Effects of Tobacco Consumption on Blood Pressure Levels in Smokers

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Abstract:
Background: The recent decades have been a massive global increase in tobacco use. Tobacco use is a major preventable cause of premature death and diseases. Immediate availability and the low price gives rise to high consumption of tobacco smoking and this may affect blood pressure. **Objectives:** To observe the effects of tobacco consumption on blood pressure levels in smokers. **Methods:** This cross sectional analytical study was conducted from July 2016 to June 2017 in the Department of Physiology, Rangpur Medical College, Rangpur. A total number of 60 subjects were selected, among them 30 were apparently healthy non-smoker subjects as control group (group A) and 30 were apparently healthy smoker subjects (group B). The subjects were selected from different area of Rangpur city. The effects of cigarette smoking on blood pressure were studied by measuring the levels of blood pressure. For statistical analysis independent sample "t" test was performed by computer based software SPSS-17.0 version for windows. **Results:** Mean blood pressure levels were significantly higher ($p<0.001$) in smoker subjects as compared with the healthy control subjects. **Conclusion:** The increased blood pressure levels in smoker subjects were evidence of development of cardiovascular disorders due to tobacco smoking and this might offer a new approach to cardiovascular risks prevention in population with tobaccco smoking.

Indexing words: Tobacco, Tobacco smoker, Blood pressure

Introduction:
Tobacco is a product prepared from the plant by curing them.[1] Tobacco contains the alkaloid nicotine, which is an extremely addictive drug.[1,2] In addition to nicotine, tobacco contains thousands of other chemicals such as cresol, pyrene, DDT, carbon monoxide, ammonia, hydrogen cyanide, acetone, methanol, formaldehyde, arsenic, cadmium etc.[3,4] Dried tobacco leaves are mainly used for smoking in cigarettes, cigars, pipe tobacco, and flavored shisha tobacco. They can be also consumed as snuff, chewing tobacco and dipping tobacco.[1] There are two kinds of commonly used tobacco products in Bangladesh i.e. smoking and smokeless tobacco products.[4]

In Bangladesh 43.3% of adults (41.3 million) use tobacco in smoking and or smokeless form. More than five million people die globally each year due to tobacco related illness, the figure expected to increase to 8.3 million by 2030.[5,6]

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Tobacco smoke contains over 4,000 particles and gases, some of which are cardiotoxic. Particles include heavy metals known to cause tubular injury such as cadmium and lead, which may reach serum concentrations above 40% in smokers.[7] Cigarette smokers are exposed to significant amounts of cadmium (Cd) and lead (Pb), which also accumulate in kidney tissue more than in any other organ.[8]

Cigarette smoking is associated with acute increase in arterial pressure due to systemic vasoconstriction and decreased skin and coronary blood flow.[9] Blood pressure and heart rate are increased by smoking, due to the action of nicotine.[8] The action of nicotine on specific cholinergic receptors causes hemodynamic changes such as increase heart rate and peripheral vascular resistance.[7] The rise in blood pressure is due to an increase in cardiac output and total peripheral vascular resistance. The blood pressure rise appears immediately increase in circulating catecholamines.[8]

Consumption of tobacco is now increasing rapidly throughout the developing world and is one of the biggest threat to current and future world health.

According to the official Agricultural Statistics (2010) in different districts of Bangladesh. Rangpur still remains highest with 40,345 acres during 2008-2009.[10]

The purpose of this study was to asses the effect of tobacco on blood pressure of smoker subjects of northern region because the rate of tobacco use is more among the people of this region.

Methods:

The cross-sectional analytical study was conducted in the Department of Physiology, Rangpur Medical College, Rangpur from July 2016 to June 2017. The Rangpur Medical college ethical committee and thesis protocol review committee approved the study protocol. Total numbers of 60 apparently healthy subjects of both sexes with age 30-45 years were divided into following groups: Group A - 30 apparently healthy non smokers and Group B - 30 apparently healthy smokers. The subjects included in each group matched in their age and socio-economic condition. The duration of smoking is more than three years. The experimental subjects were recruited from Rangpur City and outskirts. All the subjects were free from history of liver, heart, lung and other chronic systemic diseases, obesity & diabetes mellitus, hypertension, pregnancy and lactating mother. Tobacco chewers were also excluded from this study.

