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Acute Effect of Gutkha Chewing on Cardiopulmonary Efficiency in Short Term Users

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Abstract

Tobacco has been used orally alone or in combination with other ingredients. In India tobacco is taken in several forms. Use of smokeless tobacco indeed represents a health concern of growing magnitude among these groups. As a consequence of its addictive qualities, the consumption of smokeless tobacco often becomes a lifelong habit with cumulative and deleterious effects on health. Smokeless tobacco has been advocated as a substitute for cigarette smoking. On the contrary, the use of smokeless tobacco is fraught with health risk and needs to be discouraged. Previous reports have described long term harmful effects of nicotine on various body parameters, little is known about acute effect of smokeless tobacco on cardiopulmonary parameters. Very few studies have been undertaken on the acute effect of use of Gutkha, a common form of smokeless tobacco in India on cardiopulmonary parameters of youngsters.

Methods: Treadmill Exercise Testing & Pulmonary Function Tests were done before and after maximal exercise testing to assess cardiopulmonary efficiency in two groups' viz., healthy sedentary controls and healthy gutkha chewers.

Results: On studying the differences in cardiopulmonary efficiency in the two groups the resting heart rate was found to be statistically significantly higher in the study group and the delta heart rate was found to be statistically significantly lower among gutkha chewers. There was no significant difference seen in parameters like VO_2 max, maximum oxygen pulse, MVV, VE max as an acute effect of gutkha chewing.

Conclusion: In this study it appears that tobacco chewers are physically fit like controls, but after immediate tobacco chewing a lesser delta HR suggests a higher risk for cardiovascular mortality.

Stopping tobacco chewing at this juncture can be helpful in reverting back the risk and parameters like resting HR, recovery HR, and delta HR can be used as prognostic assessment tools for any intervention therapy to stop gutkha chewing in asymptomatic individuals.

Keywords: Smokeless tobacco; Gutkha; Cardiopulmonary; VO_2 max; Resting HR; Delta HR; MVV; V_E max

Introduction

Humans have used tobacco for about a thousand years. Tobacco has been used orally alone or in combination with other ingredients. In India tobacco is taken in several forms, for example Pan (betel quid), dried leaves (Patti), paste (Kiwan, Zarda), tobacco with lime (Khaini/ Mawa) [1]. There has been resurgence of smokeless tobacco use since 1970 [2], its use is common in various parts of the world, including India and central Asia. An increase in consumption of smokeless tobacco has been noticed among high school, college students and sports persons [3-5]. Use of smokeless tobacco indeed represents a health concern of growing magnitude among these groups. As a consequence of its addictive qualities, the consumption of smokeless tobacco often becomes a lifelong habit with cumulative and deleterious effects on health [6,7]. Despite the known health consequences of tobacco, "chewing" is not viewed by users as particularly dangerous and is considered less of a "social evil" than smoking by much of the public [8,9]. Smokeless tobacco has been advocated as a substitute for cigarette smoking. On the contrary, the use of smokeless tobacco is fraught with health risk and needs to be discouraged. Previous reports have described long term harmful effects of nicotine on various body parameters, little is known about acute effect of smokeless tobacco on cardiopulmonary parameters [10]. The effect of tobacco smoking on aerobic capacity and their predisposition to various unfavorable risk factors for disease is well studied. Very few studies have been undertaken on the acute effect of use of Gutkha, a common form of smokeless tobacco in India on cardiopulmonary parameters of youngsters.

Aims and Objectives

The present study has been undertaken to study the acute effect of Gutkha chewing on cardiopulmonary efficiency tests in young healthy gutkha chewers as compared to age and sex matched non gutkha chewing healthy controls.

Material and Methods

Present study was conducted in the Exercise Physiology lab of KIMS, Hubli. 30 apparently healthy sedentary male gutkha chewers of age group 18-30 years were taken as subjects and equal number of age and sex matched healthy non gutkha chewers were taken as controls. Ethical clearance was obtained from institution ethical committee.

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The subjects for the study were selected based on the following criteria

Inclusion criteria:

- Males between 18-30 years of age
- Leading sedentary life
- Chewing gutkha for 3-5 years duration of 5 or more packets per day

Exclusion criteria:

- Age more than 30 years
- Leading physically active lifestyle
- Suffering from cardiopulmonary or systemic illness like diabetes, hypertension
- Involved in any sports or exercise regimen
- Addicted (dependence) to any drugs

The subjects for the control group were selected based on the following criteria

Inclusion criteria:

- Males between 18-30 years of age
- Leading sedentary life
- Not chewed even a single packet of gutkha upto the time of study

Exclusion criteria:

- Age more than 30 years
- Leading physically active lifestyle
- Suffering from cardiopulmonary or systemic illness like diabetes, hypertension
- Involved in any sports or exercise regimen
- Addicted (dependence) to any drugs

Before starting the actual study subjects were briefed about the protocol and informed consent was obtained. Thorough history regarding suitability as per the above inclusion and exclusion criteria was elicited. Basic clinical examination was done to rule out any cardiopulmonary or other illness. Subjects in the study group [Gutkha chewers] were instructed to come to the lab and chew 2 packets of gutkha immediately before starting the recordings. Both controls and chewers were advised to refrain from consumption of coffee, tea and heavy meals at least 2 hours prior to the recordings.

Resting heart rate

Resting heart rate was measured in both study and control group, with the help of Cardiart 108T-mk-VI; ECG machine which is a single channel, 12 lead selection electrocardiograph, designed to record electrocardiograms.

