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Effect of Exercise on the Blood Pressure of Cigarette Smokers

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Faculty of Clinical Sciences, College of Health Sciences, University of Port Harcourt, Nigeria**Abstract:**

Cigarette smoking is a known risk factor of many cardiovascular diseases. The aim of this study was to determine if exercise may reduce the risk of hypertension amongst smokers. One hundred subjects (including fifty smokers and fifty non smokers) aged; 18 to 55 years who gave oral consent were randomly selected to participate. Their blood pressures were recorded before, immediately after, 10minutes and 20minutes after a skipping exercise respectively. The result showed a slight decrease in the 20-minute post exercise mean systolic blood pressure of both smokers and non smokers, although not significantly. There was also no significant difference between the 20-minute post exercise and baseline mean diastolic blood pressures of both smokers and non smokers. However, the 20-minute post exercise blood pressures of smokers were significantly higher than their non smoker controls. This is probably due to the vasoconstrictor effect of nicotine which increases peripheral resistance. Therefore, in attempting to quit smoking, smokers should also be encouraged to engage in mild to moderate exercise.

Keywords: Exercise, Blood pressure, Smokers**1. Introduction**

Cigarette smoking is a major cause of avoidable death as it is a risk factor for many respiratory and cardiovascular diseases (including hypertension). Cigarette smoke is a complex mixture of chemicals, including nicotine and carbon monoxide¹. The immediate noxious effects of smoking are related to sympathetic nervous over-activity, which increases myocardial oxygen consumption through a rise in myocardial contractility, heart rate and blood pressure². Nicotine is the addictive in cigarette that stimulates the sympathetic ganglia and adrenal medulla as it enters the body. This in turn causes the release of epinephrine, which leads to vasoconstriction. Vasoconstriction causes increased peripheral resistance and reduces delivery of oxygen and nutrients to the tissues. The heart compensates for this by increased heart rate and stroke volume resulting in high blood pressure. Heavy smoking decreases left ventricular function³ and is associated with persistent rise in blood pressure⁴. Primates et al., 2001⁵ observed a significant association between smoking and increase in systolic blood pressure of overweight and obese men. Cigarette smoking may also increase blood pressure through stiffening arteries, with particularly deleterious effects on chronic smokers⁶. Childhood exposure to tobacco smoke decreases aortic elastic properties in healthy children⁷, which may also be associated with progression of atherosclerosis, vascular injury and plague progression. These may be cumulative and irreversible resulting in hypertension in later life.

Physical activity reduces the risk of cardiovascular diseases. Sedentary living is associated with a high risk of developing hypertension compared to their physically active peers⁸. It is still not clear how exercise affects blood pressure. Physical activity may reduce the elevated sympathetic activity that is common in essential hypertension. Post exercise hypotension may involve cardiopulmonary and baro-reflexes. The operating point of these arterial baro-reflexes may be set to a lower blood pressure after an acute bout of exercise⁹. Kelm, 1990¹⁰ proposed that exercise enhances shear stress, stimulating the production of nitric oxide by the endothelium. In healthy blood vessels nitric oxide enhances smooth muscle relaxation and maintains blood vessels in the normal resting state. Exercise also causes vascular structural changes such as increased length, cross-sectional area, and/ or diameter of existing arteries and veins in addition to new vessel growth¹¹.

The Nigerian Federal Ministry of Health warns and also mandated cigarette advertisements to be followed by; 'tobacco smoking is dangerous to health and smokers are liable to die young' (Tobacco smoking control act, 1990)¹². Many of these smokers will die from

cardiovascular complications (including hypertension). The aim of this study is to determine if exercise may reduce the risk of hypertension in smokers.

2. Methodology

This cross sectional study was carried out in the city of Warri, Delta state, Nigeria between October and November 2012. One hundred apparently healthy subjects (including 50 smokers and 50 non-smokers) aged 18 to 55 years were recruited. Informed consent was obtained from all subjects who also filled questionnaires. Weight and height of each subject were measured and body mass index (BMI) calculated. Also each subject's baseline blood pressure (BPB) was measured using a digital sphygmomanometer and recorded before exercise.

The exercise regimen in this study was skipping using a skipping rope and each subject skipped for one hundred times. Blood pressures were taken immediately after exercise (BPI), 10 minutes after (BP10) and 20 minutes after exercise (BP20) respectively.

3. Results

Data obtained from this study was analyzed using the statistical package (SPSS version 17.0) and summarized as mean and standard error of mean (SEM) for continuous variables. Statistical differences for two independent means were tested using z-test. Correlation analysis was used to assess association between two continuous variables and *p* value was significant at 0.05.

