ORIGINAL ARTICLE

A COMPARATIVE STUDY OF GENDER DIFFERENCES IN AUTONOMIC FUNCTION TESTS IN YOUNG ADULTS

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HOW TO CITE THIS ARTICLE:
K. V. C. N. Madhavilatha, Shaik Azmatulla, M. Ramesh Babu, Afreen Arshad, Khizer Hussain Afroze, Suresh Babu Kondaveeti. "A Comparative Study of Gender Differences in Autonomic Function Tests in Young Adults". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 16, April 20, 2015; Page: 2390-2396.

ABSTRACT: There is much clinical evidence to suggest that the activity of autonomic nervous system varies at adulthood especially in young adults. Recent study was initiated and an attempt was made to bring out the association of autonomic functions in young adults. Our cardiovascular system is governed by autonomic nervous system. Since adults have lower cardiovascular risk, this study is aimed to find out gender differences in the autonomic modulation of young adults. The study was carried out in 60 young adults (30 males and 30 females) in the age group of 15 – 25 years. Autonomic function tests are broadly divided into sympathetic and parasympathetic nervous tests. Various autonomic function tests valsalva ratio and Handgrip test were carried out for sympathetic and parasympathetic nervous system. The tests showed more parasympathetic activity in males and more sympathetic activity in females. And our study suggests that HR response during sustained Hand grip in the age group of 15-25, is greater in females than in males. Also SBP beforehand grip is greater in males.

KEYWORDS: Autonomic Function Tests, Parasympathetic Activity, Valsava Ratio, Hand Grip Test.

INTRODUCTION: Our peripheral nervous system controlled by Autonomic Nervous system [Figure 1] and it controls many organs and muscles within the body cavity [Figure 2]. The autonomic nervous system through its sympathetic and parasympathetic divisions regulates and modulates most of the cardiovascular functions. The autonomic nervous system is the primary system for regulating heart rate in normal persons. The cardiovascular responses of blood pressure, cardiac output, heart rate and other variables to change in posture differ between the sexes. The differences are related to greater decrease of thoracic blood volume with standing in women than the men. The overall complexity of heart rate dynamics is higher in women than men. A few reports on gender-related differences in cardiac autonomic modulation reveal that, in normal Population, parasympathetic tone dominates over sympathetic in women and vice versa in men.[1] Gender differences in the autonomic nervous system may be present because of developmental variations or due to the effect of varied concentrations of male and/or female sex hormones.[2] There are conflicting opinions about gender differences in Autonomic Nervous System functions in males and females in younger age groups. Some studies claim that heart rate is low in men as compared to women.[3] This Study proposes to verify the same and also to study differences in other Autonomic Nervous System function parameters like, Heart rate variability during Respiratory cycle, heart rate response to Valsalvamanoeuvre, heart rate and blood

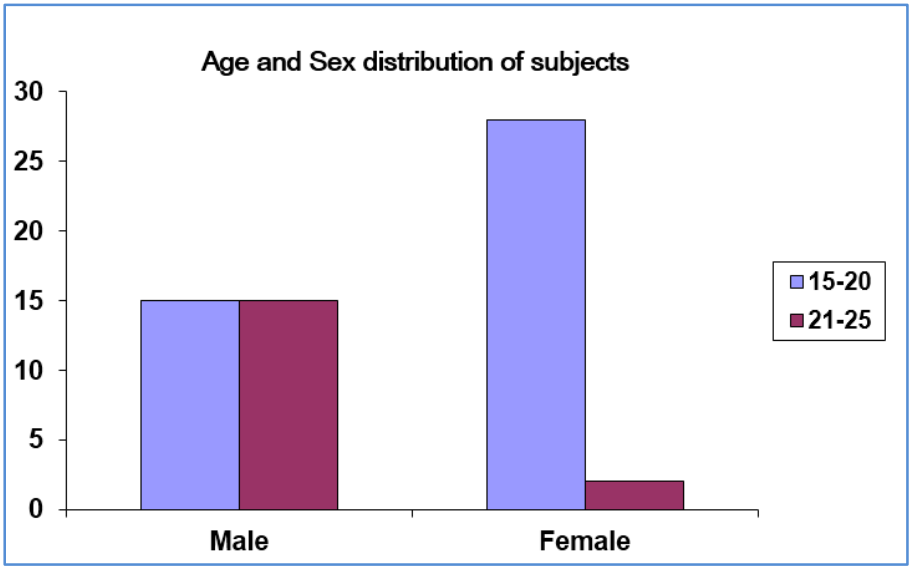
pressure response to sustained hand grip test. Coronary Heart Diseases (CHDs) are major causes of mortality globally. In Indian sub-continent, they cause more than 25% of all deaths annually. According to the "Global Burden of Diseases Study" in India, by the year 2020, projections for CHD mortality are 1.46 and 1.12 millions in men and women respectively.[4] Our cardiovascular system is governed by autonomic nervous system. Since with age there is high chances of cardiovascular risk, our study is aimed to find out any gender differences in the autonomic modulation with age especially in adulthood.

