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Research Article

GENDER AND AUTONOMIC NERVOUS SYSTEM

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ABSTRACT
There is much clinical evidence to suggest that the activity of autonomic nervous system varies with gender. The present study was initiated and an attempt was made to bring out the association of autonomic functions with gender. This study was carried out in the Department of Physiology, SGRD IMSAR, Amritsar. ANS function tests were conducted using polyrite, Medicare System. One hundred subjects were divided into four different age groups (Group A 15-30 years, Group B 31-45 yrs.; Group C 46-60 yrs. and Group D above 60 yrs. Each group consisted of 25 subjects which included 13 males and 12 females. The autonomic insufficiency was ruled out in all. The sympathetic activity of ANS was compared by Galvanic Skin Resistance (GSR); Cold Pressor Response (CPR) and Hand Grip Test and the parasympathetic activity was compared by Standing to Lying Ratio (SLR), 30:15 ratio, Valsalva Ratio and Tachycardia ratio. These were analysed statistically in each group. The result on comparison of various autonomic function tests amongst males and females in same age group suggested that the parasympathetic activity is lower in females as evident from 30:15 ratio and tachycardia ratio while sympathetic activity is higher in males as evident from low GSR, which is statistically highly significant.

Key Words*: Autonomic Function Tests, Parasympathetic Activity, Galvanic Skin Resistance*

INTRODUCTION

The ANS is a part of the peripheral nervous system and it controls many organs and muscles within the body cavity. The autonomic nervous system through its sympathetic and parasympathetic divisions regulates and modulates most of the cardiovascular functions. It is also well recognised that cardiovascular functions vary both in males and females. 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 then men.

In our study we have assessed the autonomic status in males and females of different age groups. A number of tests have been evolved over a period of time which has made it possible to assess the functional status of ANS. The parasympathetic nervous system tests include beat to beat variation, Valsalva ratio and the baro reflex sensitivity and sympathetic nervous system tests include the hand grip test, the galvanic skin resistance and the cold pressor response. Work done over the past few years gives us an indication of effect of gender on the autonomic nervous system activity so a formal study was planned to be carried out which involved a battery of autonomic nervous system tests to be done on males and females of different age groups. The changes were noticed in some parameter of both sympathetic and parasympathetic function tests amongst males and females of same age group.

MATERIALS AND METHODS

The present study of ANS functions in males & females different of age groups was conducted in the Department of physiology of SGRD IMSAR, Amritsar. The anthropometric measurements were carried out in all the groups. History taking and medical examination was carried out. The nature of the test was explained to the subjects. All the tests were performed at the same time of the day in all the subjects and at a comfortable environment. Various tests used for the assessment of sympathetic and parasympathetic activity are as follows:

For parasympathetic activity:

1) Standing to lying ratio.
2) 30:15 ratio (L/S ratio).
3) Valsalva ratio.
4) Tachycardia ratio.

For sympathetic activity:

1) Galvanic skin resistance (GSR).
2) Hand grip test (HGT).
3) Cold pressor response (CPR).

Table 1 Distribution of the total subjects according to age and sex

Group	Age (in years)	No. of Subject	Sex	
			Male	Female
A	15-30	25	13	12
B	31-45	25	13	12
C	46-60	25	13	12
D	Above 60	25	13	12

Table 2: Comparative study of parasym pathetic function tests amongst the males and females of Group A

Parameters	Males (n=13)		Females (n=12)		P-Value	Significance
	Mean	S.D	Mean	S.D.		
S/L Ratio	1.38	0.22	1.21	0.08	<0.05	S
30:15 L/S Ratio	1.30	0.15	1.15	0.08	<0.01	H.S
Valsalva Ratio	1.51	0.27	1.30	0.11	<0.05	S
Tachy Cardia Ratio	0.75	0.08	0.78	0.09	>0.05	NS

Abrev: S/L-Standing to Lying Ratio; L/S - Lying to Standing Ratio; S – Significant; HS - Highly Significant; NS - Not Significant

Table 3: Comparative study of sympathetic function tests amongst the males and females of Group A

Parameters	Males (n=13)		Females (n=12)		P-Value	Significance
	Mean	S.D	Mean	S.D.		
Cold Pressor (S.B.P)	11.54	3.18	10.0	3.30	>0.05	N.S
Response (D.B.P) (Rise in mm HG)	6.76	2.60	7.0	2.17	>0.05	N.S
Hand Group Test (S.B.P)	24.31	4.31	21.83	2.33	>0.05	N.S
Hand Group Test (D.B.P)	16.0	3.91	16.33	2.05	>0.05	N.S
Galvanic Skin Resistance (Kohms)	136.62	1.85	160.42	2.68	<0.001	H.S

