# Electrocardiographic Changes in Young Healthy Male Smokers

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| ABSTRACT | ARTICLE DETAILS |
|---|---|
| **Background:** Smoking increases the risk of CVD, however, the magnitude of this increase in risk varies substantively according to a range of factors. Smoking-related CVD risks are highest in current and recent smokers, compared to never smokers and those who have quit in the more distant past. Risk also increases with increasing duration of use and with greater intensity of smoking, as measured by the number of cigarettes smoked per day.<br>**Methods:** In the present study, a total of 60 male smokers having a history of smoking of more than 2 years and smoking at least 3 cigarettes per day were included in the study, provided they met the inclusion and exclusion criteria. 60 healthy male patients were included as controls/non-smokers. Demographic details were noted. Past, present and other relevant histories were recorded. Physical examination was done. Standard 12 lead ECG was done in the resting state after 2 hours of abstinence from strenuous physical activity, smoking and/or any caffeinated beverages.<br>**Results:** In the present study, it was observed that the mean age of the non-smokers was lower ($27.85 \pm 5.11$ years) than that of smokers ($30.22 \pm 5.26$ years); P value: 0.014. Only males were included in the present study. The BMI and heart rate were similar in the smokers and non-smokers; P value: more than 0.05. The majority of the cases had normal axis on ECG in both the groups (86.66% in non-smokers and 70% in smokers). Left axis deviation was more common than the right axis deviation in both the groups. The difference between the two groups was statistically insignificant; P value: 0.063. The width and height of the P wave were similar in both the groups; P value: more than 0.05. The R wave was significantly bigger in the smokers ($12.53 \pm 4.63$ mm) than in the non-smokers ($10.05 \pm 2.93$ mm); P value: 0.001. The duration of PR interval was significantly more in the smokers ($140.10 \pm 18.37$ ms) as compared to non-smokers ($129.45 \pm 19.90$ ms); P value: 0.003. T wave inversion was present in 10% cases of smokers while no case in the non-smoker group had T wave inversion; P value: 0.027. The ST segment was normal in most of the cases (98.33% in the non-smokers and 96.66% in the smokers' groups); P value: more than 0.05. All the cases in both the groups had normal sinus rhythm with normal PR interval, no tall T wave, no wide QRS interval or shortened QT interval.<br>**Conclusion:** The study concluded that the smokers have a mean age of $30.22 \pm 5.26$ years. The heart rate is similar to non-smokers. In general, normal axis on ECG is more common. Left axis deviation is more prevalent than right axis deviation. Smokers have bigger R waves, increased PR duration and inverted T waves. This may be because smoking generally causes a transient increase in heart rate and ECG changes, especially those pertaining to ST-T segment.<br><br>**KEYWORDS:** Electrocardiographic changes, male smokers. | **Published On:**<br>**06 December 2022**<br><br><br><br><br><br>**Available on:**<br>**https://ijmscr.org/** |

## INTRODUCTION

Cardiovascular diseases (CVDs) are among the most prevalent non-communicable diseases (NCDs) responsible for 31% of all global mortality.[1] Due to fast increasing changes in human lifestyles, prevalence of CVDs is markedly increasing in both the developed and developing countries.[2]

According to the recent assessment of GBD (Global Burden of Disease), an estimated 422.7 million individuals suffer from CVDs and 17.9 million annual deaths are attributed to these diseases.[3] Regarding the high prevalence and incidence of CVDs, there has been an increasing trend to ascertain the main determinants and underlying causes of these diseases.

## Electrocardiographic Changes in Young Healthy Male Smokers

Tobacco smoking consists of drawing into the mouth, and usually the lungs, smoke from burning tobacco. The type of product smoked is most commonly cigarettes, but can also include cigarillos, cigars, pipes or water pipes. 'Smokeless' tobacco is also popular in some parts of the world. This typically involves using tobacco preparations for chewing, sniffing into the nose or placing as a wad in the mouth between the cheeks and gums.[4]

Smoking is the second major modifiable risk factor of CVDs[5] which directly harms and affects cardiac vasculature, and also contributes to development of other cardiovascular risk factors, such as glucose intolerance, dyslipidaemia and thrombus formation.[6]

Despite the understanding of CVD and smoking, the exact pathophysiologic mechanism for the various components of cigarette and their role in CVD remains to be elucidated. Therefore, the present study was conducted to assess the ECG patterns in smokers and non-smokers.

### OBJECTIVES
1. To evaluate variations in ECG waves, segments and intervals in apparently young healthy male smokers.
2. To compare the ECG changes amongst smokers and non-smokers.

### METHODS
This case control, observational study was conducted under the Department of Medicine, MGM Medical College and Hospital, Navi Mumbai. 60 healthy male smokers attending the Medicine OPD during the study period and 60healthy male non-smokers, meeting the inclusion and exclusion criteria were selected for the study.

### Inclusion Criteria
1. Healthy smokers aged 18 to 40 years.
2. Male gender.
3. Smokers smoking for a minimum period of 2 years or more and a minimum of 3cigarettes or more/ day.
4. Healthy male non-smokers aged 18 to 40 years.

