

Cardiovascular Responses to Isometric Handgrip Training in Normotensive Students of S.P. Medical College, Bikaner

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ABSTRACT

Background: Preventive services are an important component of the national health agenda. Physicians have the opportunity and responsibility to promote regular physical activity as well as the reduction of high blood pressure, weight control, management of abnormal blood lipids, and prevention and cessation of smoking.

Aim: There is a need to know the effect of isometric hand grip exercise training of the certain degree on cardiovascular system so that similar benefits if any could also be obtained to same extent in similar age group if they practice physical training regularly.

Material & Methods: This is prospective Study group consisted of Medical students in the age group of 17-22yrs, who are pursuing their studies at S.P. Medical College, Bikaner. One hundred and fifty subjects (75 males and 75 females) were selected for this study among the MBBS students from S.P. Medical College, Bikaner. Informed consent was obtained from all the subjects after receiving full details of the protocol. The data was compared before and after the isometric hand grip training in normotensive Medical students.

Results: In present study the mean value of BMI were insignificant in male ($p=0.055$) and female ($p=0.052$), in pre-test (rest) and posttest (30% MVC Training) SBP were significant but DBP non-significant ($P=0.001^*$, $0.005NS$ respectively) in Male and Female ($P=0.001^*$, $0.005NS$ respectively), the comparison of mean Pulse/min. in pre-test

(rest) and posttest (30% MVC Training) are significant ($P<0.001$) in Male and Female respectively. The total Cholesterol, total triglyceride, HDL Cholesterol, LDL cholesterol and VLDL Cholesterol were insignificant in male & female.

Conclusion: The current study shows that 12 weeks 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.

Key Words: Normotensive, Isometric Hand Grip Exercise, Blood pressure, Lipid Profile, BMI.

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INTRODUCTION

Health is a dynamic state of complete physical, mental, spiritual and social wellbeing and not merely an absence of disease or infirmity.¹ Mankind has gone so far along with modern gadgets which have made our lives indescribably comfortable. But in the long run we have forgotten to judiciously use 'Man made' and 'Natural' assets that we possess. Off late we have realized about the negative effects, how these luxuries of life, how an imbalance use of these assets have crippled us in innumerable ways. There has been increased mental stress, excessive consumption of calories and fat with decreased or no physical activity at all, environmental pollution and many more. Rapid alterations of life

style within a very short span of time leads to chronic imbalance in both body and mind impending a direct effect on the physiology of mankind.

Preventive services are an important component of the national health agenda. Physicians have the opportunity and responsibility to promote regular physical activity as well as the reduction of high blood pressure, weight control, management of abnormal blood lipids, and prevention and cessation of smoking.

Though there is a vast knowledge on exercise, but data on exercise and its effects on the cardiovascular system and long-term survival are still limited. The responsibility for conducting

research lies with government, private health agencies, universities, and medical schools.

Numerous factors may influence the sympathetic and pressure response to physical exercise, age, sex, type of activity carried on and training. Training, in particular is considered to reduce both adrenergic and pressure response to exercise.¹

In addition, aerobic exercise adds an independent blood pressure-lowering effect in normotensive and hypertensive groups with a decrease of 8 to 10 mm Hg in both systolic and diastolic blood pressure measurements.^{2,3}

Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in healthy persons as well as in subjects with cardiovascular disease. Regular physical activity is required to maintain these training effects. The potential risk of physical activity can be reduced by medical evaluation, risk stratification, supervision, and education.⁴

In addition to the physical benefits of exercise, both short-term exercise and long-term aerobic exercise training are associated with improvements in various indexes of psychological functioning. Cross-sectional studies reveal that, compared with sedentary individuals, active persons are more likely to be better adjusted,⁵ to perform better on tests of cognitive functioning,⁶ to exhibit reduced cardiovascular responses to stress⁷ and to report fewer symptoms of anxiety and depression.⁸ The goal of treatment are to lower BP through life style modification (smoking cessation, weight loss, exercise training, healthy eating and reduced sodium intake) and if not solely effective, the addition of anti-hypertensive medication. In particular, increased physical exercise and decreased sedentarism are important strategies in the prevention and management of hypertension.

There is a need to know the effect of isometric hand grip exercise training of the certain degree on cardiovascular system so that

similar benefits if any could also be obtained to same extent in similar age group if they practice physical training regularly.