Table 4: Comparative study of para sympathetic function tests amongst the males and females of Group B

Parameters	Males (n=13)		Females (n=12)		P-Value	Signi-ficance
	Mean	S.D	Mean	S.D.		
S/L Ratio	1.10	0.14	1.17	0.18	..>0.05	S
30:15 Ratio	1.04	0.04	1.11	0.07	<0.01	H.S
Valsalva Ratio	1.36	0.21	1.36	0.19	--	--
Tachy Cardia Ratio	0.74	0.102	0.78	0.101	>0.05	NS

Table 5: Comparative study of sympathetic function tests amongst the males and females of Group B

Parameters	Males (n=13)		Females (n=12)		P-Value	Signi-ficance
	Mean	S.D	Mean	S.D.		
Cold Pressor (S.B.P)	14.92	3.61	15.50	2.84	>0.05	N.S
Response (D.B.P) (Rise in mm HG)	12.31	2.28	13.50	3.92	>0.05	N.S
Hand Group Test (S.B.P)	16.15	3.86	13.33	4.53	>0.05	N.S
Hand Group Test (D.B.P)	16.15	3.86	13.33	4.53	>0.05	N.S
Galvanic Skin Resistance (Kohms)	117.08	2.96	143.33	3.72	,<0.001	H.S

Table 6: Comparative study of para sympathetic function tests amongst the males and females of Group C

Parameters	Males (n=13)		Females (n=12)		P-Value	Signi-ficance
	Mean	S.D	Mean	S.D.		
S/L Ratio	1.10	0.19	1.12	0.13	>0.05	N.S.
30:15 Ratio	1.12	0.09	1.21	0.24	>0.05	N.S.
Valsalva Ratio	1.26	0.10	1.33	0.12	…>0.05	N.S.
Tachy Cardia Ratio	0.76	0.04	0.75	0.04	>0.05	NS

Table 7: Comparative study of sympathetic function tests amongst the males and females of Group C

Parameters	**Males (n=13)**		**Females (n=12)**		**P-Value**	**Signi-ficance**
	Mean	**S.D**	**Mean**	**S.D.**		
Cold Pressor (S.B.P)	18.00	2.16	18.66	3.30	>0.05	H.S
Response (D.B.P) (Rise in mm HG)	18.46	3.38	18.66	3.33	>0.05	N.S
Hand Group Test (S.B.P)	17.54	3.84	16.58	3.02	>0.05	N.S
Hand Group Test (D.B.P)	18.77	3.11	18.60	3.39	>0.05	N.S
Galvanic Skin Resistance (Kohms)	108.54	1.98	140.33	4.48	,<0.001	H.S

Table 8: Comparative study of para sympathetic function tests amongst the males and females of Group D

Parameters	Males (n=13)		Females (n=12)		P-Value	Signi-ficance
	Mean	S.D	Mean	S.D.		
S/L Ratio	1.16	0.06	1.10	0.07	<0.05	S
30:15 Ratio	1.11	0.05	1.09	0.06	>0.05	N.S.
Valsalva Ratio	1.12	0.07	1.17	0.06	.>0.05	N.S.
Tachy Cardia Ratio	0.85	0.03	0.80	0.03	<0.001	H.S

Table 9: Comparative study of sympathetic function tests amongst the males and females of Group D

Parameters	**Males (n=13)**		**Females (n=12)**		**P-Value**	**Signi-ficance**
	Mean	**S.D**	**Mean**	**S.D.**		
Cold Pressor (S.B.P)	23.30	3.20	22.16	2.88	>0.05	N.S
Response (D.B.P) (Rise in mm HG)	17.07	2.66	18.16	4.04	>0.05	N.S
Hand Group Test (S.B.P)	18.15	2.64	17.50	2.71	>0.05	N.S
Hand Group Test (D.B.P)	20.15	2.88	21.33	3.34	>0.05	N.S
Galvanic Skin Resistance (Kohms)	105.08	1.98	135.83	2.55	<0.001	H.S

