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GENDER DIFFERENCES IN THE CARDIOVASCULAR AUTONOMIC RESPONSE DURING ISOMETRIC HANDGRIP EXERCISE

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ABSTRACT: Physical exercise can be regarded as a period of increased sympathetic activity with simultaneous parasympathetic withdrawal. Many circulatory changes occur during exercise due to mass sympathetic discharge. The exercise capacity among gender may differ due to substantial anatomical, physiological, and morphological differences. **AIMS & OBJECTIVES:** To evaluate the gender difference in the cardiovascular response during isometric hand grip exercise. **MATERIALS AND METHODS:** 30 healthy young adult male & 30 female students aged between 18-24 years who had no prior endurance training were asked to perform Isometric handgrip contractions using an isometric handgrip apparatus. The heart rate was calculated using BIOPAC MP30. Blood pressure measurements were obtained using a sphygmomanometer. **RESULTS & CONCLUSION:** The results of the present study showed significant increase in the blood pressure values in men during isometric exercise compared to women which may be because of increased catecholamine release to acute stress among men

KEYWORDS: Autonomic function tests, Isometric hand grip exercise.

INTRODUCTION: Physical exercise can be regarded as a period of increased sympathetic activity with simultaneous parasympathetic withdrawal¹. Assessment of cardiovascular response during exercise is an important tool to assess individual susceptibility to unfavorable cardiac events. Isometric or static exercises are characterized by change in the muscle tension with no change in the muscle length. Sustained isometric muscle contraction is a useful method to assess cardiac function. Characteristically, there is an increase in cardiac output and blood pressure, but little change in total peripheral resistance. Numerous studies attempting to explain gender differences in cardiovascular response to isometric exercise are inconsistent at best and conflicting. However, it has been noted that the substantial anatomical, physiological, and morphological differences that exist between men and women may affect their exercise capacity and influence the magnitude of response to exercise.² Since average isometric strength estimate is generally about thirty percent greater in men than in women in different muscle groups,³ and due to differences in sympathetic-parasympathetic or adrenal interactions at the cardiac level, the cardiovascular autonomic response may vary in men compared with women. Thus the present study is taken up to compare the changes in the cardiovascular parameters that arise as a result of isometric hand grip exercise between males and females.

MATERIALS AND METHODS : The study was conducted on 30 healthy young adult males and 30 females aged between 18-24 years studying in P.E.S. Institute of Medical Sciences & Research, Kuppam, Andhra Pradesh, with no previous history of cardiovascular, neurological and

ORIGINAL ARTICLE

metabolic diseases. The subjects had no prior endurance training. The ethical clearance for the study was obtained from the Institutional Ethical Committee (IEC). After taking the consent a brief history was noted & BMI was calculated after measuring height in meters & weight in kilograms. Heart rate and blood pressure values at rest were recorded, then the subjects were asked to perform Isometric handgrip contractions using an isometric handgrip apparatus interfaced with a load cell and force monitor. The heart rate was calculated using BIOPAC MP30 which is an electrically isolated data acquisition, designed for biophysical measurements. Blood pressure measurements were obtained at the brachial artery from the arm that was not being used for contraction (Non-dominant arm) using a sphygmomanometer and the results were recorded. All the recordings were obtained in sitting posture.

RESULTS & ANALYSIS: The Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 11.0. The results of the tests were expressed as means, and differences between two groups were analyzed by applying the unpaired "t" test. P values <0.05 were considered to be statistically significant & P values <0.01 were considered to be highly significant. The results of the present study showed a significant increase in systolic, diastolic, pulse pressure and mean arterial pressure in males compared to females.

VARIABLE	MALE (N=30) MEAN (SD)	FEMALE (N=30) MEAN (SD)
Age (yrs)	21.16(2.11)	19.66(1.72)
Height(cm)	158.16(9.30)	150.13(8.53)
Weight (kg)	62.73(6.75)	48.96 (5.52)
BMI	24.6(3.16)	21.3(2.88)

TABLE 1: DATA SHOWING BASELINE CHARACTERISTICS

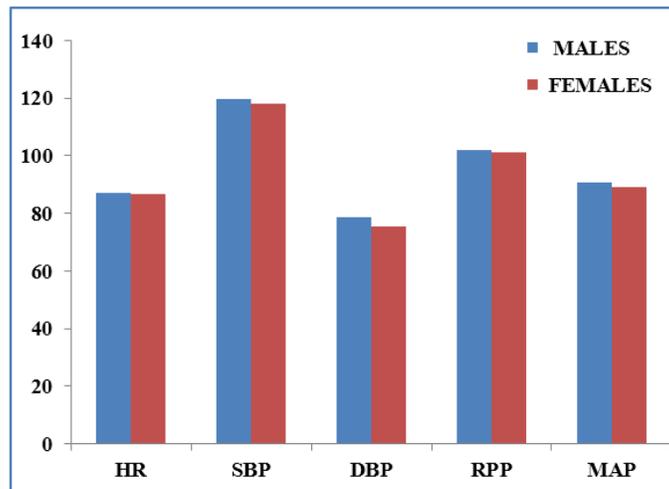
BMI: Body mass index.