MATERIAL & METHODS: A total of 60 healthy young adults (30 males and 30 females) were included in this study with age range from 15 to 25 years. The study was conducted in the Department of Physiology at Narayana group of Educational institutions, Nellore, Andhra Pradesh from 2012 to 2013. The approval of the Ethical Committee was obtained. The non-smoker, non-alcoholic, non-diabetic, having normal pulse rate, blood pressure, normal heart sounds and having no evidence of illness and having perfect physical, mental and psychological well-being were included in the study. A brief history was taken and general physical examination of all the volunteers was done with main emphasis on cardiovascular diseases, renal diseases. None of the subjects took any medication at the time of study. All the tests were carried out between 11 am to 4 pm. The procedure was explained and informed consent was obtained after the subjects had read a description of the experimental protocol, which was approved by the ethical committee of the college. The height, weight and blood pressure of the subject was measured with measuring tape, weighing machine and sphygmomanometer respectively. On auscultation, the heart sounds were found to be normal. The parasympathetic activity was assessed by heart rate response to Valsalva manoeuvre. Each subject was told to perform Valsalva manoeuvre for 15 seconds by blowing into a mouth piece attached to a sphygmomanometer and maintain a pressure of 40 mm Hg for 15sec. Three trials were performed at intervals of 5 minutes. A continuous ECG was recorded 1 minute before the maneuver (resting period), during maneuver (strain period, 15 seconds) and 60 seconds subsequently after the strain period. Valsalva ratio was taken as the maximum ratio of maximum R-R interval after the strain to that of shortest R-R interval during the strain.

$$\text{Valsalva ratio (VR)} = \frac{\text{Maximum R-R Interval after maneuver}}{\text{Shortest R-R Interval during maneuver}}$$

The sympathetic activity was assessed by blood pressure response to sustained hand grip. The subject was asked to sit comfortably in chair. Initially the subject was asked to exert maximal strength on hand grip dynamometer with right hand. First the maximum voluntary contraction (MVC) was determined and then the subject was asked to exert 30% of MVC for 5 minutes with right hand. Diastolic blood pressure was measured in left hand at rest and at 1 minute interval during handgrip. The maximum rise of diastolic pressure during 30% of MVC over the resting diastolic blood pressure was noted. The data was statistically analyzed using the SPSS software (version 12.0) and by applying Student's t-test.

RESULTS:



Graph 1: Shows the age and sex distribution of study population with mean SD

Sl. No	HR response during Hand grip	Male	Female
1.	Mean	7.47	11.8
2.	SD	4.58	5.9
3.	'Z' Value	3.1838	
4.	'P' Value	0.0013 (Highly Significant)	

Table 1: Shows the values for sustained Handgrip test which shows the p value highly significant

