ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 05 | May - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

GENDER DIFFERENCES IN THE SYMPATHETIC NERVOUS ACTIVITY OF HEALTHY INDIVIDUALS

Physiology

Thangjam Pricila Devi Assistant Professor, Department Of Physiology, Shija Academy Of Health Sciences, Langol, Imphal

Kh. Aruna Senior Resident, Department Of Physiology, Shija Academy Of Health Sciences, Langol, Imphal

Susie Keithellakpam Associate Professor, Department Of Physiology, Shija Academy Of Health Sciences, Langol, Imphal

Kanan Wangkheimayum Professor, Department Of Physiology, Shija Academy Of Health Sciences, Langol, Imphal

ABSTRACT

Background: There are indications of gender dimorphism in the autonomic regulation of a healthy body,which, in turn, determines the peculiarities of the development of hypertension in men and women. It is suggested that men have higher sympathetic tone and women have higher parasympathetic autonomic activity. This study aims to compare sympathetic nervous activity among male and female subjects. Aims and Objective: To test sympathetic division of autonomic nervous system and to compare the results between male and female subjects. **Materials And Methods:** This study was carried out in the Respiratory Physiology Laboratory of the Department of Physiology, Regional Institute of Medical Sciences, Imphal, Manipur, India. Forty healthy subjects (20 males and 20 females) participated in this study. Sympathetic division of autonomic nervous system was tested by measuring blood pressure response to sustained handgrip for 2 min and to standing from supine posture for 3 min. **Results:** Mean rise in diastolic blood pressure on sustained handgrip for 2 min was 18.15 mm Hg in male subjects whereas it was 11.84 mm Hg in female subjects, which was statistically significant. Mean rise in diastolic blood pressure on standing from supine posture for 1 min was 11.84 mm Hg in male subjects whereas it was 7.52 mm Hg in female subjects, which was also statistically significant. **Conclusion:** Rise in diastolic blood pressure on sustained handgrip and on standing from supine posture was greater in male subjects than in female subjects. The study shows a higher sympathetic function in male subjects as compared to female subjects.

KEYWORDS

Sympathetic nervous activity, handgrip test

INTRODUCTION

There are indications of gender dimorphism in the autonomic regulation of a healthy body,which, in turn, determines the peculiarities of the development of hypertension in men and women[1]. It is suggested that men have higher sympathetic tone and women have higher parasympathetic autonomic activity. Moreover, men have been reported to have higher indexes of sympathetic function, including muscular sympathetic nerve activity[2], neuron number in sympathetic ganglia[3], and low/high frequency of heart rate variability[4]. With a high predisposition to hypertension in healthy men, blood circulation at rest is determined primarily by increased influence of the sympathetic division of the ANS. But among apparently healthy women having a high predisposition to hypertension, blood circulation depend to a lesser extent on the specifics of the autonomic regulation compared to men[5].

The aim of this work was to evaluate the gender-specific state of the sympathetic nervous system of healthy people.

MATERIALS AND METHODS

This study was carried out at the Department of Physiology, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India. A total of 40 healthy subjects (20 males and 20 females) were included in the study. Those in the age range from 15 to 60 years were recruited for the study. Patients with associated diseases such as diabetes mellitus, hypertension, cardiac problems, neuromuscular diseases, and ascites were excluded.

Sympathetic division of the autonomic nervous system was tested by performing the following tests: (1) Blood pressure response to sustained handgrip: The subjects were asked to grip the dynamometer (model 2095; India Medico Instruments, Delhi, India) with their dominant hand at one-third of maximal voluntary contraction and maintain the pressure on dynamometer for 2 min. Then the blood pressure was recorded from the non-exercising arm before the test, 1 min after onset of handgrip, and just before the release of handgrip at 2 min. (2) Blood pressure response to standing from the supine posture: The subjects were asked to stand up quickly from supine posture and keep standing quietly for 3 min. The blood pressure was recorded at 0 min (in lying position) and at 0.5, 1, 2, and 3 min of standing up. The difference in systolic and diastolic blood pressure at 0.5, 1, 2, and 3 min of standing from that of supine (baseline; 0 min) posture was calculated. The results were recorded.

Statistical Analysis

For analytical purposes, statistical techniques such as mean, standard deviation, and t-test were used whenever found suitable and necessary with the help of SPSS software, and accordingly interpretations were made. p-Value of <0.05 was considered to be statistically significant.

