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Original research article

Clinical assessment of resting heart rate in smoker and nonsmoker healthy individuals

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Abstract

Background: The resting heart rate is considered to be a good barometer of the overall cardiac health and it is mainly governed by the para-sympathetic activity. The resting heart rate is a simple measurement with prognostic implications.[4] Present study was aimed to clinically assess resting heart rate in smoker and nonsmoker healthy individuals.

Material and Methods: Present study was cross sectional, case-control study, carried out in the 200 subjects who included 100 cases (smokers) and 100 controls (non-smoker healthy individuals).

Results: In present study, majority cases were from 21-30 years age group (56%). Age & physical characteristics (height, weight, BMI) distribution among smokers & nonsmokers was comparable & difference was not statistically significant ($p>0.05$). Among smokers, as per smoking index, cases were distributed into light smokers (1-100), moderate smokers (101-200) & heavy smokers (>200) as 32%, 42% & 26% respectively. Gradual increase in resting heart rate was noted as increase in smoking index. Resting heart rate was more in smokers (83.26 ± 5.24 beats/min) as compared to nonsmokers (76.44 ± 5.30 beats/min) & difference was statistically significant (p-0.001).

Conclusion: Significantly increased resting heart rate was noted among smokers as compared to nonsmokers.

Keywords: Resting heart rate, smokers, nonsmokers, sympathetic nervous system

Introduction

Smoking is defined as the inhalation of the smoke of burning tobacco that may occur occasionally or habitually as a consequence of physical addiction to some chemicals, primarily nicotine [1]. Smoking is the most prevalent and most preventable risk factor for cardiovascular diseases. Smoking results in a twofold increase in the risk of coronary artery disease and is responsible for one-fifth of all cardiovascular deaths and increases the risk of heart failure threefold [2].

Cigarette & Bidi smoking has extensive complex effects implicated in cardiac complications that include hyper coagulability, increased cardiac work, reduced oxygen transport and coronary vasoconstriction which are mainly due to actions of nicotine and carbon monoxide [3]. The frequency and duration of smoking plays an important role in determining the extent of harm caused to cardiovascular system.

The resting heart rate is considered to be a good barometer of the overall cardiac health and it is mainly governed by the para-sympathetic activity. The resting heart rate is a simple measurement with prognostic implications [4]. Present study was aimed to clinically assess resting heart rate in smoker and nonsmoker healthy individuals.

Material and Methods

Present study was cross sectional, case-control study, carried out in the Department of Physiology, at Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, India. Study period was from September 2019 to November 2019 (3 months) and study was approved by the Institutional Ethical and Research Committee.

Inclusion criteria

- Smokers, 21-40 years age, male with a history of smoking of more than 5 years were considered as the case group.
- Age matched, male subjects, who were non-smoker (does not smoke tobacco) & not passive smoker (not dwelling in the home where their spouse or other family members were smokers of hookah, cigarette, cigar or bidi).

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Exclusion criteria

- Subjects having history of diabetes mellitus, hypertension, coronary artery disease and neurological disorders and any other systemic illnesses in past and present in both case and control study group.
- Subjects on any drugs affecting the functioning of Autonomic Nervous System- like alpha blockers, beta blockers, etc.
- Subjects with BMI >25 kg/m^2.
- Subjects not willing to participate.

Prior informed written consents were obtained from them after explaining to them, the procedure and the purpose of the study tests. 200 subjects who included 100 cases and 100 controls were selected from among the staff members, residents and the patients from the routine OPD, for the present study.
Heart rate was recorded in the condition of physical and mental rest to exclude the effect of sympathetic stimulation and other physiological factors. The subjects were asked to lie comfortably for 15 minutes. The ECG was recorded continuously for 1 minute. The resting heart rate was calculated from the ECG.
Smoking Index [5] was considered to classify the smokers according to their severity (light/moderate/heavy). Smoking index was calculated by multiplying numbers of cigarette smoked per day & duration of smoking in years. According to this index smokers were classified in three groups.
Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

In present study, majority cases were from 21-30 years age group (56%), age distribution among smokers & nonsmokers was comparable & difference was not statistically significant (p>0.05).

Table 1: Age distribution

Age (in years)	Smokers (n=100)	Nonsmokers (n=100)	P value
21–30	56	55	0.82
31–40	44	45	
Mean ± SD	32.12 ± 6.27	31.83 ± 6.13	

Physical Characteristics (height, weight, BMI) distribution among smokers & nonsmokers was comparable & difference was not statistically significant (p>0.05).

