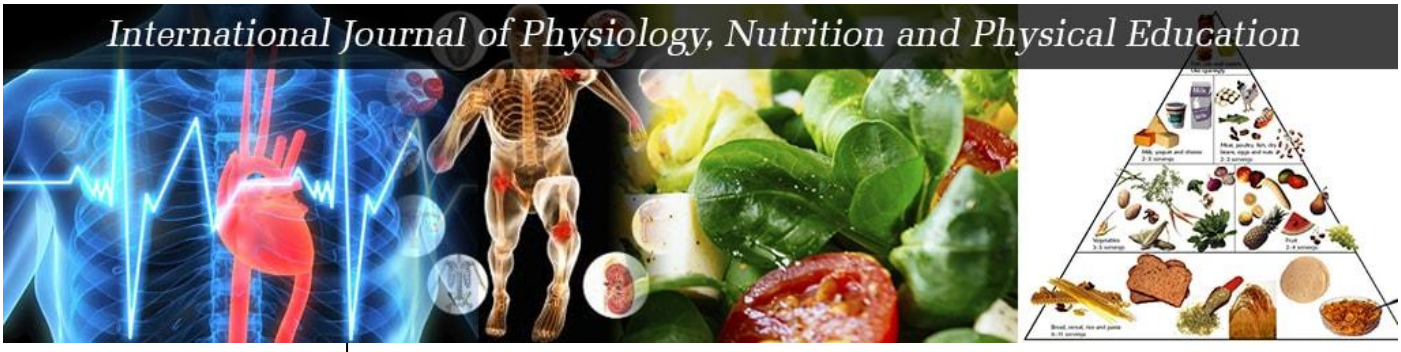

ISSN: 2456-0057
IJPNPE 2019; 4(1): 675-677

www.journalofsports.com
Received: 01-11-2018
Accepted: 03-12-2018

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Effect of isometric exercise on cardiovascular changes in normotensive healthy adults with or without parental history of hypertension

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Abstract
Family history (FH) is considered as a strong risk factor of hypertension. Previous works have shown that exaggerated cardiovascular response to exercise is a marker for early detection of future hypertension, however the use of an exercise induced physical stress response as a means of early prediction of hypertension in high risk individuals needs further confirmation. Present study was taken up to evaluate and compare the effect of isometric hand grip (IHG) exercise on pulse rate (PR) and blood pressure (BP) in normotensive healthy adults with or without parental history of hypertension. The study was performed on 30 healthy adults between 17-19 years post allocation into two groups, study group (n =10) with parental hypertension and control group (n = 20). Isometric hand grip exercise was performed and BP and PR response was measured at baseline, during the exercise, immediately after exercise, 3 minutes and 5 minutes after exercise. On analysis of the results there was a significant difference in the diastolic blood pressure (DBP) during exercise (83.25 ± 9.4 Vs. 74.6 ± 4.6, $p<0.05$), PR (78 ± 4.5 Vs 73.8 ± 3.3 $p<0.05$) and DBP (73.25 ± 4.1 Vs. 67 ± 2.5 $p<0.05$) at 5 minutes after exercise between the groups. There was no significant difference in other parameters between the groups. To conclude, there was an increased DBP response to exercise and increased recovery time in normotensive subjects with FH of hypertension.

Keywords: Isometric handgrip exercise, hypertension, family history

1. Introduction
Hypertension is considered as an important risk factor in various cardiovascular diseases. It is a known factor that the first-degree relatives of essential hypertensive patients are at an increased risk of developing hypertension due to various genetic factors and environmental components. In these individual's exposure to various physical and mental stresses is manifested by abnormal cardiovascular reactivity [1, 2]. There are several studies showing that, exposure to various task leading to mental and physical stress like mental arithmetic tasks, cold pressor test and both isometric and dynamic physical stress tests can be used as a valuable tool in prognosis of hypertension years before it establishment [3-6]. Several studies show exaggerated cardiovascular response to exercise in normotensive off springs of hypertensive parents [1, 6, 7, 8, 9]. Some studies found that FH of hypertension was not related to exaggerated cardiovascular responses during exercise [10, 11]. Due to controversial results from previous studies it is necessary to further the association between the FH for arterial hypertension and cardiovascular reactivity. Moreover, there are no much data on post exercise BP and PR response in subjects with FH for arterial hypertension, which is a valuable prognostic tool for development of hypertension. The present study was taken up to evaluate the effects of isometric hand grip exercise (IHG) on cardiovascular changes during and after exercise in normotensive healthy adults with and without parental history of hypertension.

