



EFFECT OF ISOMETRIC HANDGRIP EXERCISE TRAINING ON RESTING BLOOD PRESSURE IN PREHYPERTENSIVES

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ABSTRACT

Introduction : Prehypertension is a major risk factor contributing to cardiovascular and kidney disease. According to JNC(JOINT NATIONAL COMMITTEE FOR HYPERTENSION)recent classification, Systolic Blood Pressure(SBP) of 120-139 mmHg and/or Diastolic Blood Pressure(DBP) of 80-89 mmHg is termed as prehypertension. This population has the risk of becoming overt hypertensives. Pharmacological treatment is not recommended for individuals with prehypertension. Mainstay treatment is lifestyle modification. In addition to that the role of short-term isometric exercise to reduce blood pressure levels has been studied. **Objective:** To study the effect of short term isometric exercise training along with lifestyle modification on resting blood pressure in prehypertensives using handgrip dynamometer. **Materials And Method:** Among 100 prehypertensives, 50 were divided into control group and 50 into study group. Control group was advised lifestyle modifications, whereas study group was given isometric exercise training along with lifestyle modifications. Resting BP was recorded before starting Isometric handgrip training(IHT) . IHT was performed using handgrip dynamometer. The exercise training sessions were conducted thrice a week for 12 weeks. BP was recorded at the end of 12 weeks for both control and study group. Values were tabulated and results were compared. **Results:** BP in the control group before and after lifestyle modification did not show much reduction in SBP and DBP. P value for SBP was 0.45 and DBP was 0.05 which was statistically insignificant. BP in the study group before and after isometric handgrip training with lifestyle modifications showed significant reduction in SBP and DBP. P value for SBP and DBP was <0.001 which was statistically significant. **Conclusion:** Along with lifestyle modification ,Isometric handgrip training lowers resting BP among prehypertensives. It is simple, effective, inexpensive and non-pharmacological measure to lower BP.

KEYWORDS : isometric handgrip training, prehypertension

INTRODUCTION

Arterial Blood pressure is defined as the lateral pressure exerted by the column of blood on wall of arteries, when blood flows through the arteries⁽¹⁾. Normal resting BP in adults is around 120/80 mmHg where 120 is systolic and 80 is diastolic BP respectively⁽²⁾. SBP more than 140 mmHg, and DBP more than 90 mmHg is termed as hypertension. Nearly 30% of the global population is estimated to have hypertension⁽³⁾. According to jnc(joint national committee for hypertension)recent classification, sbp of 120-139 mmhg and/or dbp of 80-89 mmhg is termed as prehypertension⁽⁴⁾. Sedentary lifestyle, stress and food habits are important factors responsible for prehypertension in young adults. Prehypertension is a major risk factor contributing to cardiovascular and kidney disease. Lifestyle modifications like increased physical activity, salt restriction and weight reduction can revert back prehypertensive state to normotensive state or prevent its progression.

Prehypertensives are at an increased risk of developing overt hypertension. Pharmacological treatment is not recommended for individuals with prehypertension. Mainstay treatment is lifestyle modification. Recommended lifestyle changes include weight reduction, abstinence from smoking, a healthy diet and regular physical activity, such as walking, swimming, and so on. Some individuals may be unable to undertake such activity due to comorbidities like obesity, arthritis or lung disease. Hence there is a need for other types of exercise that could be used to lower resting Blood pressure. American College of Sports Medicine suggests aerobic exercises like running, swimming, cycling etc., as the main intervention to prevent and treat hypertension⁽⁶⁾. In addition to aerobic and resistance training, static (isometric) exercise has been suggested as an alternative exercise intervention to reduce BP levels. In Isometric or Static exercise there is contraction of skeletal muscle without a change in muscle length e.g. lifting or pushing heavy weights and contracting muscles against fixed objects, whereas isotonic or dynamic exercise involves contraction of the skeletal muscle with change in the length of muscle like running, swimming⁽⁷⁾. Static exercises are equally effective as dynamic exercises in improving cardiovascular efficiency and reducing Blood pressure levels⁽⁸⁾.