RESULTS

Table 1 shows a significant rise in diastolic blood pressure 2 min after handgrip test and with supine to standing after 1 min in male subjects as compared to female subjects.

Table 1: Vascular response after sympathetic function tests

Rise in DBP (mm Hg)	Male	Female	p-Value
With sustained handgrip (after 2 min)	18.15 ± 6.06	11.84 ± 4.22	0.0034
With supine to standing (after 1 min)	11.84 ± 3.58	7.52 ± 4.99	0.027

DBP, diastolic blood pressure

DISCUSSION

In our study, 40 healthy subjects (20 males and 20 females), in the age group of 15–60 years, were included whose sympathetic function tests were carried out.

The findings of the study show that sympathetic nervous activity was significantly higher in male subjects as compared with female subjects. Previous investigations have found greater sympathetic tone in men whereas higher parasympathetic autonomic activity in women[2–4], which is consistent with our findings.

Raemakers et al.[5] hypothesized that there are gender differences in autonomic modulation making women at lower risk to develop cardiovascular diseases.

The mechanisms underlying the gender difference in cardiac autonomic function are not clear. Kuo et al.[6] proposed that middle-

aged women and men have a more dominant parasympathetic and sympathetic regulation of heart rate, respectively. The gender-related difference in parasympathetic regulation diminishes after the age of 50 years, whereas a significant time delay for the disappearance of sympathetic dominance occurs in men.[7] This indicates that the decline in autonomic balance is related to the expected decrement in sex hormones later in life.[8] The dominance in sympathovagal balance of men may also contribute to a higher cardiac mortality[9] .Another study of gender differences in autonomic regulation showed significantly greater parasympathetic activity in women than in age-matched men.[10] For the parasympathetic system, it has been reported that estrogen has a facilitating effect on cardiac vagal function.[11]

CONCLUSION

This study shows that men had a shift in the autonomic balance toward the predominance of the sympathetic nervous system compared with female subject. Gender differences in the functioning of the autonomic nervous system have been suggested. An appreciation of gender differences in autonomic modulation is therefore helpful in complete understanding of common and important clinical presentations such as hypertension.

REFERENCES

1. Kuznetsova OB, Gorbunov NP. Gender peculiarities of autonomic reactions to mental workload of students with high level of physical activity. Theory and practice of physical culture. 2006;11:47–49.
2. Ettinger SM, Silber DH, Collins BG, Gray KS, Sutliff G, Whisler SK, et al. Influences of gender on sympathetic nerve responses to static exercise. J Appl Physiol. 1996;80:245–51.
3. Beaston-Wimmer P, Smolen AJ. Gender differences in neurotransmitter expression in the rat superior cervical ganglion. Brain Res Dev Brain Res. 1991;58:123–8.
4. Hayano J, Sakakibara Y, Yamada A, Yamada M, Mukai S, Fujinami T, et al. Accuracy of assessment of cardiac vagal tone by heart rate variability in normal subjects. Am J Cardiol. 1991;67:199–204.
5. Dyachuk VA, Shanin VY, Svyatov DI. Gender differences in Central blood circulation at rest in the presence of a predisposition to hypertension. Vestnik St Petersburg University. 20018;11(1):24–26.
6. Raemakers D, Ector H, Aubert A, Rubens A, Van de Werf F. Heart rate variability and heart rate in healthy volunteers. Is the female autonomic nervous system cardioprotective? Eur Heart J. 1998;19:1334–41.
7. Kuo T, Lin T, Yang C, Li C, Chen C, Chou P. Effect of aging on gender differences in neural control of heart rate. Am J Physiol. 1999;277:H2233–9.
8. Umetani K, Singer D, McCraty R, Atkinson M. Twenty-four hour time domain heart rate variability and heart rate: relations to age and gender over nine decades. J Am Coll Cardiol. 1998;31:593–601.
9. Vanoli E, De Ferrari GM, Stramba BM, Hull SS, Foreman RD, Schwartz PJ. Vagal stimulation and prevention of sudden death in conscious dogs with a healed myocardial infarction. Circ Res. 1991;68:1471–81.
10. Rossy L, Thayer J. Fitness and gender-related differences in heart period variability. Psychosom Med. 1998;60(6):773–81.
11. Du XJ, Dart AM, Riemersma RA. Sex differences in the parasympathetic nerve control of rat heart. Clin Exp Pharmacol Physiol. 1994;21:485–93.