After selection of subjects, the objectives and the procedure of the study were explained in detail to them and their informed written consent were taken. A standard questionnaire was filled after taking history and through clinical examinations.

Blood pressures were measured by palpatory method[11] and auscultatory methods.[12]

For statistical analysis independent sample "t" test was performed by computer based software SPSS-17.0 version for windows.

Results:

The data depicted in Table 1. In this cross sectional study, the mean blood pressure levels are significantly higher ($p<0.01$) in smoker subjects than those of healthy control subjects.

Table 1: Mean ± SD Blood Pressure levels in two groups (n=60)

Variables	Group A (non smokers)	Group B (Smokers)	p value
Systolic Blood Pressure mm of Hg	107.1667 ± 10.14408 (90 – 120)	138.6667 ± 7.18395 (12o0 – 145)	0.000***
Diastolic Blood Pressure mm of Hg	69.6667 ± 8.08717 (60 – 80)	85.0000 ± 5.08548 (70 – 90)	0.000***
Pulse Pressure mm of Hg	37.5000 ± 7.74040 (20 – 50)	53.6667 ± 6.14948 (35 – 60)	0.000***
Mean Blood Pressure mm of Hg	82.1660 ± 8.03641 (70 – 93.33)	102.8887 ± 5.10188 (86.67 – 108.33)	0.000***

Results are shown as mean ± SD and ranges (L-H)

A= Apparently healthy subjects of non-smokers (Control).

B= Apparently healthy subjects of smokers (Experimental). n= Number of subjects. ***= $p<0.001$.

= Normal systolic blood pressure level is < 130 mmHg.[13]

= Normal diastolic blood pressure level is average 85 mmHg.[13]

= Normal pulse pressure level is average 40 mmHg.[14,15]

= Normal mean pressure level is average 93 mmHg.[15]

Discussion:

In this cross sectional study, blood pressure levels were significantly higher ($p<0.01$) in smoker non tobacco chewer subjects than those of healthy control subjects which is comparable to others.[16,17,18,19,20,21]

Literature review suggested several mechanisms for these changes of blood pressure levels in smoker non tobacco chewer subjects. Higher levels of blood pressure in smoker non tobacco chewer subjects might be due to tobacco which contains nicotine. Blood pressure is increased due to sympathetic stimulation by nicotine which causes release of epinephrine and norepinephrine as a result there is increased heart rate and cardiac output that causes rise in systolic blood pressure. Nicotine diminishes

baroreceptor sensitivity and increases the production of thromboxane A_2 which is a powerful vasoconstritor.[16,17,18] In addition high blood pressure readings in smokers are also affected by high Na+ content in tobacco. Systemic absorption of sodium and active ingredient licorice in tobacco smokes increase blood pressure by inhibiting metabolism of mineralocorticoids and causes Na+ retention. As a result increased extracellular fluid volume, blood volume and cardiac output which in turn increase systolic blood pressure.[19]

At the same time norepinephrine causes consequent vasoconstriction which increased peripheral resistance which in turn increases diastolic blood pressure. As nicotine together with cholesterol and other fat deposits contribute to the narrowing of the lumen of the blood vessels there by the peripheral resistance is also increased which gives rise to high diastolic blood pressure. Mean pressure is also increased due to increased diastolic pressure.[16,17,18]

Tobacco contains nicotine which increased blood pressure in smokers. Smoking induces morphological and functional changes in blood vessels, including the induction of proliferation of intimal smooth muscle cells, decreases in endothelial prostacyclin synthesis and endothelial-derived vascular tone regulators, which induce an imbalance between vasodilator and vasoconstrictor vasoactive mediators. Interference with the vascular responses to acetylcholine, nitric oxide and endothelin-1 might cause predisposition to hypertension.[20,21]
From the results of the present study, higher levels of blood pressure in smoker non tobacco chewer subjects might be due to tobacco smoking for a prolong period of time which induced sustained rise of blood nicotine, carboxyhemoglobin levels.

Conclusion:

In this present study, it has been concluded that the higher blood pressure levels was found in smoker subjects may be due to tobacco conjumption. Reduction in tobacco smokes improves cardiovascular disorders & reduce mortality and morbidity in smokers non tobacco chewers.
As far as our knowledge, this kind of study is not previously done in our country. This study would increase awareness about the adverse effects of unjudicial tobacco use on cardiovascular system. But study population was small so further study with large sample size may help us to avoid bias.

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