MATERIAL & METHODS

This is prospective study group consisted of Medical students in the age group of 17-22yrs, who are pursuing their studies at S.P. Medical College, Bikaner. One hundred and fifty subjects (75 males and 75 females) were selected for this study among the MBBS students from S.P. Medical College, Bikaner. Informed consent was obtained from all the subjects after receiving full details of the protocol. The data was compared before and after the isometric hand grip training in normotensive Medical students.

Inclusion Criteria

All the subjects were without history of hypertension, cardiovascular, renal, musculoskeletal, neurological disorders.

Exclusion Criteria

Subjects with acute medical illness and/ or on any medication were excluded from the 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, Pulse rate and MVC before and at the end of training programme were recorded. 150 subjects (75 males and 75 females) were trained using unilateral isometric handgrip exercise (IHG) of the dominant arm for a total of 12 week. Each subject attended four training sessions per week. During each session, subjects performed four of 3-min bouts of IHG at 30% of MVC.

Statistical Methods

The Paired samples t-tests were used to determine the significance of differences between the variables measured pre training and post training session. SPSS for windows Version-16 (2007) was employed for statistical analysis.

Table 1: Anthropometric parameter (BMI) Comparison in Male & female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	26.36 \pm 8.94	25.28 \pm 0.155	0.055
Female	25.90 \pm 3.65	24.97 \pm 2.94	0.052

Table 2: Mean SBP at 30%MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	128.24 \pm 8.94	121.12 \pm 6.24	0.001
Female	127.36 \pm 8.10	120.17 \pm 5.22	0.001

Table 3: Mean DBP at 30%MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	82.48 \pm 6.24	78.72 \pm 3.74	0.005
Female	80.42 \pm 6.01	77.59 \pm 4.71	0.005

RESULTS

In present study the mean value of BMI were insignificant in male ($p=0.055$) and female ($p=0.052$), in pre-test (rest) and posttest (30% MVC Training). SBP were significant but DBP non-significant ($P=0.001^*$, $0.005NS$ respectively) in Male and Female ($P=0.001^*$, $0.005NS$ respectively).

In this study the comparison of mean Pulse/min. in pre-test (rest) and posttest (30% MVC Training) are significant ($P<0.001$) in Male and Female respectively.

In this study was comparison of mean of total Cholesterol, total triglyceride, HDL Cholesterol, LDL cholesterol and VLDL Cholesterol were insignificant in male & female.

Table 4: Mean Pulse/min. at 30%MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	78.00 \pm 6.98	72.76 \pm 3.91	0.001
Female	79.44 \pm 6.10	73.67 \pm 3.79	0.001

Table 5: Mean Total Cholesterol at 30%MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	221.26 \pm 38.02	218.16 \pm 31.67	0.055
Female	207.72 \pm 38.29	205.15 \pm 34.60	0.059

Table 6: Mean Total Triglyceride at 30% MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	147.64 \pm 28.78	142.94 \pm 31.19	0.056
Female	151.24 \pm 26.34	149.72 \pm 32.03	0.078

Table 7: Mean HDL Cholesterol at 30% MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	48.30 \pm 5.15	51.62 \pm 5.52	0.053
Female	40.72 \pm 3.53	42.69 \pm 5.04	0.054

Table 8: Mean LDL Cholesterol at 30% MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	155.63 \pm 43.90	153.40 \pm 36.30	0.072
Female	142.75 \pm 37.32	141.41 \pm 35.19	0.063

Table 9: Mean VLDL Cholesterol at 30% MVC of training for Medical students before and after training in Comparison in Male & Female

Sex	Pre-Test (Rest) Mean \pm S.D	Post-Test (30% MVC Training) Mean \pm S.D	p- Value
Male	29.53 \pm 5.76	28.98 \pm 6.24	0.060
Female	30.25 \pm 8.26	29.42 \pm 7.96	0.065

DISCUSSION

Most medical groups recommend regular physical activity. People over age 65 carry the highest load of chronic disease, disability, and healthcare utilization.⁹

Though many of these problems are preventable, physicians rarely provide their patients with an appropriate exercise recommendation that includes an individualized motivational message, a pre participation evaluation to ensure a safe exercise programme, and a tailored exercise prescription.¹⁰