GROUPS	MALES MEAN (SD)	FEMALES MEAN (SD)	p VALUE
HR	87.26(6.29)	86.53(5.94)	0.64
SBP	119.53(4.76)	117.96(4.75)	0.20
DBP	78.5(7.58)	75.63(5.73)	0.10
RPP	101.96(7.38)	101.0 (7.86)	0.66
MAP	90.6(5.07)	89.0(3.63)	0.16

TABLE 2: CARDIOVASCULAR RESPONSE BEFORE EXERCISE BETWEEN MALES AND FEMALES

HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, RPP: Rate pressure product, MAP: Mean arterial pressure.

ORIGINAL ARTICLE

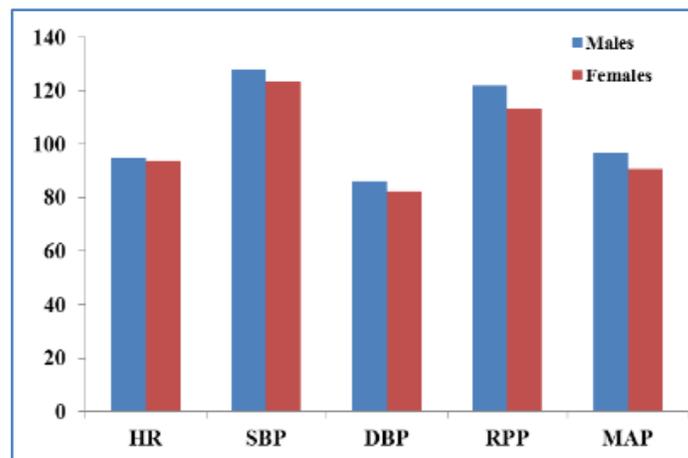


Graph 1: Cardiovascular response before exercise between males and females

GROUPS	MALES MEAN (SD)	FEMALES MEAN (SD)	p VALUE
HR	95.1(8.33)	94(7.28)	0.599
SBP	128.1(4.72)	123.5(7.47)	0.006**
DBP	86.4(7.43)	82.6(6.69)	0.041**
RPP	121.96(12.99)	113.2 (11)	0.006**
MAP	96.9(5.99)	90.7(5.89)	0.0001**

TABLE 3: CARDIOVASCULAR RESPONSE DURING EXERCISE BETWEEN MALES AND FEMALES

*P<0.05, **P<0.01.



Graph 2: Cardiovascular response during exercise between males and females

ORIGINAL ARTICLE

DISCUSSION: Several investigations have measured cardiovascular response to isometric exercise between genders whose results in these investigations were inconsistent at best. Similar to the results of the present study observations by DON MELROSE et.al., showed an increased MAP and DBP upon initiation of submaximal IHG exercise regardless of posture compared to women who had significantly lower blood pressure measurements⁴ Also supporting the present study is the work of Ettinger and associates which demonstrated attenuated increase in blood pressure and muscle sympathetic nerve activity in men.⁵

The results of the present study contradicts the results of Jones et. al,. In which they found that blood pressure responses to various forms of laboratory stressors were not consistently influenced by gender.⁶ The reason being subjects were performing isometric exercise at 30% MVC. Isometric exercise performed below 40 % MVC may not evoke the cardiovascular responses as shown by males in the present study which was done at 40% MVC.

The present study corroborates an analysis of twelve gender comparison investigations that focused on isometric hand grip exercises and reported that men have greater SBP and catecholamine response to acute stress.⁷

The possible explanation as to why men experienced greater DBP and MAP at the onset of exercise is difficult to clarify because of the many possible mechanisms. Studies by Sanchez et. al,. Showed no differences in catecholamine concentrations between genders at rest, but concentrations of norepinephrine, epinephrine, and dopamine were greater in men at the first minute of exercise. Of these three catecholamines, epinephrine concentration specifically was significantly greater in men at the first minute of exercise. In women, norepinephrine and epinephrine concentrations were unaffected throughout IHG trials.⁸

The study of gender differences during isometric exercise has few definitive conclusions, which make it difficult to identify precise mechanisms to explain gender differences in cardiovascular response to isometric exercise. Several data suggest that men are not more reactive to stress than women and sympathetic neural adjustments to stress may not be accurately reflected by cardiovascular and humoral responses.⁷

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ORIGINAL ARTICLE

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