Original Article

Effects of Cigarette Smoking on Cardiopulmonary Fitness of Some Randomly Selected Undergraduate Students in Zaria, Kaduna State.

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ABSTRACT

Cigarette smoking is a leading cause of unnecessary deaths and morbidity due to its role in lung cancer, cardiopulmonary disease (CD), ischemic heart diseases and stroke. Although, the actual mechanism of smoking in cardiopulmonary disease is not clear, smoking is well established as the primary risk factor of cardiopulmonary disease. Two hundred students of Ahmadu Bello University were involved in this study. One hundred were known smokers with a clear history of smoking while the other group (100) had no smoking history. Body mass index, body fat percentage, blood pressure, peak flow rate, skeletal muscle percentage and visceral fat were measured among the participants. The results revealed that percentage skeletal muscles and peak flow rate were significantly higher in non-smokers compared to smokers whereas systolic and diastolic blood pressure, body mass index, body fat percentage and visceral fat were significantly higher in smokers compared to the non-smokers. Evidence from this study indicates possibilities of compromise in cardiopulmonary fitness of Nigerian undergraduate smokers.

Keywords: Cardiopulmonary fitness, Cardiopulmonary disease, Cigarette smoking, Undergraduate students

INTRODUCTION

Cardiopulmonary function is a pointer of the ability to transport oxygen to the active muscles of individuals involved in regular movements in short time.[1] Cardiopulmonary function is also referred to as cardiopulmonary endurance or cardiorespiratory fitness which specifies the VO_{2max}.[1]

The U.S. Food and Drug Administration has classified cigarettes as a drug due to its harmful effects to health.[1] Tobacco smoking usage causes approximately 6 million death per year throughout the world, in the United States almost 500,000 deaths can be attributed to smoking and about 10% of these deaths are caused by second-hand smoke exposure.[2] There are about 1.1 billion smokers around the world with around 80% residing in low- and middle-income countries where over two-thirds of smoking related deaths occur,[3] while the prevalence of smokers in Nigeria tend to be on the decline, about one out of ten Nigerians still smokes daily.[4]

Smoking is a foremost cause of needless deaths and morbidity, connected to high burden of lung cancer, cardiopulmonary disease (CD), ischemic heart diseases and stroke.[3,5] Smoking is reported to be responsible for about 90% of deaths by chronic obstructive pulmonary disease, and increases the

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risk of coronary heart disease by 4 times.[6]The ventilation threshold time is significantly higher in non-smokers as smoking is reportedly said to lower the ventilation threshold time. Also, non-smokers heart rate during recovery after maximum exercise was significantly lower compared to smokers. Furthermore, it was reported that smokers had significantly lower time for reaching the ventilation threshold and heart rate recovery after exercise.[1]

Nigerian students are always involved in activities with a high intensity of maximal heart rate (HRmax) making cardiopulmonary fitness a necessity. There is however paucity of information concerning the cardiopulmonary fitness of smoking and non-smoking Nigerian undergraduate students. Thus, this research was set out to establish the effects of cigarette smoking on cardiopulmonary fitness of some selected undergraduate students in Zaria.

MATERIALS AND METHODS

Subjects

Two hundred (200) undergraduate students of Ahmadu Bello University between the ages of 18 – 40 years were randomly chosen. One hundred smokers were chosen randomly after confirming their smoking status, while one hundred non-smokers were chosen randomly after confirming them as those who have never smoked. The experimental group (n=100) comprised of undergraduate students who had been smoking for at least a year while the nonsmoker group (n=100) were undergraduate students with no history of smoking at all.

All subjects were given appropriate details of the content and purpose of the study, then completed forms to provide consent before partaking in the experiment.

Measurement of BMI

The physical characteristics of the participants were measured using an automatic height estimator (DS-102, Jenix, Seoul, Korea) for their height (cm) and weight (kg) to calculate their body mass index (BMI) with the calculation BMI=weight (kg)/height $(m)^2$.

Body fat percentage, Skeletal muscle percentage and Visceral fat

The subjects were asked to stand barefooted on a body sensor: composition and scale, with both arms stretched at 90º to the body truck. The subject stays in the upright position until the results appear. The result for the body fat percentage, skeletal muscle percentage and visceral fat were then recorded.

