

# Blood pressure response to isometric exercise in young smokers using hand grip dynamometer test

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## Abstract

**Background:** Smoking is one of the most ancient and widespread men activities, analytical and statistical studies has firmly concluded that cigarette smoking has various hazards on different system of human being. **Material and methods:** 60 young smokers(smoking 10-25 cigarettes/day) and 60 normal healthy non smokers were selected for the study, hand grip dynamometer test was used to determine the blood pressure response during isometric exercise. **Results:** The result of the present study indicates high baseline systolic and diastolic blood pressure in the smoker males when compared with non-smoker males. After the isometric exercise by using hand grip dynamometer the rise in the diastolic blood pressure in smoker subjects were significantly lesser than non smoker subjects. **Conclusion:** Smoking is associated with an increase in systolic and diastolic blood pressure in young males at resting condition. When compared with age, weight and sex matched non smoker controls Blood pressure response to isometric exercise using hand grip dynamometer is lowered in smokers when compared with controls indicating lower sympathetic activation in smokers to isometric exercise. **Key Word:** Hand Grip Dynamometer; Smokers; Blood Pressure, Isometric Exercise

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system and define the role of sympathetic nervous system in the exercise response. Isometric muscle contraction evokes large increase in mean arterial pressure, heart rate and muscle sympathetic nerve activity and minor rise in central haemodynamics.<sup>3,4,5</sup> The sustained hand grip test is a useful measure of autonomic damage and when abnormal implies extensive damage to sympathetic efferent pathways, it is the only single measure of reflex sympathetic damage test available which fulfills the criteria of a useful test of autonomic function.

## INTRODUCTION

Cigarette smoking is a worldwide major risk factor for the development of atherosclerosis, coronary heart disease, acute myocardial infarction and sudden cardiac death.<sup>1</sup> Cigarette smoke is a mixture of several toxic chemicals of which nicotine, carbon monoxide and oxidant chemicals are most commonly implicated in the pathogenesis of cardiovascular diseases.<sup>2</sup> Isometric exercise provides convenient and easy way to activate the cardiovascular

## MATERIALS AND METHODS

60 smokers and 60 non-smokers young males of the age group 18-25 years were selected randomly from the general population.

### Inclusion criteria:

- Young smoker males aged 18-25 years.
- Young non smoker males aged 18-25 years.

### Exclusion criteria:

- Age below 18 years and above 25 years.

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- Subjects with history of Asthma, Diabetes, Mellitus, Hypertension, other cardiovascular diseases, endocrine disease or surgery.
- Subjects on chronic medication.
- Alcoholics
- Subjects with noticeable weight loss over the preceding 3 month
- Subjects having any neuro-muscular disorders.

A pretested structured proforma is used to collect the relevant information. All subjects were explained about the procedures to be undertaken and written informed consent was obtained from them. Following tests are performed in sitting posture 2-3 hours after light breakfast in sequence after familiarizing the subjects with the testing procedure. Handgrip dynamometer test was performed to elicit sympathetic cardiovascular functions during the isometric exercise. The baseline systolic and diastolic blood pressure values were recorded. The subjects were asked to perform maximal voluntary contraction (MVC) by gripping the handgrip dynamometer, as hard as possible for few seconds and the maximum force exerted was noted down. After giving rest for a few minutes, the subjects were made

to perform isometric exercise at 30% of the maximal voluntary contraction to the point of fatigue. Systolic and diastolic blood pressure recordings were taken at intervals of each minute during the period of exercise. The mean systolic and diastolic blood pressure, the increase in systolic and diastolic blood pressure during the isometric exercise were calculated and the maximal values of systolic and diastolic BP achieved during exercise were noted down.

## RESULTS AND DISCUSSION

60 smoker subjects and 60 non smoker subjects were analysed for the results. The results obtained are expressed as mean  $\pm$  standard deviation.

**Blood pressure response to hand grip dynamometer test:** The mean baseline systolic blood pressure (mm of Hg) in non-smoker was  $117.0 \pm 4.7$ . The mean baseline systolic blood pressure (mmHg) in smoker subjects was  $124.3 \pm 4.6$ . There was a statistically significant increase in baseline systolic blood pressure in smoker males when compared to non-smoker male controls ( $p < 0.001$ ) (Table 1).

