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## CARDIOVASCULAR RESPONSES TO ISOMETRIC HANDGRIP TRAINING IN NORMOTENSIVE MEDICAL STUDENTS

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### ABSTRACT

**Objective:** The study was designed to assess the effects of isometric handgrip training on cardiovascular system, using handgrip dynamometry and comparing the results between trained and untrained groups.

**Materials and Methods:** Study subjects consisted of 30 healthy adult normotensive medical students in the age group of 18-22 years. Age and sex matched adults who were not active in sports or in physical activities constituted the control group (n= 30)

Hemodynamic parameters; blood pressure and heart rate were recorded and evaluated after a defined protocol of handgrip dynamometer at rest and post exercise. BP and HR were recorded with the help of Sphygmomanometer, stethoscope, and ECG machine.

There was no change in resting blood pressure and heart rate between the subject and control group before the training sessions. There was significant decrease in resting blood pressure and heart rate in trained subject group when compared to untrained control group after 5 weeks of training sessions.

**Keywords:** Isometric hand grip exercise; Handgrip dynamometer; blood pressure; heart rate.

### INTRODUCTION

Cardiovascular responses to isometric handgrip exercises have been studied in different sportsmen of different categories. It has shown that regular exercise training reduces both adrenergic and pressure response to isometric exercises. The same data is lacking in medical students.

The study was designed to assess the effects of isometric handgrip training on cardiovascular system, using handgrip dynamometry and comparing the results between trained and untrained groups.

### METHODOLOGY

#### MATERIALS & INSTRUMENTS:

The study group consisted of trained medical students in the age group of 18-22 years

In the study, the data was compared before and after the isometric hand grip training in normotensive medical students.

#### INSTRUMENTS:

##### 1. HANDGRIP DYNAMOMETER(HGD):

The device used to measure the grip strength is called dynamometer. It is widely accepted and handgrip strength measurements provide an objective index of the functional integrity of the upper extremity. The handgrip dynamometer is easy to handle and reliable in its measurements. The handgrip dynamometer used in our study is the Spring handgrip dynamometer. Dynamometer was appropriately calibrated from time to time by the set of instructions and recommendations in the manual.

##### II. ECG machine

- III. Mercury sphygmomanometer and Stethoscope
- IV. Stop watch

#### SELECTION OF SUBJECTS:

All the subjects were normotensive and were without history of hypertension, cardiovascular, renal, musculoskeletal, neurological disorders. Subjects with acute medical illness and or on any medication were excluded from the study and control groups.

#### Method of study:

The exercise testing was performed in the normal room temperature with bright light. Subjects were studied before and after the training sessions of isometric handgrip exercise. Hemodynamic changes like BP,HR, and MVC (Maximal Voluntary Contraction) before and at the end of training programme were recorded. BP was recorded by mercury sphygmomanometer and stethoscope.HR was recorded by using ECG machine. Isometric

exercise was performed by HGD. The duration of the static exercise is of 3min timed by stopwatch or performed till fatigue. The subjects were instructed not to hold their breath during the handgrip to avoid performing the Valsalva maneuver.

#### METHOD OF SELECTION OF SUBGROUPS:

30 healthy, normotensive, untrained volunteers of 18-22 years of age are selected.

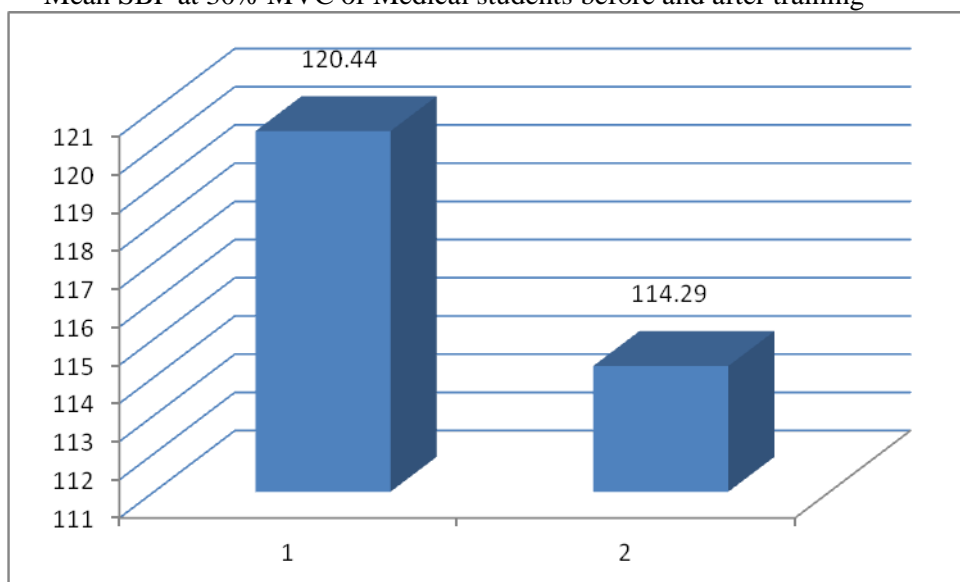
#### PROCEDURE OF STUDY:

Heart rate and Blood pressure were measured before and after 5wks of IHG training.

