Original Research Paper

Volume-9 | Issue-4 | April-2019 | PRINT ISSN No 2249-555X

Physiology

# AUTONOMIC FUNCTIONS AMONG TOBACCO CHEWERS: A CASE CONTROL STUDY

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**ABSTRACT**

**Background –** Tobacco chewing leads to dysfunction of autonomic nervous system, has rarely been studied.
**Objective –** Evaluation of cardiovascular autonomic neuropathy (CAN) by assessment of autonomic functions in tobacco chewers.
**Material and methods –** 30 male tobacco chewer subjects (age group 25-30 years) and 30 age and BMI matched male control subjects were evaluated by resting heart rate, heart rate response to standing, E/I ratio, valsalva ratio, resting supine blood pressure, blood pressure response to standing and sustained handgrip test recorded by CAN-Win based on EKG. Statistical analysis was performed using unpaired students "t"-test to derive the level of significance.
**Results –** The mean of resting heart rate, resting diastolic blood pressure were found significantly higher whereas mean E/I ratio, valsalva ratio, rise in DBP on sustained handgrip were found to be significantly lower in tobacco chewers as compared to control subjects.
**Conclusion–** Tobacco chewing leads to sympatho-vagal imbalance.

**KEYWORDS :** Autonomic functions, cardiovascular system, tobacco chewer.

## INTRODUCTION:

- Tobacco is the most widely distributed and commonly used habit forming substance for years.[1]

Many social factors, psychological states, economic and political factors have contributed to the global spread of tobacco consumption.[1]

An increase in consumption of smokeless tobacco has been noticed among high school, college students, adults and indeed represents a health concern of growing magnitude among these groups.[2]

The prevalence of smokeless tobacco use is estimated at 29.6% for men and 12.8% for women and 21.4% of all adults in India as per Global Adult Tobacco Survey, India (2016-17).[3]

Smokeless tobacco contain more than 2500 chemicals including nicotine, carcinogenic chemicals such as tobacco-specific N-nitrosamines, benzopyrene, nitrate, cadmium, lead, arsenic, nickel, and chromium, flavoring additives and alkalines.[2],[4],[5],[6]

Smokeless tobacco chewing is associated with many health risks like oro-pharyngeal, esophageal and other cancers, cardiovascular diseases (MI,HTN,CVA etc), oral diseases (periodontitis, gingivitis) affecting all organ systems.[7],[8],[9]Nicotine enhances the release of various neurotransmitters including epinephrine, norepinephrine, acetylcholine etc.[10]

Cardiovascular disease (CVD) is the leading cause of death worldwide, responsible for over 17 million annual deaths globally and tobacco has been estimated to directly cause 10% of all CVD worldwide and smokeless tobacco products contribute potential risk for cardiovascular morbidity and mortality.[11]

Analysis of autonomic functions nowadays has become one of the most popular non-invasive tools for the detection of early sympathetic-parasympathetic imbalance. Low variability in HR implies poor or inhibited ability to maintain internal homeostasis. Generally sympathetic influence increases HR (tachycardia response) and lowers variability of the heart rate, while parasympathetic input slows the HR (bradycardia response) and increases the variability. The present study is an attempt to an early understanding of the autonomic nervous system dysfunctions in tobacco chewer subjects using autonomic function testing to prevent cardiovascular morbidity and mortality in these subjects.

## MATERIALAND METHODS

The present study was conducted in the Department of Physiology, S.M.S. Medical College and Attached Hospitals, Jaipur, Rajasthan from 1st March 2017 to 10th January 2018 on 30 tobacco chewer male subjects between the age group of 25-30 years, taken from the various departments of S.M.S. Medical College and Attached hospitals, Jaipur along with 30 healthy age and BMI matched non tobacco chewer, non smoker healthy subjects from the same departments of S.M.S. Medical college and attached Hospitals, Jaipur. It was a community based case-control type of observational study.

The procedures were in accordance with the ethical standards of the committee of the institute.

Inclusion criteria for case group subjects: male tobacco chewers aged 25-30 years, chewing 5 gram or more tobacco/day.

Exclusion criteria: any acute as well as chronic diseases like diabetes, liver diseases, cardiac diseases, smoking and alcoholism.