Sl. No.	Parameter	Male		Female	
1.	Normal resting HR	75.43	9.662	76.07	8.534
2.	Inspiration	95.93	9.713	98.37	8.779
3.	Expiration	80.57	9.821	82.17	8.801
4.	E:I ratio	1.18	0.104	1.20	0.117
5.	30 Sec before valsalva	75.97	8.688	76.73	8.111
6.	During valsalva	91.20	13.456	89.3	9.237
7.	30 Sec after valsalva	74.50	9.142	73.83	6.665
8.	Valsalva ratio	1.23	0.181	1.21	0.133
9.	Heart rate before handgrip	77.47	8.504	76.60	7.518
10.	SBP before handgrip	114.67	8.588	111.13	7.157

11.	DBP before handgrip	68.73	8.077	68.73	7.325
12.	Heart rate during handgrip	85.10	8.837	88.60	7.582
13.	SBP during handgrip	122.47	8.529	120.80	7.819
14.	DBP during handgrip	80.13	7.537	82.27	7.177

Table 2: Shows that the mean values and standard deviations of all parameters in both male and female subjects

Sl. No.	Parameter	'z' value	'p' value
1.	Normal resting HR	0.31	0.3783
2.	Inspiration	1.07	0.1423
3.	Expiration	0.71	0.2389
4.	E:I ratio	0.83	0.2033
5.	30 Sec before Valsalva	0.35	0.3632
6.	During Valsalva	0.65	0.2578
7.	30 Sec after Valsalva	0.35	0.3632
8.	Valsalva ratio	0.50	0.3085
9.	Heart rate before handgrip	0.46	0.3228
10.	SBP before handgrip	1.80	0.0359
11.	DBP before handgrip	0.000	0.500
12.	Heart rate during handgrip	1.80	0.0359
13.	SBP during handgrip	0.87	0.1922
14.	DBP during handgrip	1.16	0.1230

Table 3: The 'z' and 'p' values obtained for different parameters in all sixty subjects

The table no 2&3 shows that there are significant differences in two parameters, i.e. Systolic blood pressure beforehand grip and HR during hand grip.

The tables also shows that there is no distinguishable differences between males and females in most of the parameters like normal resting HR, HR during inspiration, expiration, expiratory - inspiratory ratio, HR 30sec before Valsalvamanoeuvre, during Valsalvamanoeuvre and 30sec after Valsalvamanoeuvre and Valsalva ratio. HR, DBP beforehand grip, Systolic and Diastolic blood pressure during hand grip also do not show significant difference.

DISCUSSION: The present cross sectional study was carried out in 30 Healthy adult males and 30 Healthy adult females. Evaluation of status of autonomic nervous system was done with the help of two non-invasive tests like Valsalva maneuver and sustained hand grip. Work done over the past few years gives us an indication of effect of gender on the autonomic nervous system activity. The data on this aspect was lacking in this part of the country, so the present study was conducted to measure the autonomic nervous system activity in adult males and females. The Systolic blood pressure beforehand grip is more in males (114.67) than in females (111.13) and the difference is significant (P=0.035). HR during hand grip is more in females (88.60) than in

males (85.10) and this difference is considered as significant (P = 0.035). The results of the study by Evans and all showed that autonomic modulation was significantly different in men and women as revealed by the values of relevant indexes.[5] Men had greater sympathetic activity whereas women had parasympathetic dominance.[6] In our study Autonomic functions tests in males and females subjects are well balanced and individuals in both groups did not differ significantly in age,[7] weight and blood pressure.[8] Mehata and all studied the gradual decline in parasympathetic activity with ageing and in the same sex.[9] In sympathetic functions tests during the hand grip test, it was found that the statistical significance. The above results of low parasympathetic activity in females are consistent with the studies carried out in this field by various studies.[10-12]

Heart rate response to sustained hand grip is more in females as compared to males. This finding conflict with earlier studies which have shown that heart rate response is more in males when compared to females one reason for this difference in finding in our study could be due to age factor. Other Parameters like Resting Heart rate, Heart rate response during deep breathing i.e. both in inspiration and in expiration, E:I ratio, Heart rate response before Valsalvamanoeuvre, during Valsalvamanoeuvre, After Valsalvamanoeuvre, Valsalva ratio and DBP during hand grip show no statistically significant differences. So the heart rate and blood pressure changes during these above tests are having similar effects between genders.