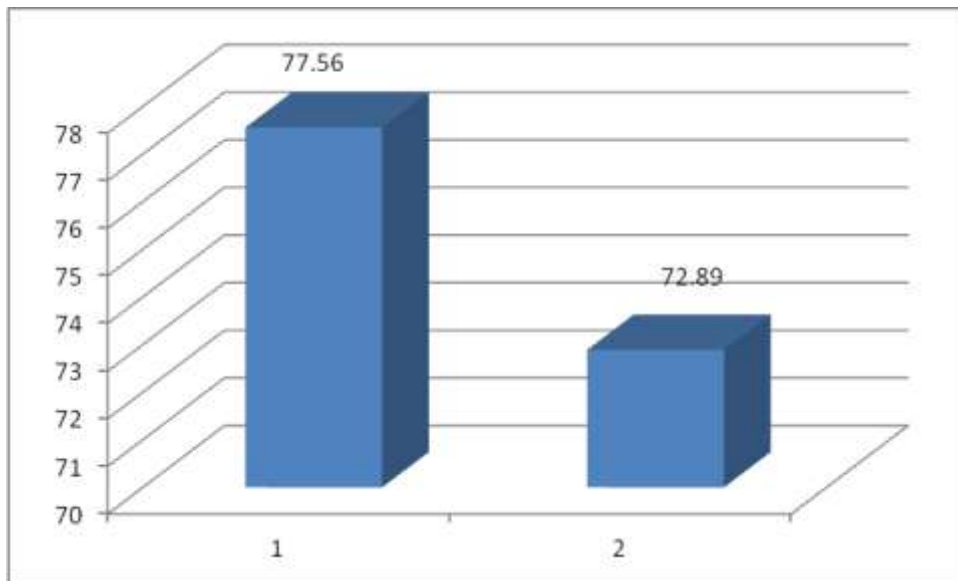
30 subjects were trained using unilateral IHG of the dominant arm for a total of 5wks.Each subjects attended four of 3-mins bouts of IHG at 30% MVC while sitting with the working arm extended towards the front. Each bout was separated by a 5-mins rest period. Before every training session, each subject's MVC value was determined at the highest value obtained on three attempts, separated by 1 min of rest.

## RESULTS

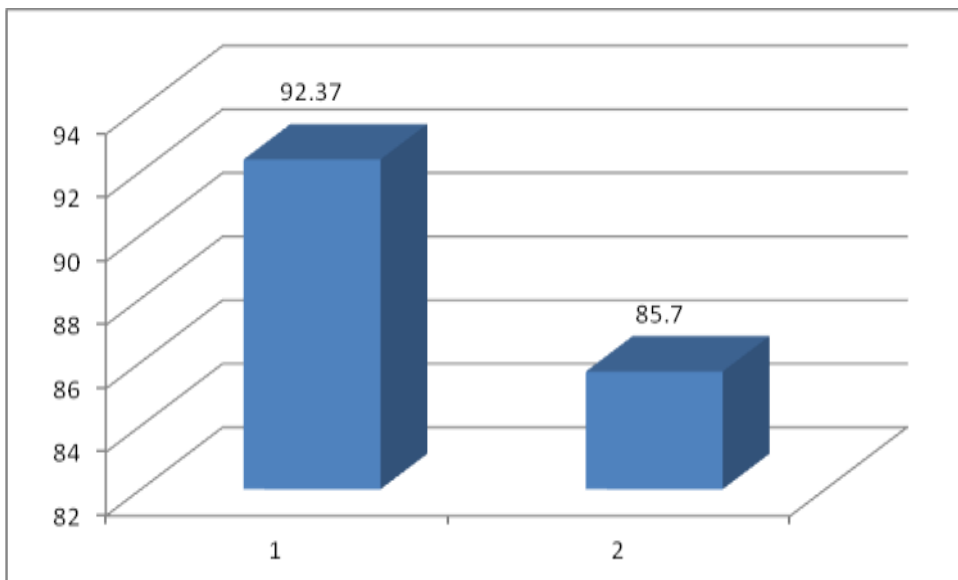
Mean SBP at 30% MVC of Medical students before and after training



