

ORIGINAL RESEARCH

Effect of exercise on electrocardiographic parameters amongst smokers and non- smokers

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ABSTRACT

Background: Smoking is a detriment to physical fitness even among relatively young, fit individuals with lower physical endurance than non-smokers. The present study was conducted to assess effect of exercise on electrocardiographic parameters amongst smokers and non- smokers.

Materials & Methods: 120 smokers and non- smokers of both genders were equally divided into two groups, i.e., Group I (smokers) and Group II (non-smokers). The baseline pulse and blood pressure were taken, whereas ECG parameters were recorded by using BIOPAC in both groups.

Results: Group I had 45 males and 15 females and group II had 48 males and 12 females. There was significant difference in P wave, QRS, QT interval, ST segment, SBP, DBP and pulse rate after exercise in both groups. The difference was significant ($P < 0.05$).

Conclusion: Smokers shows more variations in ECG and cardiovascular parameters after exercise than non- smokers and hence are more prone to cardiovascular diseases.

Key words: Smoking, electrocardiographic, blood pressure

Introduction

Cigarette smoking is strongly associated with an increase in coronary artery disease. Cigarette smoking increases the relative risk of coronary artery disease by 2.8-fold and 3.1-fold in young men and women, respectively.¹ Smoking has acute deleterious effects on the blood pressure and sympathetic tone, and it reduces the myocardial oxygen supply. Compared to non-smokers, smokers have increased incidence of coronary spasm and a reduced threshold for ventricular arrhythmias. Smoking is associated with increased ventricular premature beats, and it is a strong risk factor for sudden cardiac death.²

Smoking is a detriment to physical fitness even among relatively young, fit individuals with lower physical endurance than non-smokers.³ The immediate detrimental effects of cigarette smoking on pulmonary and cardiovascular function, particularly when these systems are

stressed by the metabolic demands of exercise, have been thoroughly investigated.⁴ The inhalation of cigarette smoke exerts the immediate respiratory effect of increasing airway resistance.⁵ Moreover, carbon monoxide levels in the blood increase after smoking. Both of these changes reduce the amount of oxygen absorbed into the body. The physiologic work capacities of the upper and lower extremities limit maximal exercise performance differently. At any level of VO_2 , both the heart rate and blood pressure are higher during arm exercise than during leg exercise. In addition, other researchers have found that substrate oxidation during arm exercise differs from substrate oxidation during leg exercise.⁶ The present study was conducted to assess effect of exercise on electrocardiographic parameters amongst smokers and non- smokers.

Materials & Methods

The present study comprised of 120 smokers and non- smokers of both genders. Study was conducted in dept. of Physiology and Medicine. All gave their written consent for the participation in the study.

Data such as name, age, gender etc. was recorded. All the subjects were equally divided into two groups, i.e., Group I (smokers) and Group II (non-smokers). All the subjects were asked to abstain from smoking and caffeine beverages, 48 hours prior to the recording of all study parameters. The baseline pulse and blood pressure were taken, whereas ECG parameters were recorded by using BIOPAC in both groups. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table I: Distribution of patients

