

Effects of Tobacco Chewing on Cardiovascular Autonomic Function

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Abstract

Background: Knowledge on the effects of tobacco smoking is well known, but the knowledge on the effects of tobacco chewing on the cardiovascular system is limited. The present study was undertaken to find out the association between the tobacco chewing and the alteration in the cardiovascular autonomic regulation.

Materials and Methods: A total of 40 healthy adult male participants were recruited in that 20 were non-chewers and 20 were chewers of tobacco. The chewers were again divided into the users of <10 years and users of more than 10 years. The resting heart rate, standing heart rate, systolic and diastolic blood pressures were recorded for controls and for the chewers before and after chewing. For tobacco chewers, blood pressure was recorded as before and after grip.

Results: Significant increase in the resting and standing heart rates of the tobacco users of <10 years was observed. In the tobacco users of more than 10 years, the heart rate was increased but not statistically significant. There was no significant difference in the blood pressures of chewers.

Conclusion: Tobacco chewing has a definite impact on the autonomic regulation of heart rate. It can be considered as one of the risk factors causing cardiovascular disease.

Key words: Blood pressure, Chewing, Heart rate, Tobacco

INTRODUCTION

India is one among the world's top five tobacco producers and consumers. The WHO attributed 4 million tobacco-related deaths every year and is expected to raise 8.4 million deaths by 2020.¹ Two major forms of tobacco use in India are smoking (bidis or cigarettes) and chewing.² Gutka or gutkha is the industrially prepared smokeless tobacco most commonly available in India, Pakistan, South East Asian countries, and also UK. In India, growth of gutka is rapid and has overtaken smoking of tobacco, especially among the young generation and women.^{3,4}

Cardiovascular disease (CVD) is the leading cause of death worldwide, responsible for over 17 million deaths globally

and tobacco has been estimated to directly cause 10% of all CVD worldwide. The epidemiological evidence on cigarette smoking in relation to CVD is well known, but the relationships between CVD and chewing of tobacco is limited and remains uncertain.^{3,5,6} The present study was carried out to find out the effects of tobacco chewing on cardiovascular autonomic function.

MATERIALS AND METHODS

The present study consists of 40 healthy male volunteers - 20 non-chewers (non-users) and 20 chewers (users) of tobacco between 20 and 50 years of age. Care was taken to see the average age of controls and chewers were same. Tobacco chewers were divided into users of <10 years and users of >10 years. Thus, there were 3 groups. They are non-users, users of >10 years, and users of <10 years. Research participants with major illness and history of CVDs such as chest pain, dyspnea, and palpitations were excluded from the study. All the research participants were explained about the procedures and recruited after obtaining informed consent.

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Methodology

For controls

After explaining the procedure, the Research participants or subjects were asked to sit at ease, and the resting heart rate was recorded. Participants were asked to stand after recording resting heart, and the standing heart rate was recorded. To record resting blood pressure before grip, the participants were asked to sit comfortably, and the systolic and diastolic blood pressures were recorded. To record blood pressure after grip, the participants were asked to hold a circular wooden ruler firmly, and then, the systolic and diastolic blood pressures were as the participants were maintaining the sustained hand grip.

For tobacco chewers

Before chewing tobacco, the resting heart rate, standing heart rate, systolic and diastolic blood pressures before grip, and systolic and diastolic blood pressures after grip were recorded as the same method in controls. Then, each participant was given one sachet of Goa, the popular brand of gutkha to chew. After 5 min of chewing, the resting heart rate, standing heart rate, systolic and diastolic blood pressures before grip, and systolic and diastolic blood pressures after grip were recorded.

RESULTS

Resting heart rates of all the 3 groups were similar before chewing (Table 1). However, the heart rate before versus after chewing in the users of <10 years duration shows statistically significant increase in the resting heart rate after chewing (Table 1a). The heart rate before versus after chewing in users of >10 years duration shows no statistically significant difference in the heart rate though the average seems to be a little higher after chewing (Table 1b). Probably, this is an effect of long-term habituation of cardiovascular system to chewing tobacco.