After the analysis, the data revealed that the mean values for the S/L, 30:15 and valsalva ratio in females were lower than males but the tachycardia ratio was slightly higher in Group A. The statistically

significant difference could be established in S/L ratio and valsalva ratio (P <0.05) (Table 2) whereas 30:15 ratio was highly significant statistically. The SBP values (systolic blood pressure) were lower in females in both cold pressor response and handgrip test. The values of diastolic blood pressure were slightly higher in females in both the tests. GSR values **were** higher in females and **were** highly significant (P <0.001) (Table 3) . In group B, S/L ratio, 30:15 ratio and tachycardia ratio were found to be higher in females while valsalva ratio showed no change. Only 30:15 ratio showed highly significant difference (P <0.01) (Table 4) . The SBP and diastolic BP values are higher in females in cold presser test while in hand grip test DBP values are higher in females and SBP values **were** higher in males, no significance could be made out. GSR (Galvanic skin resistance) values were higher in females and were highly significant (P<0.001) (Table 5) . In group C S/L ratio, 30:15 ratio and valsalva ratio were higher in females and tachycardia ratio was higher in males. On analysis no significance could be made out (Table 6) . The DBP values were higher in hand grip test in both males and females while no change occurred in cold pressor response. GSR values were higher in females and were highly significant (P <0.001) (Table 7) . In group D, S/L ratio, 30:15 ratio and tachycardia ratio were higher in males. On analysis S/L ratio found to be significant (P<0.05) and tachycardia ratio found to be highly significant (P <0.001) (Table 8) . The SBP values were higher in males in both the cold presser response and hand grip test and DBP values were higher in females in both the tests. No significance could be made out GSR values were higher in females and were highly significant (P <0.001) (Table 9) .

DISCUSSION

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 males and females. Such a formal study was planned to be carried out which involved a battery of autonomic tests to be done on males and females of different age groups.

In the present study, changes were noticed in some parameters of both sympathetic and parasympathetic function tests during comparison amongst males and females of same age group. The conclusion reaches at by present study was compared with those derived from other studies in the past. In parasympathetic function tests S/L ratio showed increase mean values in males in group A(Table 2) and group D (Table 8) and these are statistically significant (P<0.05). This shows parasympathetic activity is more in males. The value for 30.15 ratio showed statistically highly significant differences amongst the males and females of group A (Table 2) and group B (P<0.001) (Table 4) . However it was high in males in group A and in females in group B. In valsalva ratio on comparison amongst males and females of the same age group, it was found that in younger age (Group A and Group B) values were lower in females and were statistically not significant (P>0.05) (Table 2,4) . In the older age group values were higher in females, but these were not statistically significant (P >.0.05)(Table 6 , 8) . This showed that the effect of sex on parasympathetic activity was not evident. In tachycardia ratio it was seen that females had higher values in younger age group (Table 2,4) but lower values in older age group (Table 6,8) than males. These values were statistically not significant. So our results of males having more parasympathetic activity than females as evident in' our study was consistent with the studies carried out by Storm *et al*., (1989) who studied blood pressure and heart rate responses to the valsalva maneuver. Cowan *et al.*, (1994) observed the effect of gender and age on heart rate variability (HRV) in healthy individuals and in persons after sudden cardiac arrest. Frey Tomaselli (1994) studied and showed the cardiovascular responses to standing differ, in some respects between the sexes and with age, Ryan at al (1994) analyzed heart rate dynamics during EGG recordings in healthy individuals of different age group both men and women. Barbosa et al (1996) studied the influence of age, sex and the presence of coronary heart disease on heart rate variability. Braune et al (1996) studied the influence of age and sex on autonomic functioning. Sinn Reich et al (1998) also found strong age and sex association on the stability of short recordings of heart rate variability. Mehta Ahuja *et al*., (1999) studied the gradual decline in parasympathetic activity with ageing and in the same sex. In sympathetic functions tests during the cold pressor response and the hand grip test

it was found that the statistical significance could not be made out in group (P>0.05)(Table 3,4,7,9) . This showed that the effect of gender on sympathetic activity was not evident.

In Galvanic skin resistance test the values were found to be highly significant in the females (P<0.001) in all the groups (Table 3,5,7,9). This showed as GSR values were higher in females so more sympathetic activity in males was noticed. Our results are comparable with the studies carried out by Ng *et al.,* (1993) who studied the muscle sympathetic nerve activity at rest. Jaquet *et al.,* (1998) studied the relationship between ambulatory blood pressure levels within subject blood pressure variability and age in men and women. Matsu Kawa et al (1998) concluded that sympathetic nerve activity increase with age in women and men. Mehta Ahuja et al (1999) that there was significant decrease in GSR (P<0.05) in males as compared to females. Our study is consistent with Jens Tank (2005), Kim *et al*., (2006), Stritt matter *et al*., (2007) Lemien *et al.,* (2009), To wifighi *et al.,* (2009) Berger *et al.,* (2009), WangJ *et al.,* (2010), Andrea Bassi *et al*., (2010), NugentL *et al.,* (2011) and Viola Vaccarmio *et al*., (2011) So from the above discussion it is concluded that on comparison of various autonomic function tests amongst males and females in same age group it was found that the parasympathetic activity is lower in females as evident from 30:15 ratio and tachycardia ratio, while sympathetic activity is higher in males as evident from low GSR.

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