All subjects were tested between 10 am to 1.00 pm under similar laboratory conditions and were allowed to adapt themselves to experimental and environmental conditions for 30 minutes to make them comfortable, as anxiety and stress can affect autonomic functions. The subjects were asked to avoid caffeine, carbonated drink, and tobacco 12 hours prior to and after having light breakfast 2 hours' prior of autonomic functions test. The room ambient temperature was maintained at 24-25°C.

The assessment of autonomic functions was done by recording with CAN-Win (version 1.0) based on the principle of EKG.

Autonomic functions were recorded in classified posture after 15 minutes of supine rest in a quiet environment.
Following parameters of autonomic functions were included in the study:

- Resting Heart Rate (beats/min)
- 30:15 R-R ratio
- Expiration/Inspiration ratio
- Valsalva ratio
- Resting supine systolic blood pressure (mmHg)
- Resting supine diastolic blood pressure (mmHg)
- Blood pressure response to standing (mmHg)
- Blood pressure response to sustained handgrip (mmHg)

Statistical analysis was performed using Microsoft Excel 2007 and unpaired student's "t"-test was used to derive the level of significance.

## RESULTS:

Mean of resting supine heart rate was found to be 80.3±2.09 beats/min

in tobacco chewers as compared to 74.10±6.23 beats/min in control subjects (p value<0.05, table2).

Mean of 30:15 RR ratio was found to be 1.14±0.30 and 1.16±0.12 in tobacco chewers and control subjects respectively. (p value>0.05, table 2)

Mean of E/I ratio was found to be 1.24±0.17 and 1.55±0.38 in tobacco chewers and control subjects respectively. (p value<0.001, table 2)

Mean of valsalva ratio in tobacco chewers was 1.17±0.24, while 1.35±0.11 in control subjects. (p value<0.05, table 2)

Mean of resting supine systolic blood pressure was 123.3±9.30 mmHg in tobacco chewers as compared to 119.68±7.84 in control subjects. (p value>0.05, table 3)

Resting mean supine diastolic blood pressure was 77.76±7.3 mmHg and 72.46±8.63 mmHg in tobacco chewers and control subjects respectively. (p value<0.05, table 3)

Mean of orthostatic fall in systolic blood pressure in tobacco chewers was found to be 3.4±4.88 mmHg, as compared to 5.10±4.21mmHg in control subjects. (p value>0.05, table 3)

Mean of rise in diastolic blood pressure on sustained hand grip test was found to be 5.53±2.28 in tobacco chewers as compared to 13.16±2.71 mmHg in control subjects. (p value<0.001, table 3)

## DISCUSSION:

In recent years, there has been increasing trend of tobacco chewing in young age[2].

Despite extensive health burden of tobacco chewing, only a small number of studies have explored its effect on cardiovascular health.

Consumption of tobacco in any form has harmful effects on health, which leads to disease, disability and death.

Apart from serious ill effects on various systems of body, chewing tobacco is one of the important causes of cardiovascular morbidity and mortality.[11],[17]

Cardiovascular system is influenced by autonomic nervous system and use of smokeless tobacco leads to sympatho-vagal imbalance, which may leads to MI, HTN, stroke and arrhythmia etc in future.[18]

Autonomic function tests are simple, cost effective, non invasive technique to evaluate sympatho-vagal balance and widely used method to measure autonomic functions. [12]

## PARASYMPATHETIC AUTONOMIC PARAMETERS:

Mean of resting supine heart rate in tobacco chewers 80.3±2.09 beats/min, as compared to 74.10±6.23 beats/min in control subjects (p value <0.05), indicating sympathetic dominance in tobacco chewers. This finding is similar with results observed by Bolinder G (1997)[13] and Gupta BK et al (2007).[12]

Significant reduction of mean of E/I ratio 1.24±0.17 in tobacco chewers as compared to 1.55±0.38 in control subjects (p value <0.001), is suggestive of hypoactive parasympathetic system.

Mean of valsalva ratio 1.17±0.24 in tobacco chewers, as compared to 1.35±0.11 in control subjects (p value<0.05) suggests disordered sympatho- vagal activity in tobacco chewers. However no previous study could be found to be support our findings.

## SYMPATHETIC AUTONOMIC PARAMETERS:

Mean of resting supine diastolic blood pressure was found to be 77.76±7.30mmHg in tobacco chewers, as compared to control subjects 72.46±8.63mmHg in control subjects (p value<0.05) suggestive of sympathetic dominance in tobacco chewers. Pandey A et al (2009)[14]suggested that sympatho-adrenal influencing properties of nicotine and high $Na^+$ content in tobacco could be the main causative factor for high B.P. in tobacco chewers.