The mean values of standing heart rates of all the 3 groups were given in Table 2. There was no statistically significant difference in the standing heart rate of all the 3 groups before chewing. Standing heart rate of users of <10 years duration shows statistically highly significant increase in the standing heart rate after chewing which conforms that there is a definite effect of nicotine on heart rate changes associated to posture (Table 2a). Standing heart rate of the users of more than 10 years duration shows increase in heart rate but not statistically significant (Table 2b).

The mean values of resting systolic and diastolic blood pressures of all the 3 groups were similar before chewing (Table 3). The resting systolic and diastolic blood pressures before versus after chewing tobacco showed no effect on

Table 1: The resting heart rate of all the 3 Groups before chewing

Group	Number of participants	Mean±SD	SE	P
Non-users	20	82.0±5.7	1.28	>0.05
Users <10 years	9	82.8±8.8	2.93	>0.05
Users >10 years	11	76.7±8.9	2.67	>0.05

SD: Standard deviation, SE: Standard error

Table 1a: The resting heart rate before versus after chewing tobacco of users <10 years

Before Vs After	Number of participants	Mean±SD	SE
Before	9	82.8±8.8	2.93
After	9	93.6±9	3.57

T value: 2.57, P<0.05 (statistically significant), SD: Standard deviation, SE: Standard error

Table 1b: The resting heart rate before versus after chewing tobacco of users >10 years

Before Vs After	Number of participants	Mean±SD	SE
Before	11	76.7±8.9	2.67
After	11	85.1±11.8	3.00

SD: Standard deviation, SE: Standard error

Table 2: Standing heart rate before chewing

Group	Number of participants	Mean±SD	SE
Non-users	20	88±5.6	1.26
Users <10 years	9	92.7±8.6	2.87
Users >10 years	11	85.1±10.7	3.23

SD: Standard deviation, SE: Standard error

Table 2a: The standing heart rate before versus after chewing tobacco of users <10 years

Before Vs After	Number of participants	Mean±SD	SE
Before	9	92.7±8.6	2.87
After	9	104.0±8.9	2.96

T value: 2.74, P<0.02 (Highly significant), SD: Standard deviation, SE: Standard error

Table 2b: The standing heart rate before versus after chewing tobacco of users >10 years

Before Vs After	Number of participants	Mean±SD	SE
Before	11	85.1±10.7	3.23
After	11	93.1±10.7	3.24

SD: Standard deviation, SE: Standard error

the resting systolic and diastolic blood pressures of all the groups (users <10 years duration and users of >10 years duration) (Table 3a and b). The systolic and diastolic blood pressures of all the 3 groups were consistently increased after gripping and show a progressive decline from non-users to users <10 years duration to users of

Table 3: Systolic and diastolic blood pressures of all the 3 Groups before grip

Blood pressure	Group	Number	Mean±SD	SE
Systolic blood pressure	Non-users	20	124±8.8	1.97
	Users <10 years	9	124.4±17.4	5.44
	Users >10 years	11	123.6±18.0	5.44
Diastolic blood pressure	Non-users	20	82±8.4	1.89
	Users <10 years	9	77.8±6.7	2.22
	Users >10 years	11	81.5±8.4	2.55

SD: Standard deviation, SE: Standard error

Table 3a: Systolic and diastolic blood pressures of users <10 years before versus after chewing before grip

Blood pressure	Before/after chewing	Number	Mean±SD	SE
Systolic pressure	Before chewing	9	124.4±17.4	5.44
	After chewing	9	114.4±18.8	6.26
Diastolic pressure	Before chewing	9	77.8±6.7	2.22
	After chewing	9	78.9±7.8	2.61

SD: Standard deviation, SE: Standard error

Table 3b: Systolic and diastolic blood pressures of users >10 years before versus after chewing before grip

Blood pressure	Before/after chewing	Number	Mean±SD	SE
Systolic pressure	Before chewing	11	123.6±18.0	5.44
	After chewing	11	122.7±16.2	4.88
Diastolic pressure	Before chewing	11	81.5±8.4	2.55
	After chewing	11	84.4±6.3	1.90

SD: Standard deviation, SE: Standard error

>10 years duration (Table 4a and b). However, there was no statistically significant difference between the elevated systolic and diastolic blood pressures of control and study groups (Table 4).