2. Materials and methodology
The study was conducted on 30 students of Adichunchanagiri Medical College in the age group of 18- 20 years. The subjects were divided into 2 groups: Group 1 (study group) consisted of 10 subjects with parental history of hypertension (one parent suffering from hypertension) and Group 2 (Control Group) consisted 20 subjects without parental history of hypertension.

2.1 Following subjects were excluded from the study

- Subjects suffering from chronic disease like hypertension, diabetes mellitus, chronic heart disease, renal disease, neuropsychiatric disorders.
- Smokers and alcoholics
- Subjects on any form of regular physical activity
- Subjects on chronic medication

Height and weight of all the subjects were measured and BMI was matched. IHG Exercise training was done by using Hand grip spring dynamometer. The subject squeezes the dynamometer with their dominant hand by putting maximum force and values were recorded. The procedure was repeated 3 times with a brief pause of 10 sec between each trial. Highest value was taken as maximum voluntary contractions (MVC). Handgrip was then maintained steadily at 30% of MVC until fatigue. Subject's pulse rate (PR) and BP were measured at baseline, during the exercise, immediately after exercise, 3 minutes and 5 minutes after exercise.

The data collected was analyzed by the application of appropriate statistical tests. The unpaired t test was used to compare differences between the means of the study group and control group.

The results are expressed as Mean and Standard Deviation (SD) for all the quantitative data and p Value > 0.05 is taken as 'not significant' and p Value < 0.05 is considered as 'significant'.

3. Results and discussion

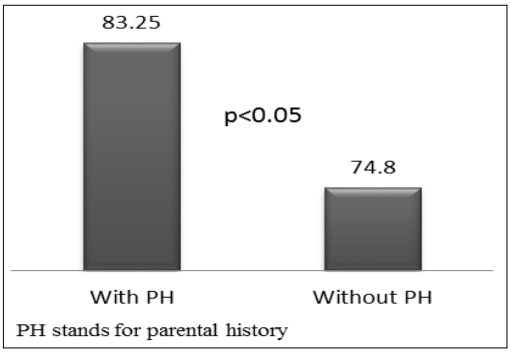
3.1 Results

A total of 30 adults recruited, 10 in study group & 20 in control group and baseline characters were well matched. General physical characters of both the groups are as shown in the table 1.

Table 1: shows that a total of 30 adults recruited, 10 in study group & 20 in control group

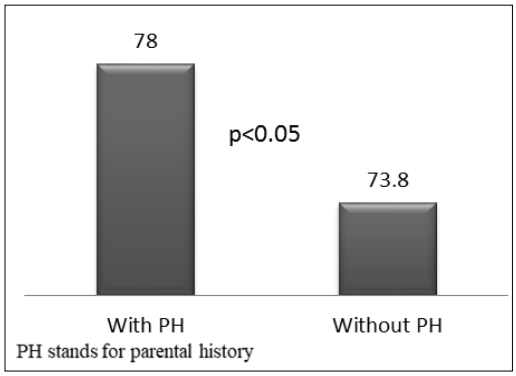
	Study group	Control group	p value
Age	18.9 ± 0.78	18.8 ± 0.71	NS
Height	162.3 ± 3.02	161.2 ± 2.4	NS
Weight	59.8 ± 3.31	61 ± 4.24	NS
BMI	22.7 ± 3.4	22.12 ± 3.02	NS
All values are mean ± SD, NS stands for non-significant (p>0.05).			

The baseline cardiovascular parameters (PR: 77.25 ± 4.7 Vs 76 ± 4.2 beats/ minute, SBP: 125 ± 5.8 Vs 121 ± 3.2 mm of Hg and DBP: 75 ± 4.6 Vs 72.6 ± 3.2 mm of Hg) before the onset of exercise did not differ significantly between the groups. Diastolic blood pressure (DBP) during exercise was significantly higher in study group (83.25 ± 9.4 mm of Hg) when compared to the control group (74.6 ± 4.6 mm of Hg, p<0.05) as shown in graph 1.