Measurement of blood pressure

The blood pressure was measured twice within a 5-min interval on the left arm with the participant seated using a mercury sphygmomanometer (AccosonÔ Ltd., Ayrshire, UK) and Littmann's stethoscope (3M LittmannÒ, Minne-sota, USA). Systolic blood pressure (SBP) was taken at the first appearance of Korotkoff's sounds, while its disappearance was considered diastolic

Peak flow rate

The peak flow rate was analyzed using a peak flow meter method as described by Adeniyi and Erhabor.[7]

Statistical analysis

For data analysis, an independent t-test was used for comparison of average changes among the groups. The statistical significance for all statistics was tested using IBM SPSS Statistics ver. 21.0 (IBM Co., Armonk, NY, USA) at a level of P=0.05.

RESULTS

. The results showed a significant difference $P < 0.05$ in the systolic and diastolic blood pressures, BMI, body fat percentage, peak flow rate, skeletal muscle percentage and viscera fat between the non-smokers and cigarette smokers. The percentage skeletal muscles and peak flow rates were significantly higher in non-smokers when compared to smokers($P < 0.05$). Furthermore, the systolic and diastolic blood pressures, BMI, body fat percentage and visceral fats were significantly higher in

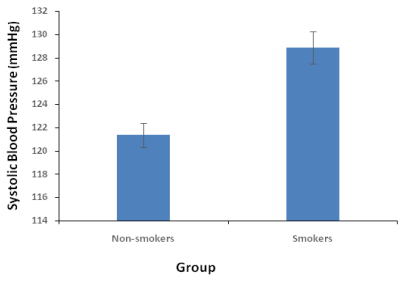

Figure 1: Systolic blood pressure in non-smokers and smokers

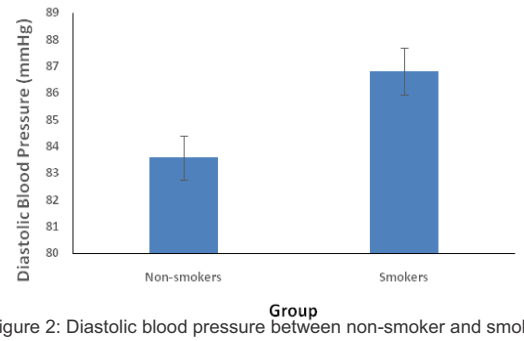

Figure 2: Diastolic blood pressure between non-smoker and smokers

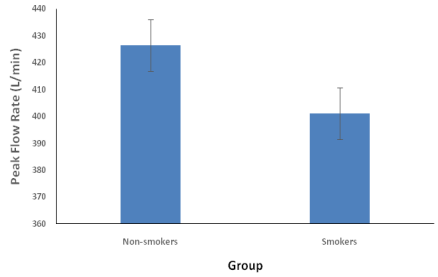

Figure 3: Peak flow rate between non-smokers and smokers

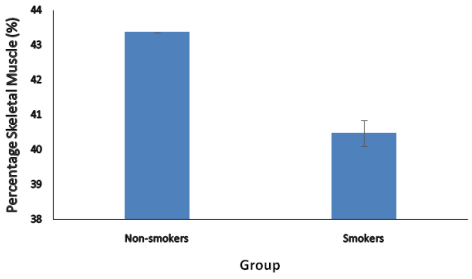

Figure 4: Skeletal muscle percentage between non-smokers and smokers

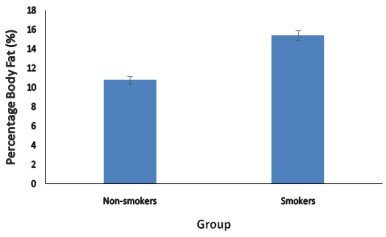

Figure 4: Figure 5: Body fat percentage between non-smokers and smokers

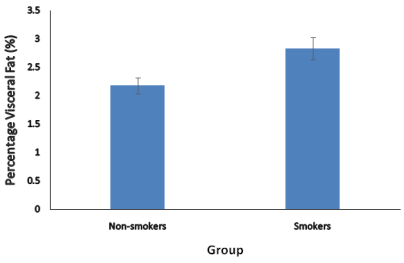

Figure 6: Visceral fat percentage between non-smokers and smokers

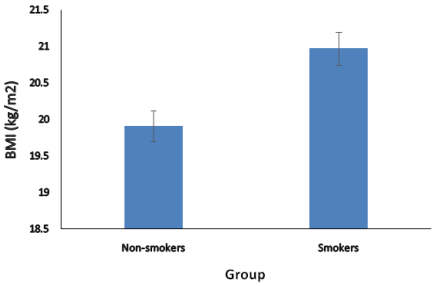

Figure 7: BMI of smokers and non-smokers

DISCUSSION

Findings from this study revealed that smokers had a higher systolic and diastolic blood pressure compared to the non-smokers. This result corresponds with reports of Naznin*et al.*[9] who reported a higher systolic and diastolic blood pressure in smokers compared to non-smokers. Furthermore, the findings from this study corresponds with the reports of Bassey *et al.*[10] who reported an increase in diastolic blood pressure among some Nigerian cigarette smokers. This observed increase in blood pressure of cigarette smokers could be as a result of the nicotine content in cigarette which is responsible for the fast mobilization of catecholamines that is accompanied by an increase in heart rate and blood pressure.[11] The higher systolic and diastolic blood pressure in cigarette smokers is an indication that cigarette smokers could be more prone to hypertension than non-smokers. Hbejan[12] reported an 8-fold increase of myocardial infarction in smokers compared to non-cigarette smokers and the incidence of hypertension was also higher in smokers compared to non-smokers.Reports has shown that cigarette smoking is a major cause of cardiovascular disease and other general anomalies.[8]

Peak flow rate is a major marker that is used in lung function assessment.[13] It is a delicate pointer that assesses the muscles for respiratory capacity. Furthermore, the results from this revealed that the peak flow rate for smokers were lower when compared with non-smokers. This report is consistent with the reports of Nighute*et al*[14] and Medabala*et al*[15] which reported a decrease in the peak flow rate of smokers compared to non-smokers. Furthermore, Naznin*et al*[9] reported abnormal peak flow rate among

