Original Article

Comparative Study of Electrocardiographic Parameters among Tobacco Smokers and Tobacco Chewers

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ABSTRACT

Background and Aim: Nicotine and other components of cigarette can produce profound changes in the heart, which can be assessed by doing electrocardiogram (ECG). The present study compares the vitals and ECG parameters among tobacco non-smokers (controls), tobacco smokers and tobacco chewers. **Methods:** One hundred and fifty healthy male volunteers, age group of 18-25 years from outpatient department, were included for the study. The subjects were divided into group 1 (control, n=50), group 2 (tobacco smokers, n=50) and group 3 (tobacco chewers, n=50). Subjects were asked to abstain tobacco and beverages consumption 2 hours prior to recording ECG. The subject's vital: blood pressure and ECG parameters: heart rate, QT interval, QTc (corrected QT interval) were recorded in physiology lab of Nobel Medical College and Teaching Hospital, Nepal. **Results:** The data analysis was done by independent student "*t*" test. The data analysis showed significant increase in blood pressure on comparison of group 1 with group 2 (p=0.001) and group 3 (p=0.001) respectively. The data analysis of ECG parameters also showed decrease in QT and QTc (corrected QT) comparing group 1 with group 2 (p=0.001) and group 3 (p=0.001) separately which was highly significant. There was significantly increase in heart rate on comparison of group 1 separately with group 2 and group 3. **Conclusion:** The study concluded that the consumption of either smoked or chewed form of tobacco adversely affects cardiovascular system.

Key words: Electrocardiogram, Abstain, Blood pressure, QTc.

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INTRODUCTION

Tobacco smoking is the single most cause of the preventable death globally. Tobacco is consumed in many forms and one such form is cigarette smoking.[1] By the early 19th century tobacco was rolled in paper, smoked as cigarettes and rapidly marketed all over the world. Beyond nicotine, the main constituent of tobacco responsible for its additive character, unburned tobacco contains carcinogens and other toxins capable of causing gum disease and oral cancers.[2] Cigarette smoking increases the relative risk of coronary artery disease by 2.8-fold and 3.1-fold in young (35–64 years) men and women, respectively.[3] Smoking is associated with increased ventricular premature beats and it is a strong risk factor for sudden cardiac death.[4] Effect of smokeless tobacco consumption on cardiovascular events has been studied in detail in western population. Results from these studies paint a mixed picture with some showing increased incidence of these adverse events.[5,6]

The cardiac effects of nicotine are attributed to the release of catecholamine, which are released due to the binding of nicotine to the nicotinic cholinergic gate on the cation channels in receptors (nAchRs) throughout the body.[7] A longer retention of nicotine occurs in the blood and in other specific tissues such as the oesophagus, fundus, antrum, spleen, caecum, pancreas, testes, heart and the muscle via a constant exposure.[8] Nicotine is a potent inhibitor of the cardiac A type potassium channels, which contributes to the changes in the electrophysiology and it also induces arrhythmias.[9]

Nicotine and other components of cigarette can produce profound changes in the heart, which can be assessed by doing electrocardiogram (ECG). A number of studies have strongly correlated the role of smoking in causative factor for CAD but a very little work has been done on tobacco chewers.

MATERIALS AND METHODS

The present study was conducted in Nobel Medical College and Teaching Hospital in department of physiology lab, Nepal from April 2017 to September 2017. The subjects were selected from the out-patient department by questionair who were light to heavy smokers and physically healthy attendants. The age of the selected subject was 20.3±1.48 (mean± SD) years. The subjects were included in the study after written consent was taken. Selected subjects were divided into three groups.

Group 1: Normal healthy Population (Neither smoked nor chewed, n=50)

Group 2: Exclusive light to heavy smokers (Only smoked the filtered cigarette, n=50)

Group 3: Exclusive Chewers (Only chewed the bhola gutkha, n=50).

Light Smokers –A person who smokes 10 or less than 10 tobacco products per day. Heavy Smokers – A person who smokes more than 10 but less than 20 tobacco products per day.

This is a case control study. The cases are exclusively smokers, smokeless tobacco users and controls (did not consume tobacco in any form). A working proforma (case sheet) was filled for every subject. It included demographic data [particulars of subject like name, age, sex, address, contact number], past history and family history of chronic illness. Further addiction history was taken which included type, amount and duration of consumption of smokeless tobacco and cigarette.