	Non-smokers n=50	Smokers n=50	<i>P</i> value	Difference
SBPB (mmHg)	128.52 ± 2.09	137.34 ± 1.74	0.012	Significant
DBPB (mmHg)	81.96 ± 1.79	89.94 ± 1.55	0.003	Significant
SBPI (mmHg)	162.54 ± 2.65	177.62 ± 2.52	0.012	Significant
DBPI (mmHg)	84.66 ± 1.95	95.68 ± 1.81	0.001	Significant
SBP10 (mmHg)	128.42 ± 2.16	138.98 ± 1.78	0.001	Significant
DBP10 (mmHg)	81.84 ± 1.68	90.20 ± 1.38	0.000	Significant
SBP20 (mmHg)	123.48 ± 1.87	132.28 ± 1.65	0.003	Significant
DBP20 (mmHg)	78.08 ± 1.60	85.84 ± 1.19	0.000	Significant
BMI (Kg/m ²)	22.83 ± 0.65	23.53 ± 0.42	0.112	Not significant

Table 1: Difference in mean blood pressures and BMI ± standard error of mean of non-smokers and smokers.

The table above showed that blood pressures measured before, immediately after, 10minutes after and 20minutes after exercise were significantly higher in smokers when compared with non smokers even when there is no significant difference in the body mass index (BMI) of both groups.

	BPB (mmHg)	BP20 (mmHg)	<i>P</i> value	Difference
SBP of smokers	137.4 ± 1.74	132.28 ± 1.65	0.178	Not Significant
DBP of smokers	89.94 ± 1.55	90.20 ± 1.38	0.178	Not Significant
SBP of non-smokers	128.52 ± 2.09	123.48 ± 1.87	0.178	Not Significant
DBP of non-smokers	81.96 ± 1.79	78.08 ± 1.60	0.544	Not Significant

Table 2: Differences between the mean baseline blood pressure and 20-minute post exercise BP of smokers and non-smokers.

As shown in table. 2, there is not significant differences in the blood pressures of both smokers and non smokers.

Smokers	BP	<i>P</i> value	Correlation
Age	SBPB	0.000	Significant
Age	DBPB	0.064	Not Significant
Age at 1 st smoke	SBPB	0.042	Significant
Age at 1 st smoke	DBPB	0.481	Not Significant
No. of sticks/day	SBPB	0.000	Significant
No. of sticks/day	DBPB	0.000	Significant
BMI	SBPB	0.000	Significant
BMI	DBPB	0.002	Significant

Table 3: Correlation of Age, Age at 1st smoke, number of sticks/day and BMI with blood pressures of smokers

Table. 3 showed that there is significant correlation between age and systolic blood pressure but not diastolic blood pressure. Again, age at 1st smoke well correlated with systolic and not diastolic blood pressure. However, both the number of sticks of cigarette smoked per day and BMI had significant correlation with blood pressures.

4. Discussion

The mean baseline blood pressure of smokers was significantly higher than that of non-smokers (table.1). This agrees with earlier reports^{3,5}. In this study, there was no significant difference between the mean BMI of smokers and that of non-smokers (table.1). Number of cigarette sticks/day correlated significantly with both mean pre-exercise systolic and diastolic blood pressures (Table.3). This supports Bowman et al., 2007³ that the risk of developing hypertension increases with increasing number of cigarette sticks smoked/day. There was also significant correlation between age at first smoke and pre-exercise systolic blood pressure but not diastolic blood pressure (Table.3). Younger smokers are at risk of systolic hypertension. Heavy smoking for a prolonged period causes loss of elasticity and stiffening of the arteries earlier in life with resultant increase in peripheral resistance and thus increasing the risk of hypertension⁶. These arterial complications associated with smoking are also known to be factors in aging, making worse for cardiovascular disease to occur in elderly smokers. Also smokers who live a sedentary lifestyle may be at a higher risk.

Mean post-exercise blood pressures of smokers were also significantly higher than that of non-smokers (Table.1). There was a slight reduction in mean systolic blood pressure 20 minutes after exercise in both smokers and non-smokers (Table.1), although not significantly (Table.2). There was also no significant difference between the 20-minute post exercise and pre-exercise mean diastolic blood pressures of both smokers and non smokers. However, the 20-minute post exercise blood pressures of smokers were significantly higher than their non smoker controls. Therefore, exercise may give better blood pressure lowering effect in non smokers.

Nitric oxide; a vasodilator substance may also be involved in post-exercise blood pressure lowering¹⁰. Post-exercise blood pressure lowering may result from arterial and cardiopulmonary baro-reflexes which are said to be set to a lower blood pressure following an acute bout of exercise. One of the proposed mechanisms increasing the risk of hypertension in smokers is the vasoconstrictor effect of nicotine (the active ingredient in cigarette). Conversely, during exercise the blood vessels especially to skeletal muscles dilate to increase free flow of blood to exercising muscles. This in turn, aids oxygen and nutrient delivery.

Therefore, smokers who engage in regular mild to moderate exercise may counteract the vasoconstrictor effect of nicotine, thus reducing the risk of hypertension. Smokers and non-smokers are encouraged to exercise regularly. Also, those with mild to moderate hypertension will benefit from exercise, as it has been proposed as one of the non-pharmacological measures in the management of hypertension.

5. Conclusion

Regular exercise has a blood pressure lowering effect on both smokers and non smokers. Both the pre- and post exercise blood pressures of smokers were significantly higher than their non smoker controls. This is probably due to the vaso-constrictive effect of nicotine. However, smokers who engage in regular mild to moderate exercise may have a lower risk of developing hypertension since exercise tends to reduce peripheral resistance. This study also suggests that non smokers who exercise may have better blood pressure control than smokers

6. References

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