smokers than non-smokers. The harmful substances in cigarette and nicotine have been reported to increase the gradual weakening of the lung functions by impairing ciliary oscillation continuity, leading to the excessive secretion of mucus and hindered mucociliary clearance.[16,17] The smoke from cigarette slows down cilia movement in the airway epithelium, damaging the epithelial airway barrier and the sub-mucosal secretory cells.[18]

Furthermore, results from this study revealed a lower skeletal muscle percentage in smokers compared to non-smokers. Cigarette smoking has been reported to be a major factor implicated in the dysfunction of skeletal muscles before the manifestation of pulmonary pathology.[19] Nicotine in cigarette has been reported to cause the twitching and weakness of muscles. Furthermore, the reduction in skeletal muscle percentage could be due to the constituents of cigarette smoke which acts in synergy with systemic inflammatory mediators to increase proteolysis and inhibit the synthesis of protein leading of muscle mass loss.[19] Wang *et al*.[20] however reported a decrease in muscle strength and protein synthesis signaling without a change in muscle mass of smokers. Smoking affects skeletal muscle mass via numerous mechanisms. The increase in carbon monoxide level of smokers interferes with both respiratory and muscle proteins such as hemoglobin, myoglobin and others. In addition, cigarette smoking weakens oxygen delivery to the mitochondria hence impairing the formation of adenosine triphosphate.[19]

A higher percentage of visceral fat in smokers compared to non-smokers was also observed in this study and this corresponds with the reports of Efendi *et al*.[21] and Fujiyoshi*et al*.[22] who reported an increase in abdominal fat of heavy smokers. Also, it was reported that BMI, waist circumference and visceral fat area which are usually high in non-smokers will definitely be increased with an increase in cigarette smoking amount.[23]

Many literature reviews are of the idea that there is an increased amount of body fat after smoking cessation. Nicotine is known to be an appetite suppressant. Smokers however are known to have a higher metabolic rate. Clair *et al*.[24] supports this research that body fat percentage is higher in smokers compared to nonsmokers. One of the main reasons as documented, why people don't want to quit smoking, is a concern that they would gain weight.[25]

Several studies have identified smoking as a factor for a reduced BMI. In fact, the need to lose or maintain weight could be a reason for cigarette smoking according to Taylor *et al*.[26] However, report from this study revealed a higher BMI in cigarette smokers compared to their non cigarette smokers. The reason for this could be due to the athlete-type of lives lived by the participants (students) of this study.

CONCLUSION

In conclusion, evidence from this study reveals that Nigerian undergraduate smokers could be prone to a cigarette smoking related compromise in cardiopulmonary fitness.

CONFLICT OF INTEREST

The authors declared no potential conflict of interest with respect to the research, authorship or publications of this article. We received no financial support for the research and /or publication.

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