**Table 1:** Comparison of systolic blood pressure response to hand grip dynamometer test between non smoker and smoker males (n = 60 each)

Systolic blood pressure (mm Hg)	Non smoker	Smoker	Significance	
			t - value	p - value
Baseline Systolic BP (mean $\pm$ SD)	$117.0 \pm 4.7$	$124.3 \pm 4.6$	6.08	<0.001, HS
Maximum Systolic BP (mean $\pm$ SD)	$138.1 \pm 2.7$	$143.8 \pm 4.2$	6.25	<0.001, HS
Change in Systolic BP ( $\Delta$ )(mean $\pm$ SD)	$21.1 \pm 5.5$	$19.5 \pm 4.6$	1.22	0.23, NS

The mean baseline diastolic blood pressure (mm Hg) in non-smoker males was  $79.3 \pm 4.9$ . The mean baseline diastolic blood pressure (mm Hg) in smoker male subjects was  $84.4 \pm 5.0$ . There was a statistically significant increase in baseline diastolic blood pressure in smoker male when compared with non-smokers males ( $p < 0.001$ ) (Table 4).

**Table 2:** Comparison of diastolic blood pressure response to hand grip dynamometer test between non smoker and smoker males (n = 60 each)

Diastolic blood pressure (DBP) (mm Hg)	Non smoker	smoker	Significance	
			t - value	p - value
Baseline diastolic BP (mean + SD)	$79.3 \pm 4.9$	$84.4 \pm 5.0$	3.99	<0.001, HS
Maximum Diastolic BP (mean $\pm$ SD)	$96.8 \pm 3.5$	$94.3 \pm 3.4$	2.81	<0.01, S
Change in Diastolic BP ( $\Delta$ )(mean $\pm$ SD)	$17.5 \pm 6.6$	$9.9 \pm 6.0$	4.60	<0.001, HS

\*unpaired 't' test NS – Not Significant, HS – Highly significant

The differences in the mean values of each parameter between smoker and non-smoker males are analysed and discussed. The result of the present study indicates high baseline systolic and diastolic blood pressure in the smoker males when compared with non-smoker males After the isometric exercise by using hand grip dynamometer the

rise in the diastolic blood pressure in smoker subjects were significantly lesser than non smoker subjects. A rise in the diastolic blood pressure of 15 mm Hg or more is considered as normal, 11-15 mm Hg as borderline and 10 mm Hg or less as abnormal response to handgrip dynamometer test. It can be hypothesized that higher

baseline blood pressure in smoker group could be due to higher vasoconstrictor tone.

**The following conclusions can be drawn from the results of the present study:** smoking is associated with an increase in systolic and diastolic blood pressure in young males at resting condition. When compared with age, weight and sex matched non smoker controls Blood pressure response to isometric exercise using hand grip dynamometer is lowered in smokers when compared with controls indicating lower sympathetic activation in smokers to isometric exercise

## DISCUSSION

According to Holly R. Middlekauff the effects of tobacco smoke on sympathetic nerve activity (SNA) depend on the net balance of the sympathetic excitatory effect of cigarette smoke on central neural outflow, and the sympathetic inhibitory effect of the baroreflex, activated by the increase in blood pressure from smoking. When the baroreflex is intact, SNA is suppressed, but when the baroreflex is chronically impaired, SNA increases.<sup>7</sup> The prolonged exposure of nicotine and tobacco smoke leads to increased sympathetic nerve activity, which becomes persistent via a positive feedback loop between sympathetic nerve activity and reactive oxidative species. Regarding the baroreflex role on the sympathetic nerve activity two hypotheses has been postulated, one hypothesis states that the reduction in baroreflex sensitivity which increases the resting blood pressure, another hypotheses state that the baroreflex reset takes place. During isometric exercise. On an average the increase in systolic, diastolic blood pressure, mean arterial pressure from resting level was to a lesser extent in smokers when compared non-smokers during exercise. This shows the impairment of sympathetic nerve activity among smokers.

## CONCLUSION

Thus the study concludes that there is evidence sympathetic impairment among young mild smokers. This shows there is decreased baroreflex sensitivity resulting in sympathetic impairment in habitual smokers. Baroreceptor and sympathetic activity can be restored after quitting smoking. Thus the study can convince young mild smokers to quit smoking

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