Group	Group I	Group II
Status	Smoker	Non- smoker
M:F	45:15	48:12

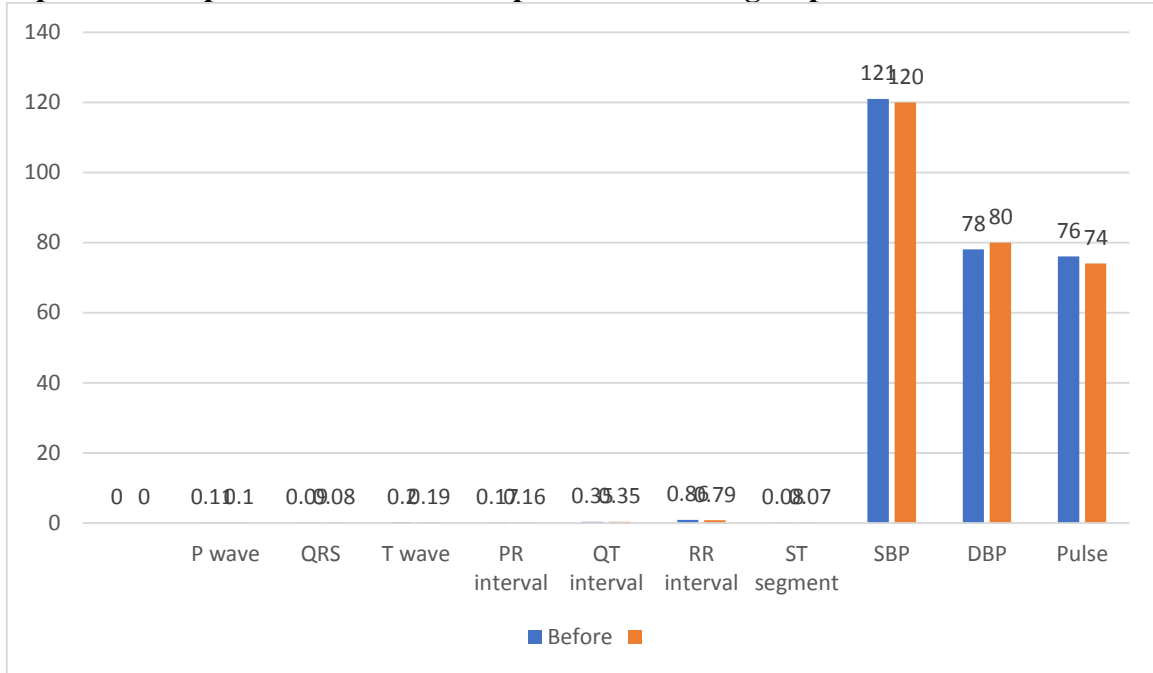
Table I shows that group I had 45 males and 15 females and group II had 48 males and 12 females.

Table II: ECG parameters and blood pressure for two groups before and after exercise

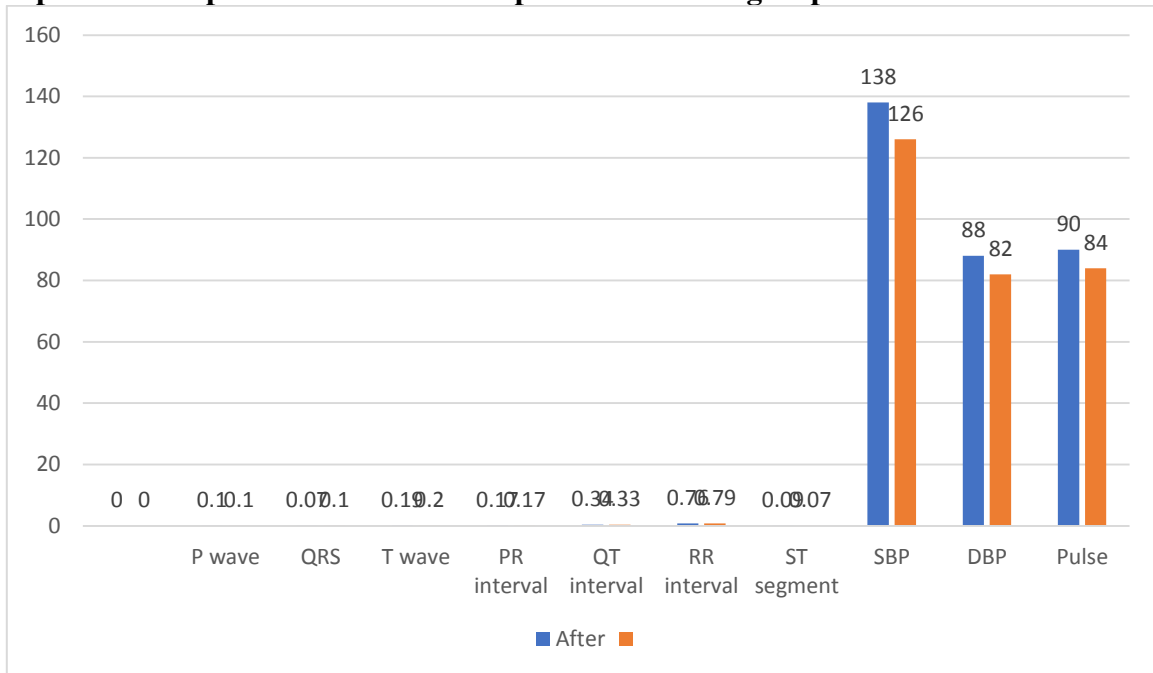
Parameters	Before		P value	After		P value
	Group I	Group II		Group I	Group II	
P wave	0.11	0.10	0.43	0.10	0.10	0.05
QRS	0.09	0.08	0.94	0.07	0.10	0.04
T wave	0.20	0.19	0.81	0.19	0.20	0.17
PR interval	0.17	0.16	0.75	0.17	0.17	0.38
QT interval	0.35	0.35	0.63	0.34	0.33	0.05
RR interval	0.86	0.79	0.84	0.76	0.79	0.25
ST segment	0.08	0.07	0.54	0.09	0.07	0.02
SBP	121	120	0.90	138	126	0.03
DBP	78	80	0.82	88	82	0.05
Pulse	76	74	0.16	90	84	0.04