### Exclusion Criteria
1. Female patients.
2. Patients diagnosed with systemic diseases like hypertension, diabetes mellitus, etc.
3. Patient's history of cardiac, respiratory, renal and endocrine disorders.
4. Patients who do not consent to participate in the study.
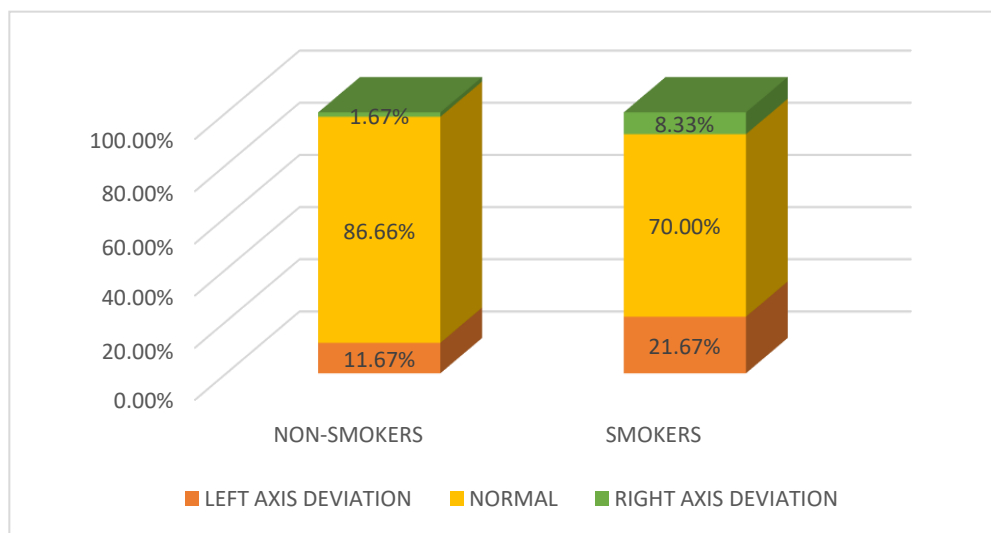
### MATERIAL REQUIRED
1. Standard Weighing machine
2. Stadiometer for height measurement
3. ECG machine.

Demographic details were recorded. Detailed history with personal and past history were taken from the all the patients and recorded. Details of smoking habit, that is duration and quantum of smoking was obtained from cases. For each subject in the case group, number of pack years was calculated. (Number of Pack Years = Average number of packs of cigarette smokes per day x Total number of Years of smoking). 10 (One packet =10 cigarettes). General and systemic examinations were meticulously performed. Weight was measured by the standard weighing machine. Height was measured by the Stadiometer. BMI was calculated by the Quetlet Index (Weight (kg)/Height (m)$^2$). The patients were asked to abstain from strenuous physical activity, smoking and/or any caffeinated beverages 2 hours prior to ECG recording. Standard 12 lead ECG was done during lying down. The ECG was evaluated for different parameters like heart rate, PR interval, QRS complex duration, QT interval/QTc interval, ST segment, Q wave and T wave. Any cardiac abnormality were noted.

### STATISTICAL ANALYSIS
The data was analysed using statistical software (IBM SPSS, IBM Corporation, Armonk, NY, USA)

### RESULTS
**Table 1. Distribution of the study population in the two groups according to the ECG axis**

| AXIS | NON-SMOKERS | | SMOKERS | | P VALUE |
|---|---|---|---|---|---|
| | N | % | N | % | |
| LEFT DEVIATION | 7 | 11.67% | 13 | 21.67% | 0.063 |
| NORMAL | 52 | 86.66% | 42 | 70% | |
| RIGHT DEVIATION | 1 | 1.67% | 5 | 8.33% | |
| TOTAL | 60 | 100% | 60 | 100% | |

Most of the cases had normal axis on ECG. ECG axis was similar in the two groups; Pvalue: more than 0.05.

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**Graph 1. Distribution of the study population in the two groups according to the axis in theECG findings**

**Table 2. Distribution of the ECG findings in the two groups**

| PARAMETER | NON-SMOKERS | SMOKERS | P Value |
|---|---|---|---|
| P WAVE WIDTH (mm) | 64.83 ± 17.61 | 63.00 ± 16.40 | 0.556 |
| P WAVE HEIGHT (mm) | 51.00 ± 14.92 | 52.67 ± 15.61 | 0.551 |
| R WAVE (mm) | 10.05 ± 2.93 | 12.53 ± 4.63 | 0.001* |
| PR DURATION (ms) | 129.45 ± 19.90 | 140.10 ± 18.37 | 0.003* |

R wave was significantly bigger in smokers and PR duration was also prolonged; P value:less than 0.05.