The subjects having history of cardiovascular illness, renal disease, diabetes, obstructive or restrictive lung disease and drug consumption for prolong duration were excluded from the study.

Measurement of blood pressure was carried out along with the height, weight and BMI after the subjects were thoroughly acquainted with working of the corresponding instrument.

After 5 mins of rest, the resting heart rate, QT, QTc, were measured in both nonsmokers and smokers group, with the help of Cardiart 108T-mk-VI; Electrocardiograph (ECG) machine manufactured by BPL India Ltd., which is a single channel, 12 lead selection electrocardiograph designed to record electrocardiograms. Three Silver-chloride (Ag-Cl) electrodes were used to record ECG signal. The electrodes were connected with ECG machine and were affixed on right arm (RA), left arm (LA) and left leg (LL) of the subject. Ground electrode was placed on right leg (RL) of the subject. Hardware setting of ECG were: Gain: 10, Mode: Normal, Low pass filter: 35 Hz, High pass filter: 0.5 Hz. Recording was done for limb lead I, II and III. Lead II was used for analysis of QT, QTc and heart rate

Statistical Analysis of data

Statistical Analysis was done using SPSS (Statistical Package for Social Sciences) version 18. A P-value of less than 0.005 ($P < 0.005$) was considered to be statistically significant.

RESULTS

A total of 150 male subjects from the outpatient department were included in the study.

Statistical analysis showed increase in blood pressure and heart rate which is highly significant ($p < 0.005$) comparing group 1 with group 2 and group 3 separately.

QT interval and QTc between group 1, group 2 and group 3 were also significantly increased in tobacco smokers (group 2) and tobacco chewers (group 3).

DISCUSSION

Smoking during life can have a profound impact on the overall health of the smoker and cardiovascular health in particular. Therefore the present study was planned to examine the correlation between smoking and changes occurring in blood pressure and ECG. The present study was conducted in male subjects which showed the comparison between tobacco smokers (20.06± 1.5 years) and tobacco chewers (19.74 ± 1.35 years) with controls (20.3± 1.5 years).

Our study showed the significantly increase in heart rate in smokers and chewers compared to controls. This study is consistent with the result of Amit Srivastava et al where there was significant decrease in R-R interval in smokers compared to non-smokers. Heart rates were 74 ± 2 and 83 ± 3 among nonsmokers and smokers respectively.[10] The study by Salman S Siddhiqui et al showed the similar result of increase in heart rate in smokers (88.56 ± 5.06) as well as chewers (85.29 ± 4.7) compared to controls (72.2 ± 8.4).[11] Vankatesh G *et al.* reported the heart rates 76.0 ± 6.9 and 80.8 ± 10.2 among controls and smokers respectively which also concluded the increase in heart rate in smokers.[12]

The QT and the QTc interval in the present study are significantly decreased as compared to control. The QT in smokers (0.3 ± 0.037) and chewers (0.34± 0.028) compared to control (0.37±0.035) was significantly decreased. Similarly, the QTc in smokers (0.4±0.032) and chewers (0.35±0.041) comparing with control (0.37±0.03) also significantly decreased in present study. The study conducted by Salman S Siddiqui showed the decrease in QT interval which was not significant but the QTc was not calculated.[11] The study of Amit Srivastava et al showed that the QTc interval of nonsmokers is 0.32 ± 0.013 and smokers is 0.36 ± 0.042 which is not clinically significancant.[10] The study is not consistent with present study which might be because of small sample size. The systolic blood pressure was 140 and diastolic blood pressure was 90 in tobacco smokers compared to controls which were 120 and 70 respectively and were statistically significant ($p< 0.0001$) in a study by Vandana V. Chiddarwar *et al.*[13] Our study also showed the increased systolic (smokers=120.04± 5.78, chewers=118.92± 4.21) and diastolic blood pressure (smokers = 98.4 ± 6.26, chewers = 94.88 ± 8.77) compared to control (systolic= 112.2 ± 6.73, diastolic= 89.7 ± 6.5).

Limitations of the study

The sample size was modest in the study. Hence the correlation of smoking status with cardiovascular parameters has not been done.

Table 1: Anthropometric variables of non-smokers, smokers and gutkha chewers.