Reduced rise in diastolic blood pressure on sustained handgrip test 5.53±2.28mmHg in tobacco chewers as compared to 13.16±2.71 mmHg in healthy control subjects respectively (p value<0.001).Tayade MC et al (2015) found similar results and suggested that use of tobacco affects the autonomic system as well as somato sensory system.

Patho-physiological mechanisms of chronic tobacco exposure lead to excessive inflammatory-fibroproliferative response in the vascular wall of endothelium as well as smooth muscle layer, and adverse effect on release of cytokines, growth factors, which may lead to altered hemostasis and in due course of time contribute to the development of cardiovascular diseases.[16]

## CONCLUSION:

In the present study, we observed that chewing tobacco predisposes to autonomic dysfunctions, which may lead to cardiovascular morbidity and mortality. Therefore autonomic function testing can be used to screen the subjects consuming tobacco for timely diagnosis and treatment.

## OBSERVATIONS

**Table: 1**

Comparison of anthropometric and baseline clinical characteristics of tobacco chewer and control subjects:

| Parameter | Groups (Mean±SD) | | p- value | Significance |
|---|---|---|---|---|
| | Case(n=30) | Control(n=30) | | |
| Age (years) | 27.83±1.64 | 27.85±1.58 | >0.05 | NS |
| Weight (kg) | 65.83±8.67 | 66.5±7.92 | >0.05 | NS |
| Height (cm) | 171±8.83 | 174.03±6.56 | >0.05 | NS |
| BMI (kg/m2) | 21.78±2.09 | 21.46±1.87 | >0.05 | NS |

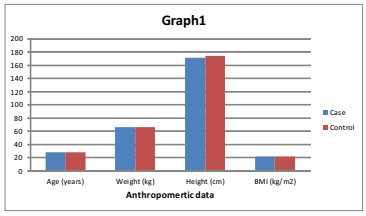
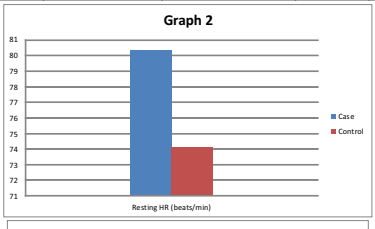



**Table: 2**

Comparison of parasympathetic autonomic function tests in tobacco chewer and control subjects:

| Parameter | Groups (Mean±SD) | | p-value | Significance |
|---|---|---|---|---|
| | Case(n=30) | Control(n=30) | | |
| Resting HR(beats/min) | 80.3±2.09 | 74.10±6.23 | <0.05 | **Significant** |
| 30:15 R-R ratio | 1.14±0.30 | 1.16±0.12 | >0.05 | NS |
| E/I ratio | 1.24±0.17 | 1.55±0.38 | <0.001 | **HS** |
| Valsalva ratio | 1.17±0.24 | 1.35±0.11 | <0.05 | **Significant** |



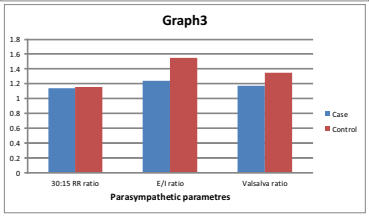
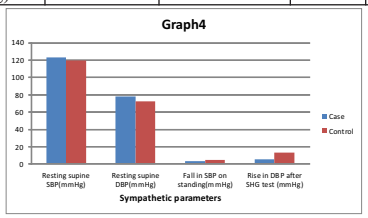




**Table: 3**

Comparison of sympathetic autonomic function tests in tobacco chewer and control subjects:

| Parameter | Groups (Mean±SD) | | p-value | Significance |
|---|---|---|---|---|
| | Case(n=30) | Control(n=30) | | |
| Resting Supine SBP (mmHg) | 123.3±9.30 | 119.68±7.84 | >0.05 | NS |
| Resting supine DBP(mmHg) | 77.76±7.30 | 72.46±8.63 | <0.05 | Significant |

| | | | | |
|---|---|---|---|---|
| Fall in SBP on standing(mmHg) | 3.4±4.88 | 5.10±4.21 | >0.05 | NS |
| Rise on DBP on SHG(mmHg) | 5.53±2.28 | 13.16±2.71 | <0.001 | HS |

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