**T a b l e  3. Distribution of the study population in the two groups according to the ECGfindings**

| PARAMETER | NON-SMOKERS | | SMOKERS | | P VALUE |
|---|---|---|---|---|---|
| | N | % | N | % | |
| ABNORMAL SINUS RHYTHM | 0 | 0% | 0 | 0% | - |
| Q WAVE PRESENT | 4 | 6.67% | 3 | 5.00% | 0.999 |
| DEEP S WAVE | 58 | 96.67% | 60 | 100% | 0.248 |
| SMALL S WAVE | 2 | 3.33% | 0 | 0% | 0.248 |
| T WAVE INVERSION | 0 | 0% | 6 | 10% | 0.027* |
| TALL T WAVE | 0 | 0% | 0 | 0% | - |
| NARROW QRS | 0 | 0% | 2 | 3.33% | 0.248 |
| WIDE QRS | 0 | 0% | 0 | 0% | - |
| QT PROLONGATION | 6 | 10% | 13 | 21.67% | 0.080 |
| QT SHORTENED | 0 | 0% | 0 | 0% | - |
| ST DEPRESSION | 0 | 0% | 1 | 1.67% | 0.999 |
| ST ELEVATION | 1 | 1.67% | 1 | 1.67% | 0.999 |

T wave inversion was significantly more in smokers; P value: 0.027. Rest all the parameterswere similar in the two groups; P value: more than 0.05.

**RESULT AND DISCUSSION**

While the link of smoking and CVD is substantiated by epidemiologic studies, the precisemechanisms responsible for this association have not been defined yet because cigarette is a mixture of chemical compounds that are either bound to aerosol particles or free in the gas phase. Thus, due to the variety of compounds contained in cigarette, the exact pathophysiological contribution of each compound in the development of cardiovascular diseases and other adverse biological effects, remains to be elucidated. Therefore, the present study was conducted to evaluate the ECG findings in smokers and non-smokers.

In the present study, it was observed that the mean age of the non-smokerswas lower (27.85 ± 5.11 years) than that of smokers (30.22 ± 5.26 years); P value: 0.014. Only males were included in the present study. In the study by Lakhanpal A. et al[7], they included a total of 200 cases. They observed that the mean age of smokers was significantly more (49.14 ± 14.12 years) than the non- smokers (37.93 ± 13.23 years); P value: less than 0.001. This was similar to the present study.

Thus, it can be effectively concluded that the age of smokers is more than non-smokers.

In the present study, the BMI and heart rate were similar in the smokers and non-smokers; P value: more than 0.05. In the study by Prasad D. et al[8], they observed that the heart rates were similar in the controls/non-smokers and smokers before smoking; P value: more than 0.05. However, the heart rate increased after smoking and became significantly high. Since in the present study, the heart rate wasn't measured immediately after smoking, therefore it was similar kin both the groups.

In the present study, majority of the cases had normal axis on ECG in both the groups (86.66% in non-smokers and 70% in smokers). Left axis deviation was more common than the right axis deviation in both the groups. The difference between the two groups was statistically insignificant; P value: 0.063. In the study by Lakhanpal A. et al[7], it was observed that majority of the cases had no ventricular hypertrophy (89% in smokers and 100% in non-smokers). LVH was more common than RVH. These findings were similar to the present study. Thus, it can be concluded that most of the cases have normal axis on ECG. Left axis deviation is more common than right axis deviation. The axis is similar in smokers and non-smokers.

In the present study, the width and height of the P wave were similar in both the groups; P value: more than 0.05. The R wave was significantly bigger in the smokers (12.53 ± 4.63 mm) than in the non- smokers (10.05 ± 2.93 mm); P value: 0.001. The duration of PR interval was significantly more in the smokers (140.10 ± 18.37 ms) ascompared to non-smokers (129.45 ± 19.90 ms); P value: 0.003. T wave inversion was present in 10% cases of smokers while no case in the non-smoker group had T wave inversion; P value: 0.027. The ST segment was normal in most of the cases (98.33% in the non-smokers and 96.66% in the smokers' groups); P value: more than 0.05. All the cases in both the groups had normal sinus rhythm with normal PR interval, no tall T wave, no wide QRS interval or shortened QT interval. In the study by Ghule A. and Shinkar S.[9], they observed that the PR interval was slightly higher among non-smokers (0.167 sec) than smokers (0.159 sec) with a P value of less than 0.001. This was similar to the present study. In the study by Ramakrishnan S. et al[10], they found that 10% of the cases had episodes of significant (1–2 mm) ST segment and T wave changes in inferior leads during and after smoking. The onset was 8–12 min after smoking and lasted for 28–120 min. Thus, there might be non-ECG changes if evaluated after long duration after smoking. Thus, it can be effectively concluded that smokers have bigger R wave with increased PR interval and inverted T wave, as compared to noon-smokers.

## CONCLUSION
It can be concluded from the present study that the smokers have a mean age of 30.22 ± 5.26 years. The heart rate is similar to non-smokers. In general, normal axis on ECG is more common. Left axis deviation is more prevalent than right axis deviation. Smokers have bigger R waves, increased PR duration and inverted T waves. This may be because smoking generally causes a transient increase in heart rate and ECG changes, especially those pertaining to ST-T segment.

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