We have studied in the age group of 15-25 years. Whereas the other studies have studied in the age group of 20-40 years. Further research is needed to elucidate the basic underlying mechanisms.

CONCLUSION: We conclude that HR response during sustained Hand grip in the age group of 15-25, is greater in females than in males. Also SBP beforehand grip is greater in males. The exact mechanisms that are responsible for these findings have to be elucidated by further research because of the limited sample size.

ACKNOWLEDGEMENT: We would like to convey our thanks to the students who have participated in the study and to the management Narayana educational institutions, Nellore, Andhra Pradesh for their support and the facilities provided to conduct this study.

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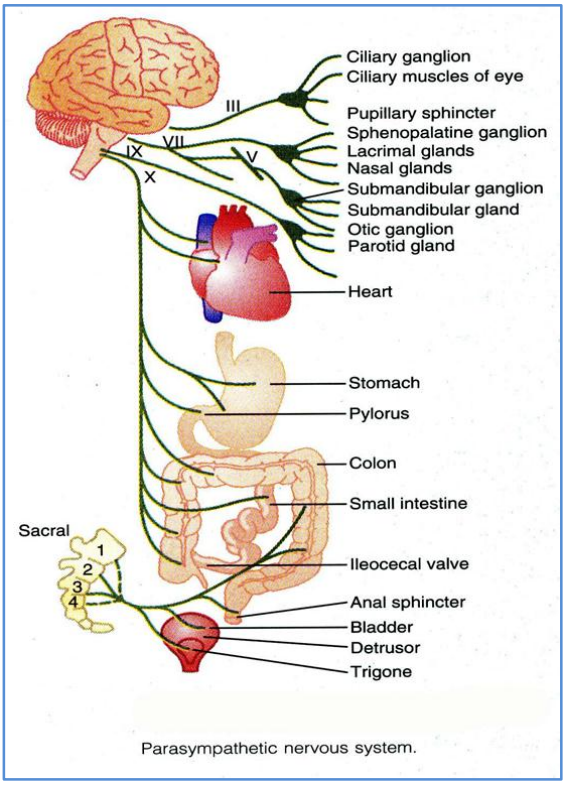

Fig. 1: Overview of Parasympathetic nervous system activity

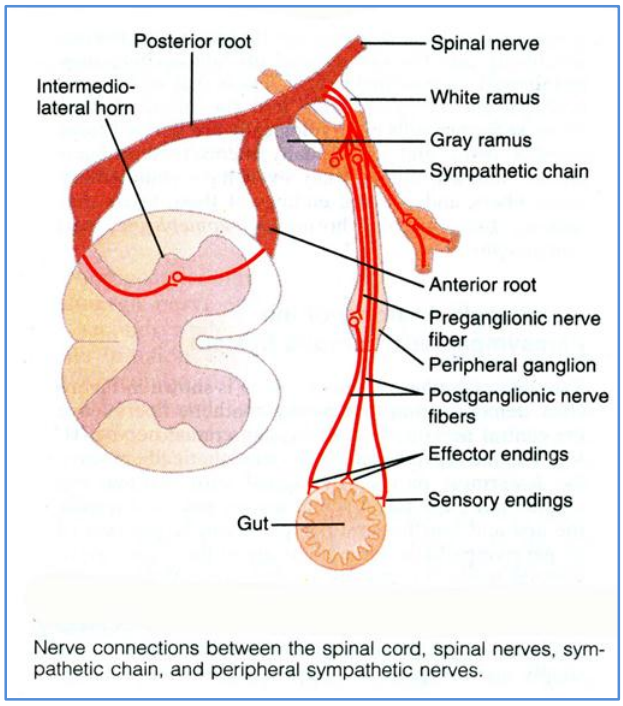

Fig. 2: Controlling of organs activity through peripheral nervous system

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Date of Submission: 18/02/2015.
Date of Peer Review: 19/02/2015.
Date of Acceptance: 24/02/2015.
Date of Publishing: 15/04/2015.