Studies in normotensive and hypertensive subjects have suggested that short periods (10 min or so) of isometric exercise undertaken three to four times a week can lower SBP and DBP⁽⁹⁾. Many studies have found the effect of isometric handgrip exercise training on resting BP in hypertensives and normotensives. This study aims to study the effect of

short term isometric exercise training on Blood pressure in prehypertensives using handgrip dynamometer.

MATERIALS AND METHODS

After getting ethical committee clearance, 100 prehypertensive individuals with age group of 20-50 years were recruited from MTM clinic from a tertiary care hospital. Among 100 prehypertensives 50 were divided into control group and 50 into study group. Control group was advised lifestyle modifications like salt restriction, weight reduction and abstinence from smoking, whereas study group was given short term isometric exercise training along with lifestyle modifications.

Inclusion Criteria: individuals with SBP 120-139 mmHg and DBP of 80-89 mmHg, in the age group of 20-50 years

Exclusion Criteria: Persons suffering from hypertension(BP>140/90 mmHg); Subjects with Cardiovascular disease, cerebrovascular disease, chronic kidney disease and Diabetes; Persons suffering from hypertension(BP>140/90 mmHg). The participants were non-smokers, non-alcoholics, were not on any medications and were not engaged in any regular exercise routine or walking, jogging, yoga, and pranayama. The subjects having a hand deformity, or any history of inflammatory joint disorder, fracture or any muscular or neurological disorder of upper limb were excluded from the present study.

Isometric Handgrip Training:

The resting Blood pressure was measured in sitting position for both groups. Control group was advised lifestyle modifications. The study group were asked to press the handle of the handgrip dynamometer with the dominant hand briefly for about 2 - 3 seconds with maximum effort and the value of maximum voluntary contraction (MVC) was noted. The subjects were given 3 attempts with a gap of 1 minute between each attempt. The highest value of the 3 attempts obtained on the handgrip dynamometer was recorded as MVC. The procedure was repeated for the other hand. The subjects were asked to rest for 5 minutes before starting exercise training. The subjects were instructed to perform isometric handgrip exercise training for 12 weeks. Isometric handgrip training consisted of three sets of 2 minutes isometric contractions at 30% MVC, with a rest of 2 minutes after each contraction. This procedure is repeated on the other hand. This supervised IHT protocol was conducted 3 times per week for a total period of 12 weeks. After completing 12 weeks of isometric exercise training, again three recordings of BP were taken with a gap of two

minutes after each of the readings. Average values of 3 readings each of SBP and DBP obtained after IHT were used for statistical analysis. BP was recorded at the end of 12 weeks for both control and study group. In control group BP before starting lifestyle modifications were compared with BP after 12 weeks of lifestyle changes. In study group BP before exercise training was compared with BP after giving exercise training and lifestyle modification of 12 weeks. Values were tabulated and results were compared.

Statistical Analysis

Data is reported as mean \pm SD. Paired t-test was used for statistical analysis. P-value <0.001 was taken as significant.

RESULTS

Table 1:

CONTROL GROUP (n 50)				
INITIAL BP		BP AFTER 12 WEEKS		P value
SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)	SBP-0.45 DBP-0.05
128.65 \pm 4.66	85.8 \pm 1.83	127.85 \pm 4.85	83.9 \pm 2.75	

Table 2:

STUDY GROUP (n 50)				
INITIAL BP		BP AFTER 12 WEEKS		P value
SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)	SBP <0.001 DBP <0.001
127.35 \pm 4.41	83.9 \pm 2.75	119.7 \pm 5.84	78.05 \pm 4.06	

Table 1 shows BP in control group before and after lifestyle modification, which did not show much reduction in SBP and DBP. P value for SBP was 0.45 and DBP was 0.05 which was statistically insignificant.