Arterial baro-reflexes are important mechanisms for the overall regulation of circulation.¹¹ Under resting conditions, an increase in arterial pressure stimulates arterial baroreceptors and decreases the heart rate and the peripheral vascular resistance in resting skeletal muscles. Handgrip exercise induces an increase in arterial pressure, and although the increase in pressure should stimulate the arterial baroreceptors, it is accompanied by increase in heart rate and peripheral vascular resistance in resting skeletal muscles. This phenomenon indicates that arterial baroreflex functions are modified during exercise and that this modification may include changes in the gain and/or operating range of the reflex.¹² There are a number of studies addressing changes in arterial baroreflex function during exercise. However, most of them have focused on the reflex control of heart rate or arterial pressure.¹³

Present study has showed that there is marked decrease in Blood pressure and Pulse rate/min. to sustained isometric handgrip exercise training performed by the Medical students. Post training Subjects had a significant lower hemodynamic response to the isometric handgrip exercise compared to age and sex matched Pre training subjects.

It is generally accepted that regular endurance exercise can effectively attenuate resting arterial blood pressure.¹⁴

There is limited evidence that resistance training may also lower blood pressure, but the published results are equivocal, with some studies showing decrease,¹⁵ whereas others have shown no change.¹⁶ Most recently, isometric training has reportedly lowered blood pressure in short-term studies.¹⁷

The present study has showed that there is marked decrease in Blood pressure and Pulse rate/min, similar results found by Mughal MA et al who studied to see the effects of aerobic exercise, on changes in blood pressure, in patients with essential hypertension and observed statistically significant decrease in resting systolic & diastolic blood pressure were found ($p < 0.05$). Reduced pulse pressure from baseline and no discernible effects on mean body mass index.¹⁸

It was suggested previously that changes in sympathetic neural influences on total vascular resistance might act as a sufficient stimulus to produce a decline in blood pressure after isometric training.¹⁷ While the present study does not reveal the precise mechanisms responsible for these changes the data suggest that the attenuated blood pressure response was at least in part mediated by alterations in autonomic nervous system activity. Previous investigators have proposed alternative mechanisms such as decreased muscle sympathetic nerve activity,¹⁸ increased muscle blood flow and baroreceptors resetting.¹⁹

In a study which conducted 6 week of isometric handgrip training,¹⁸ showed attenuation in sympathetic nerve activity in their subjects as measured by micro-neurography. The authors proposed that the decrease in sympathetic nerve activity was

probably secondary to a reduction in muscle chemoreceptor stimulation. 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. In the present study we did not measure muscle sympathetic nerve activity so we are unable to offer any further insights.²⁰

In a recent investigation,²¹ a reduction in muscle sympathetic nerve activity that was accompanied by a decrease in lactate production during forearm exercise after training. They suggested that venous lactate served as a useful marker of metabolic by-product production during exercise. Perhaps the reduction in sympathetic nerve activity resulted from a decrease in metabolite accumulation following training.²² If this is the case, endurance forearm training might have the potential to decrease anaerobic metabolism and increase aerobic metabolism during exercise.¹⁸ Other investigators have suggested that the measurement of muscle sympathetic nerve activity can be used as an indirect index of chemo-sensitive muscle afferent activation.²³ 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.

The present study has showed that there was not marked decrease in Lipid Profile to sustained isometric handgrip exercise training performed by the Medical students. Post training subjects had a insignificant mean difference value of Total Cholesterol, Total triglyceride, LDL Cholesterol, VLDL Cholesterol and HDL Cholesterol in isometric handgrip exercise subjects compared to age and sex matched Pre trained subjects.

The present study showed differ results found that a short lifestyle modification and stress management education program significantly reduces TC, LDL, VLDL, while increases HDL cholesterol leads to favorable metabolic effects.²⁴

A study of beneficial effects on blood pressure and lipid profile of programmed exercise training in subjects and found significant reductions were found in plasma total cholesterol (-6.1%), low-density lipoprotein cholesterol (LDL-C) (-14.1%), and triglyceride (-11.4%). Elevation of high-density lipoprotein cholesterol (HDL-C) (+11.2%) was also noted.²⁵

The present study explored the relationship between physical training and subsequent changes in autonomic modulation of pulse rate and blood pressure. We showed that trained subjects have attenuated response in PR, SBP and DBP to isometric handgrip contractions when compared to Pre trained subjects and were associated with a corresponding change in sympatho-vagal balance. We conclude that physical training at a modest intensity could be a useful adjunct to the pharmacological treatment of hypertension.

CONCLUSION

The current study shows that 12 weeks 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. Thus the arterial pressure reduction reported in this study would have an important impact on these cardiovascular related illnesses. Furthermore, our results support the concept that isometric training is an effective modality in the prevention of hypertension.

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