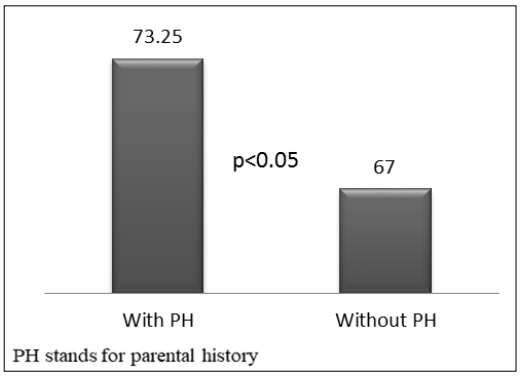
Graph 1: DBP-During exercise

The mean pulse rate after 5 minutes of IHG exercise was 78 beats/ minute ± 4.5 in study group compared to 73.8 beats/ minute ± 3.3 in control group. Hence, PR after 5 minutes of IHG exercise remained significantly high (p<0.05) in study group compared to control group (graph 2).



Graph 2: PR-after 5 mins

The DBP at 5 minutes after IHG exercise also showed a significant increase in the study group) compared to control group (73.25 mm of Hg ± 4.1 Vs 67 ± 2.5 mm of Hg, p<0.05). This is depicted in graph 3.



Graph 3: DBP-after 5 mins

The PR during exercise (83.25 ± 4.2 Vs 78.4 ± 3.2), immediately after exercise (87.5 ± 3.6 Vs 83.6 ± 4.08) and 3 minutes (81.37 ± 3.32 Vs 77.9 ±2.53) after exercise was more in study group when compared to control group, but the increase was not statistically significant. The SBP was 125 ± 5.8 and 121 ± 3.2 mm of Hg before exercise in study group and control group respectively. During exercise it increased to 133.75 ± 3.6 and 130 ± 2.8 mm of Hg in study group and control group respectively. Immediately after exercise the SBP was 128 ± 4.6 and 127 ± 4.42 mm of Hg in 2 groups which further dropped to 123 ± 4.08 and 121 ± 4.8 at 3 minutes after exercise in study group and control group respectively, showing complete recovery. However, the changes in the SBP were not significantly different between the groups.

3.2 Discussion

Our study showed an increase only in the DBP response during IHG exercise. The SBP and PR did not differ significantly between the groups. There are several studies showing greater DBP response to physical stress, but it is always associated with increased in SBP [1, 7, 12]. There is no much data demonstrating an isolated increase in DBP. Several studies showed a significant rise in DBP during physical exertion in normotensive subjects [12, 13], suggesting an

increased resting peripheral vascular resistance and impaired exercise-induced vasodilation [6]. Hence, failure to reduce total peripheral resistance is the most likely cause of increased DBP in study group during exercise. In our study, the pulse rate and DBP remained significantly high after 5 minutes of exercise in normotensive offspring of hypertensive parents, thus implying an increase recovery time in this group.

Differences in cardiovascular reactivity to various stress responses in relation to parental hypertension may be affected by the characteristics of stimulus and the degree of stressor.[1] A study by Falkner *et al*. demonstrated an increased DBP and HR responses to psychological stressors in normotensive children with parenteral hypertension. Another study by Jorgenson *et al*. showed that female children with parenteral hypertension displayed increased DBP and HR responses when compared to offspring of normotensives. There are several studies showing that enhanced cardiovascular responsiveness to stress helps in early detection of development of hypertension [14, 15]. Our study did not show a significant variation in SBP which is contradictory to the general hypothesis which states that individuals with a history of parental hypertension are predisposed to exaggerated cardiovascular responses to stress [1, 8, 9, 10]. Further research with an increased sample is required to confirm the findings of our study which showed an isolated increase in DBP.

4. Conclusions

In conclusion our study states that subjects with parenteral history of hypertension have increased DBP during physical stress along with increased recovery time compared to subjects without parenteral history of hypertension. Since parental hypertension is a non-modifiable risk factor, the off springs of hypertensive parents should tjake measures in altering the modifiable risk factors of hypertension targeting at increasing parasympathetic activity.

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