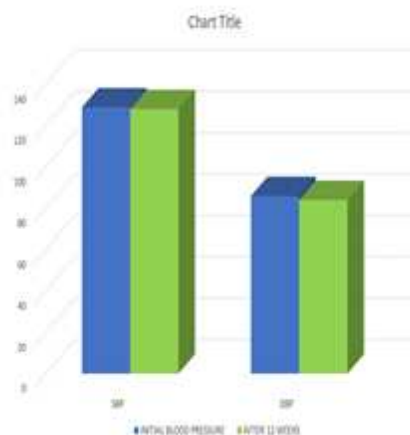
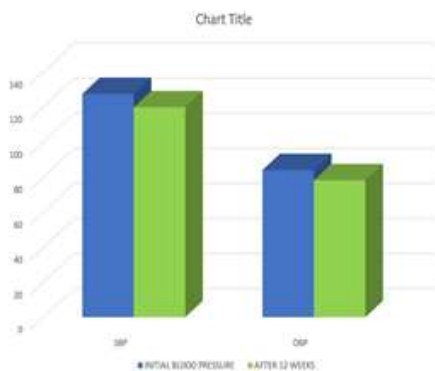


Table 2 shows BP in study group before and after isometric handgrip training which showed significant reduction in systolic and diastolic BP. P value for SBP and DBP was <0.001 which was statistically significant.



DISCUSSION

Our study showed that, there is decrease in resting BP in the study group following IHG exercise training along with lifestyle modification for a period of 12 weeks in prehypertensives with p value of <0.001 which was statistically significant.

Results of our study was similar to study conducted by **Miller et al.**, which suggested Following 8 weeks of IHG training, participants demonstrated significant reductions in resting SBP and DBP⁽¹⁰⁾.

A meta-analysis of controlled trials of isometric exercise on resting BP was undertaken by **Owen et al.** in which Isometric exercise for <1 hr per week reduced SBP and DBP.⁽¹¹⁾

Wiley et al., reported significant reduction in BP after a isometric exercise training of 8 weeks and concluded that IHG exercise can be used as nonpharmacological measure in regulating BP⁽¹²⁾.

Study by **Devereux et al.**, showed significant reductions in systolic, diastolic, and mean arterial pressure with bilateral-leg isometric exercise training for 4 weeks⁽¹³⁾

The sympathetic nervous system is an important regulator of blood flow. Sympathetic neural activity is vital for the redistribution of blood flow and maintenance of arterial pressure during exercise⁽¹⁵⁾. Reductions in resting BP and increase in blood flow to the skeletal muscle are the two cardiovascular adaptations associated with exercise training⁽¹⁴⁾. These adaptations are because of decrease in sympathetic vasoconstrictor outflow following training.

Hypertension causes endothelial dysfunction leading to less endothelial dependent, nitric oxide-mediated vasodilatation⁽¹⁶⁾. Isometric handgrip training increases exposure to systemic shear stress via the pressor response which enhances the release of endothelium-derived Nitric Oxide⁽¹⁷⁾. Nitric Oxide diffuses from the endothelium to smooth muscle cells, causing them to relax, which in turn dilates the blood vessel walls. Dilatation of blood vessel increases blood flow through the vessels causing reduction in blood pressure⁽¹⁸⁾.

According to **Mofousi et al.**,⁽¹⁹⁾ regular exercise increased capillary density and Oxygen extraction in skeletal muscles. Increased vascular flow and ability of trained muscle to maintain aerobic metabolism lowers interstitial concentrations of metabolites, causing less stimulation of metaboreceptors, leading to smaller sympathetic response causing less vasoconstriction which prevents increase in Blood pressure⁽²⁰⁾. During isometric training there is less chemoreceptor reflex stimulation, thereby attenuating the sympathetic nervous system activity, ultimately causing lowering of Blood pressure.⁽²¹⁾

CONCLUSIONS:

Isometric handgrip training reduced resting arterial pressure following 12 weeks of training in prehypertensives. Hence it can be used as an adjunctive therapy for lowering Blood pressure.

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