]

5. Results

Our study shows that there is increased sympathetic activity and decreased parasympathetic activity due to traffic noise in humans. HF nu is significantly decrease in traffic noise when compared to white noise with $p<0.05$, and a significant($p<0.05$)increase in LF nu and LF-HF ratio is significantly increased when compared to white noise.

Table 1: Basic characteristics of subjects

Variables	Subjects
Age in years	20±2
BMI (kg/m^2)	23.06±0.31

6. Discussion

It is generally accepted that noise exposure enhances sympathetic nerve activity. Although investigators have sought to measure stress responses to acute noise exposure, the currently used objective parameters include stress hormone levels and HRV. Measuring of pulse rate and BP changes are well established methods for measuring overall cardiovascular responses. However, these methods can exhibit immediate reactions upon exposure to strong noise, and it is difficult to identify such changes in response to weak or moderate noise. Therefore, recent studies have investigated variables associated with ANS activity. [1]

In a study by Lee, et al., which compared HRV according to noise loudness, no noise-related differences in HF, an indicator of parasympathetic nervous system activity, were observed when the same subjects were presented with white noise at levels of 23, 50, 60, 70, and 80 dB(A). [4]

However, significant increases were observed in LF and the LF/HF ratio as the noise level increased. This finding was interpreted as demonstrating increased sympathetic nervous system activity simultaneously with the increased acute noise level. [8]

Among studies that observed changes in heart rate according to noise type, Umemura and Honda measured changes in subjects heart rates after listening to classical music, rock music, and noise. [9]

Among subjects who listened to classical music, LF (an indicator of sympathetic nervous system activity) decreased during the stable stage, whereas among subjects who listened to rock music or noise, LF increased. This indicated that the sympathetic nervous system was inhibited in subjects who listened to classical music, yet excited in subjects who listened to rock music or noise. It can also be inferred that classical music would promote comfort, whereas rock music or noise would induce discomfort or tension. Therefore, it could be suggested that even noises of the same intensity may have different impacts on the ANS, depending on the type of noise.

In this study there was a significant ($p<0.05$) decrease in HF nu in traffic noise when compared to white noise, and a significant ($p<0.05$) increase in LF nu and LF-HF ratio in traffic noise when compared to white noise. Thus indicating increased sympathetic activity and reduced parasympathetic activity in traffic noise. These results are in accordance with those of previous studies, which showed that classical music increased comfort and decreased the LF level.

7. Limitations of the study

The present study is focused only at the effect of noise stimuli on the cardiac autonomic frequency domain parameters. The study is limited to one geographical area and confined to one gender of a specific age group.

8. Conclusion

These results suggest that with appropriate noise exposure levels, we could observe activated ANS function and an improved degree of overall balance between the sympathetic and parasympathetic nervous systems. Typically, the theory of traffic noise acting as a stressor and exerting a negative impact on the human body has been dominant. According to the results obtained in this study, white noise might act as a eustressor that relieves anxiety resulting from silence. Additionally, these results suggest that an appropriate noise

Table 2: Comparision of FFT spectrum between white noise and traffic noise

HRV	W hite noise	T raffic noise	P value
LF nu	31.824±2.68 (26.619-43.017)	37.249±3.049 (31.889-47.717)	<0.05*
HF nu	68.175±4.085 (59.203-75.401)	62.75±3.04 (54.107-68.441)	<0.05*
LF/HF	0.4467±0.05 (0.321-0.722)	0.593±0.07 (0.421-0.871)	<0.05*

level can positively affect the ANS.

9. Source of funding

None.

10. Conflict of interest

None.

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Cite this article: Lakshmi A, Sowmya P . Effect of white noise and traffic noise on heart rate variabilty in young adult males. *Indian J Clin Anat Physiol* 2019;6(4):430-432.