Table II, graph Ia, b shows that there was significant difference in P wave, QRS, QT interval, ST segment, SBP, DBP and pulse rate after exercise in both groups. The difference was significant (P< 0.05).

Graph Ia: ECG parameters and blood pressure for two groups before exercise



Graph Ib: ECG parameters and blood pressure for two groups after exercise



Discussion

There has been a growing recognition of the importance of the autonomic nervous system in cardiovascular disease.⁷ Various measures of heart rate variability (HRV) evaluate changes in beat-to-beat interval durations using ambulatory ECG.⁸ Various measures of HRV provide quantitative indicators of cardiac autonomic function. Studies have documented the increase in HRV shortly after smoking cessation.^{9,10} Changes in heart rate and HRV are also described in association with acute passive smoking or exposure to respirable suspended particles (RSP).^{11,12} The present study was conducted to assess effect of exercise on electrocardiographic parameters amongst smokers and non- smokers.

We found that group I had 45 males and 15 females and group II had 48 males and 12 females. Ramkrishnan et al¹³ studied the temporal relationship of smoking with electrophysiological changes. Male smokers with atypical chest pain were screened with a treadmill exercise test (TMT). A total of 31 such patients aged 49.8 ± 10.5 years, in whom TMT was either negative or mildly positive were included. Heart rate variability (HRV) parameters of smokers were compared to those of 15 healthy non-smoking participants. All patients underwent a 24 hours Holter monitoring to assess ECG changes during smoking periods. Heart rate increased acutely during smoking. Mean heart rate increased from 83.8 ± 13.7 bpm 10 min before smoking, to 90.5 ± 16.4 bpm during smoking, ($p < 0.0001$) and returned to baseline after 30 min. Smoking was also associated with increased ectopic beats (mean of 5.3/h prior to smoking to 9.8/h during smoking to 11.3/h during the hour after smoking; $p < 0.001$). Three patients (9.7%) had significant ST-T changes after smoking. HRV index significantly decreased in smokers (15.2 ± 5.3) as compared to non-smoking controls participants (19.4 ± 3.6 ; $p = 0.02$), but the other spectral HRV parameters were comparable.

We found that there was significant difference in P wave, QRS, QT interval, ST segment, SBP, DBP and pulse rate after exercise in both groups. Chen et al¹⁴ compared the immediate effects of smoking on cardiorespiratory responses to dynamic arm and leg exercises. 5 min after smoking, the participants exhibited reduced forced vital capacities and forced expiratory volumes in the first second, in addition to elevated resting heart rates. The high-frequency, low-frequency, and the total power of the heart rate variability were also reduced at rest. For the exercise test periods, smoking reduced the time to exhaustion and the ventilatory threshold in the LC tests, whereas no significant effects were observed in the AC tests. A trend analysis revealed a significant trial-by-time interaction effect for heart rate, VO_2 , and VE during the graded exercise test. Lower VO_2 and VE levels were exhibited in the exercise response of the smoking trial than in those of the control LC trials, whereas no discernable inter-trial difference was observed in the AC trials. Moreover, the differences in heart rate and VE response between the LC and AC exercises were significantly smaller after the participants smoked.

Bharti et al¹⁵ compared the effect of exercise on ECG variations and cardiovascular parameters in a healthy smoker and non-smoker male. After exercise, the ECG variations showed significant increase in pulse rate by 7.1% ($p = 0.001$), systolic blood pressure by 9.7%.

The limitation the study is small sample size.

Conclusion

Authors found that smokers shows more variations in ECG and cardiovascular parameters after exercise than non- smokers and hence are more prone to cardiovascular diseases.

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