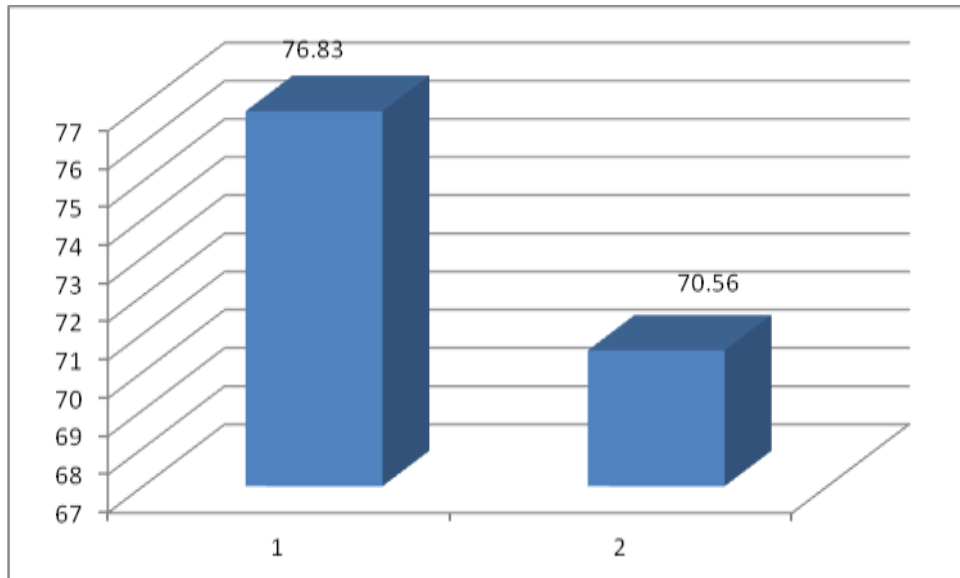
**Mean DBP at 30% MVC of medical students before and after training.**



**Mean MAP at 30% MVC of training for medical students before and after training.**



**Mean HR at 30% MVC of training for medical students before and after training.**



	Before	After
Systolic BP	120.44 ± 6.86	114.29 ± 7.96
Diastolic BP	77.56 ± 6.25	72.89 ± 6.49
Mean Arterial Pressures	92.37 ± 4.92	85.7 ± 4.14
Heart rate	76.83 ± 6.30	70.56 ± 6.77

## DISCUSSION

This study has showed that there is marked decrease in Blood pressure and heart rate to sustained isometric handgrip exercise training performed by the Medical students when compared to controls. Trained subjects had a significant lower dynamic response to the isometric handgrip exercise compared to age and sex matched untrained controls.

In a study which conducted 6wk of isometric handgrip training, showed attenuation in sympathetic nerve activity in their subjects as measured by microneurography. The authors proposed that the decrease in sympathetic nerve activity was probably secondary to a reduction in muscle chemoreceptor stimulation. Surprisingly, a reduction in blood pressure did not accompany the decrease in sympathetic

nerve activity and the investigators speculated that the method of blood pressure measurement may have attributed to their nonsignificant finding. Alternatively, they proposed that vasoconstriction in other vascular beds(e.g. mesenteric and renal)might override any blood pressure reductions resulting from the decrease in sympathetic nerve activity in skeletal muscle<sup>1-10</sup>. In the present study we did not measure muscle sympathetic nerve activity so we are unable to offer any further insights.

In recent investigation, a reduction in muscle sympathetic nerve activity that was accompanied by a decrease in lactate production during forearm exercise training. They suggested that venous lactate served as a useful marker of metabolic by-product production during exercise<sup>11-17</sup>. Perhaps the

reduction in sympathetic nerve activity resulted from a decrease in metabolic accumulation following training. If this is the case, endurance forearm training might have the potential to decrease anaerobic metabolism and increase aerobic metabolism during exercise<sup>18, 19</sup>. Other investigators have suggested that the measurement of muscle sympathetic nerve activity can be used as an indirect index of chemosensitive muscle afferent activation. This is because there is little or no increase in sympathetic nerve activation during handgrip work until the chemoreceptors are stimulated by a decrease in muscle PH and other metabolites<sup>20</sup>.

Another physiological adaptation documented following training is an increase in blood flow to the exercising muscle. It is uncertain as to whether the increased flow is the result of reduced sympathetic vasoconstrictor influences and/or the result of increased intrinsic vasodilatory activity. The study reported that after 4 weeks of handgrip exercise, a localized training induced increase in forearm blood flow occurred, that was associated with an increase in vascular vasodilatory capacity<sup>21, 22</sup>. The increase in blood flow resulted from a decrease in minimal peripheral resistance. This adaptation could possibly explain the attenuated blood pressure response seen in our investigation.

### CONCLUSION

The current study shows that 5 wks of unilateral IHG training elicits reduction in mean arterial pressure at rest. Although the reported reduction in arterial pressure appears modest, recent studies indicate that small reductions in diastolic arterial pressure in the population would have significant health benefits<sup>13</sup>. A 2-mmHg drop in diastolic arterial pressure would lead to a 17% decrease in hypertension as well as a 6% reduction in coronary heart disease and a 15% reduction in stroke related events. A 5 to 6mmHg reduction in diastolic pressure

decreased coronary heart disease and stroke incidents by 16% and 38%, respectively. Thus the arterial pressure reduction reported in this study would have an important impact on this cardiovascular related illness. Furthermore, our results support the concept that isometric training is an effective modality in the prevention of hypertension.

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Ethical clearance has been obtained from ethical committee Jagadguru Sri Shivarathreeswara Medical College, Mysore and informed consent from subjects was taken.

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