Table 2: Physical Characteristics of Subjects

		Smokers (n=100)	Nonsmokers (n=100)	P value
Height (meters)	Range	1.58 - 1.87	1.54 - 1.83	0.74
	Mean ± SD	1.72 ± 4.16	1.73 ± 3.55	
Weight (Kgs)	Range	53 - 92	54 - 90	0.79
	Mean ± SD	69.13 ± 11.37	68.95 ± 10.92	
BMI	Range	18.23 - 24.95	18.51 - 24.57	0.82
	Mean± SD	22.82 ± 2.38	22.17 ± 2.37	

Among smokers, as per smoking index, cases were distributed into light smokers (1-100), moderate smokers (101-200) & heavy smokers (>200) as 32%, 42% & 26% respectively. Gradual increase in resting heart rate was noted as increase in smoking index.

Table 3: Smoking Index

Smoking Index [5]	No. of cases	Resting heart rate (Beats /minute) (Mean ± SD)
Light smokers (1-100)	32	79.36 ± 5.76
Moderate smokers (101-200)	42	80.49 ± 5.21
Heavy smokers (>200)	26	82.96 ± 4.54

Resting heart rate was more in smokers (83.26 ± 5.24 beats/min) as compared to nonsmokers (76.44 ± 5.30 beats/min) & difference was statistically significant (p-0.001).

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Table 4: Comparison of resting heart rate Between Non-Smokers and Smokers

		Smokers (n=100)	Nonsmokers (n=100)	P value
Resting heart rate	Range	77-89	70-84	0.001
	Mean ± SD	83.26 ± 5.24	76.44 ± 5.30	

Discussion

Smoking, either active or passive, can cause cardiovascular disease via a series of interdependent processes, such as enhanced oxidative stress, hemodynamic and autonomic alterations, endothelial dysfunction, thrombosis, inflammation, hyperlipidemia, or other effects [6]. The high resting heart rate is a predictor of the total and the cardiovascular mortalities which are independent of other risk factors in the patients with coronary artery disease [7].

Motilal C Tayade [8], noted that Resting Heart Rate had significantly increased and the Expiration: Inspiration Ratio, the 30:15 Ratio (Response to standing) and the Valsalva Ratio had significantly decreased in the smokers as compared to those in the non-smokers. There was a highly significant difference between the mean values of the para-sympathetic function tests among the smokers and the non-smokers (p<0.01). Similar findings were noted in present study & by Rupareliya DM *et al*., [4].

In a case control study on 100 smokers and 100 non-smokers Ashish Lakhanpal *et al*., [9] noted that heart rate was increased in smokers which was statistically significant. The analysis showed that QTc interval was shortened and that the QRS complex duration was widened the QT interval and the ST segment were shortened as compared to those in the non-smokers which was highly significant statistically. QTc interval was shortened and that the QRS complex duration was widened in the smokers, although the values did not show any statistical significance.

It has since long been known that blood pressure and heart rate increase during smoking. This increase in resting heart rate is an indicator of high sympathetic tone. Increase in heart rate could be due to stimulation of sympathetic ganglia and discharge of catecholamines from adrenal medulla [10].

Cigarette smoking increases heart rate both acutely (up to 20 beats per minute) as well as throughout the day with regular dosing (average increase 7 beats per minute as measured during ambulatory monitoring). The elevated heart rate is presumed to reflect persistent sympathetic nervous stimulation, which may be an important mechanism by which nicotine can contribute to cardiovascular disease and nicotine may also play a role in producing endothelial dysfunction, lipid abnormalities, and insulin resistance in smokers [11].

Smoking habit typically begins at a young age, usually in the early teens and continues throughout life. This puts the younger population at considerable risk of all the ill effects of smoking. As it is a modifiable and preventable risk factor, it is worthwhile to study its effects and create awareness among young individuals who may be maximally benefited by quitting.

Present study limitations were cross-sectional study design, sample size was relatively small and other co-morbidities were excluded, thus data was not sufficient enough to allow the final conclusions. Therefore, cohort studies are needed in future to further understand the chronic effect of smoking & association between smoking with resting heart rate,

Conclusion

Significantly increased resting heart rate was noted among smokers as compared to nonsmokers. Smoking caseation is ultimate solution to normalize the hyperactive sympathetic system & to bring resting heart rate at normal level.

Conflict of Interest: None to declare.

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