Parameters	non-smokers (mean ± SD)	Smokers (mean ± SD)	gutkha chewers (mean ± SD)
Age (years)	20.3± 1.5	20.06± 1.5	19.74 ± 1.35
Height (cm)	162.6± 7.12	162.08 ± 5.5	167.74 ± 6.73
Weight (kg)	59.72± 3.64	60.08 ± 3.8	65.96 ± 6.04
BMI (kg/cm²)	22.6 ± 1.06	22.87 ± 1.09	23.88 ± 3.53

Table 2: Vitals and ECG parameters of non-smokers, smokers and gutkha chewers.

Parameters	Group 1 (mean ± SD)	Group 2 (mean ± SD)	Group 3 (mean ± SD)
Systolic BP (mmHg)	112.2 ± 6.73	120.04± 5.78	118.92± 4.21
Diastolic BP (mmHg)	89.7± 6.5	98.4 ± 6.26	94.88 ± 8.77
Heart Rate (beats/min)	70.4 ± 5.9	83.06± 8.2	75.59 ± 6.51
QT interval (sec)	0.37± 0.035	0.3± 0.037	0.34 ± 0.028
QTc (sec)	0.4 ± 0.032	0.35± 0.041	0.37 ± 0.03

Table 3: Statistical analysis of Vitals and ECG parameters for levels of significance among group 1, group 2 and group 3.

Variables	Groups	Groups	Bonferroni Mean Difference	Std. Error	Significance	95% Confidence Interval Lower Bound	Upper Bound
Systolic BP	1	2	-7.84000*	1.14661	0.0001*	-10.6167	-5.0633
		3	-6.72000*	1.14661	0.0001*	-9.4967	-3.9433
	2	1	7.84000*	1.14661	0.0001*	5.0633	10.6167
		3	1.12	1.14661	0.991	-1.6567	3.8967
	3	1	6.72000*	1.14661	0.0001*	3.9433	9.4967
		2	-1.12	1.14661	0.991	-3.8967	1.6567
Diastolic BP	1	2	-7.10000*	2.03626	0.002*	-12.0312	-2.1688
		3	-5.18000*	2.03626	0.036*	-10.1112	-0.2488
	2	1	7.10000*	2.03626	0.002*	2.1688	12.0312
		3	1.92	2.03626	1	-3.0112	6.8512
	3	1	5.18000*	2.03626	0.036*	0.2488	10.1112
		2	-1.92	2.03626	1	-6.8512	3.0112
Heart Rate	1	2	-12.5796	1.40432	0.0001*	-15.9804	-9.1788
		3	-5.10540*	1.40432	0.001*	-8.5062	-1.7046
	2	1	12.57960*	1.40432	0.0001*	9.1788	15.9804
		3	7.47420*	1.40432	0.0001*	4.0734	10.875
	3	1	5.10540*	1.40432	0.001*	1.7046	8.5062
		2	-7.47420*	1.40432	0.0001*	-10.875	-4.0734
QT interval	1	2	.06960*	0.00688	0.0001*	0.0529	0.0863
		3	.03440*	0.00688	0.0001*	0.0177	0.0511
	2	1	-.06960*	0.00688	0.0001*	-0.0863	-0.0529
		3	-.03520*	0.00688	0.0001*	-0.0519	-0.0185
	3	1	-.03440*	0.00688	0.0001*	-0.0511	-0.0177
		2	.03520*	0.00688	0.0001*	0.0185	0.0519
QTc	1	2	.05260*	0.00722	0.0001*	0.0351	0.0701
		3	.02940*	0.00722	0.0001*	0.0119	0.0469
	2	1	-.05260*	0.00722	0.001*	-0.0701	-0.0351
		3	-.02320*	0.00722	0.005*	-0.0407	-0.0057
	3	1	-.02940*	0.00722	0.0001*	-0.0469	-0.0119
		2	.02320*	0.00722	0.005*	0.0057	0.0407

P < 0.005 is considered highly significant, *= highly significant

CONCLUSION

Smoking during life can have a profound unwanted impact on the overall health of the smoker and cardiovascular health in particular. Thus the study strongly discourage the smoking of young individuals for the healthy long life.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

ABBREVIATIONS

CAD: Coronary Artery Disease.

SUMMARY

On analysis ECG for 150 healthy male volunteers who were tobacco chewers and smokers, it was concluded that the consumption of either form of tobacco adversely affects the cardiovascular system

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