DISCUSSION

Smokeless tobacco products contain nicotine and known carcinogenic chemicals such as tobacco-specific N-nitrosamines, benzopyrene, nitrate, cadmium, lead, arsenic, nickel, and chromium.^{7,8} Nicotine is the active ingredient in tobacco and is readily absorbed from the respiratory tract, buccal mucous membrane, and the skin. Nicotine in chewing tobacco is more slowly absorbed than inhaled nicotine and has a longer duration of effect. Approximately 80-90% altered in the body, mainly in the liver and also in the kidneys and the lungs.⁹

In the present study, the tobacco chewers of <10 years duration showed an increase in their heart rate after

Table 4: Systolic and diastolic blood pressures of all the 3 Groups after grip

Blood pressure	Before/after chewing	Number	Mean±SD	SE
Systolic pressure	Non-users	20	132.0±7.7	1.72
	Users <10 years	9	130.0±19.4	6.45
	Users >10 years	11	128.2±19.9	6.00
Diastolic pressure	Non-users	20	87±6.4	1.44
	Users <10 years	9	82.9±9.8	3.25
	Users >10 years	11	89.6±9.7	2.91

SD: Standard deviation, SE: Standard error

Table 4a: Systolic and diastolic blood pressures of users <10 years before versus after chewing after grip

Blood pressure	Before/after chewing	Number	Mean±SD	SE
Systolic pressure	Before chewing	9	130.0±19.4	6.45
	After chewing	9	116.7±18.7	6.24
Diastolic pressure	Before chewing	9	82.9±9.8	3.25
	After chewing	9	81.8±10.2	3.39

SD: Standard deviation, SE: Standard error

Table 4b: Systolic and diastolic blood pressures of users >10 years before versus after chewing after grip

Blood pressure	Before/after chewing	Number	Mean±SD	SE
Systolic blood pressure	Before chewing	11	128.2±19.9	6.00
	After chewing	11	127.5±19.4	5.84
Diastolic blood pressure	Before chewing	11	89.6±9.7	2.91
	After chewing	11	89.6±7.8	2.36

SD: Standard deviation, SE: Standard error

chewing tobacco. This is probably due to the effect of nicotine on the autonomic nervous inputs to heart; in particular, this is due to stimulation of catecholamine release by activation of acetylcholine receptors localized on peripheral postganglionic sympathetic nerve endings and the adrenal medulla.¹⁰

In the present study, there was no significant difference in the heart rate of tobacco chewers of more than 10 years. This could be due to the habituation of the cardiovascular system to the effects of nicotine. Similar habituation or tolerance to the effects of nicotine was described in the rodent's brain and brains of human smokers. Perry *et al.* explained that the increase in the density of cholinergic nicotinic receptors in the cerebral cortex and hippocampus modify the central nervous system effects of nicotine and contribute to the altered response to nicotine. The same effect could explain the fact that long-term tobacco chewers did not show significant tachycardia.¹¹

Postural variation of heart rate was estimated by taking standing heart rate immediately after taking resting heart rate. The standing heart rate was increased after chewing for users of <10 years duration. This also could be explained as a response to nicotinic stimulation in the study group. Again this effect was not statistically significant in chronic users.

In the study of the effect of tobacco chewing on arterial blood pressure, it emerges that nicotine seems to have no immediate effect on the short-term regulation of systolic and diastolic blood pressures. This is perhaps in tune with the finding of Perkins *et al.*, who reported substantial acute tolerance to nicotine with regard to blood pressure but less tolerance with regard to heart rate.¹² Gupta *et al.* found the tobacco chewers had a significantly higher blood pressure, heart rate than control group but similar to the smoker group.⁶

CONCLUSION

With the limitations of the present study, it can be concluded that the tobacco chewing is harmful for cardiovascular system as the consumption of tobacco leading to tachycardia.

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