Measurement was carried out only after the subjects were thoroughly acquainted with working of the corresponding instrument and the prescribed maneuver.

Special instructions

- The subject was made to rest for fifteen minutes after the attachment of leads.
- He was instructed to remain in sitting posture and completely relaxed.

The calibration (1 mv=10 mm deflection height) and paper speed (25 mm/sec) were checked. Lead selection was switched to LEAD-II and E.C.G. was taken. The resting heart rate was calculated and results were expressed as beats per minute.

$$\text{Heart rate} = \frac{1500}{\text{Distance between two consecutive R} - \text{R interval in mm.}}$$

Maximal Voluntary Ventilation (MVV)

MVV was measured in both the study and the control group with the help of computerized spirolyser.

Spirolyser

In this study, the instrument used to measure respiratory parameters was spirolyser model Spl –95, which is an electronic spirometer. The instrument has facility for calibration, and gives reliable values of tests, which are displayed on the screen along with its graphical interpretation. The instrument is standardized. The instrument has an in-built printer, which prints on special thermal paper. The instrument has memory for 2-3 tests, hence best of the 3 tests can be chosen.

Recording of MVV

The sensor was placed on the stand and then MVV key was pressed. The subject was instructed to keep the disposable mouthpiece attached to pneumotachograph half way in the mouth above the tongue. The nose clip was applied and the start button was pressed. The subject was asked to breathe as deeply and as quickly as possible for 12 seconds, at the end of which the test terminates automatically. Now the sensor is replaced back on the stand. The screen displays the values of MVV along with its graph. This test has no memory. The print key was pressed to obtain a print.

Maximal oxygen consumption (VO_2 max)

VO_2 max was indirectly assessed by the strand-astrand nomogram method from sub maximal exercise data obtained while running on a treadmill. In this study, the treadmill used was model GM1300 motorized treadmill, with assembling size: 146 (L) × 66 (w) × 143 (H) cm and running surface of 360 × 1150 mm. It is driven by a 1.25 H.P. DC motor capable of 4000 r.p.m. The treadmill has a speed range of 1-11 km/hour with 3 levels of pre-set elevations which can be selected. The 3 possible elevations are 1° (1.75 percent grade), 3° (5.23 percent grade) and 7° (12.28 percent grade). This tread mill has a polyster-backed belt and waxed deck for silent operation and 8 elastomer cushions for a low impact running surface. The LCD monitor of the above treadmill has a 5 window display and displays time, distance travelled, speed, pulse rate and calories consumed. It also has an ear pulse sensor, magnetic safety key for emergency stop, ON/OFF and FAST/SLOW switches. In addition there are switches for mode, set & reset.

Submaximal exercise testing

Subject preparation:

- Subjects had to appear for the test only after 2-3 hrs have lapsed after the last meal.

- Contra-indications to testing are ruled out.
- A detailed explanation of the testing procedure was given outlining risks and possible complications.
- The subject was told how to perform the exercise test and the testing procedure was demonstrated.
- All safety measures for the exercise testing were undertaken.

The treadmill was set to the elevation of 7°. The safety key was put in place and the mains switched ON. The subject was made to stand on the belt and support his arms by the side in the arm support provided. ECG limb leads were connected and the cables were securely tied to the legs. The ear pulse sensor was connected.

The 'ON' Switch is pressed to start the motor. The 'FAST' Switch is pressed to increase the speed gradually up to 5 km/hr and the subject is instructed to run at this speed. The running is continued till a heart rate between 125 and 170 beats per minute is obtained as shown on the LCD display. A steady heart rate for a given work load is indicated by a variation of not more than 5 beats per minute. On attaining this heart rate, the speed is gradually brought down by pressing the slow switch and the machine is switched OFF.

Lead II is selected in the E.C.G. machine and E.C.G. is recorded for a few complexes and sub maximal heart rate is calculated. The distance travelled and time taken is noted down from the LCD display.

The power reached is calculated as follows:

X = sin α x B Where X = vertical distance travelled

α = elevation in degrees

B = Distance travelled on Treadmill (in km)

Work done = Weight of subject x (X)

Power = Work done / Time

The Astrand nomogram is used. The heart rate and the power reached are connected in the nomogram. VO_2 max (in Lit / min) is read from the VO_2 scale.

Corresponding values of VO_2 max in terms of body weight, height and surface area are calculated.

Since the subjects in this study did not exceed 25 years of age, age correction factor was not applied**.**

Maximal exercise testing: This is done after a rest period of 10 minutes. The L.C.D. display of the treadmill is reset to zero values. The spirolyser is switched ON, subject's details entered and the VC key is pressed and kept ready. The ECG limb leads are connected and the cables secured as before. The subject was suitably instructed about the test manoeuvre. Elevation was continued at 7°. The subject was asked to run till exhaustion and to stop only when he felt that he could no longer run. With the subject on the belt, the treadmill was switched ON and the FAST key pressed. The speed was gradually raised to 10 km/hr. When the subject could no longer continue running, the speed was gradually brought down and the treadmill switched OFF. Lead II is selected in the E.C.G. machine and E.C.G. is recorded for a few complexes and Maximal Heart Rate is calculated.

Maximal Heart Rate: Simultaneously, the nose clip is applied; the disposable mouth piece on the pneumotachograph of the ready spirolyser is placed on the subject's mouth over the tongue. The start switch is pressed in the VC Mode to record the respiration at VO_2 max work load. After 50 seconds the test terminates automatically. The sensor is placed back in its place. A print is obtained.

Delta Heart Rate (δHR): The δHR was the calculated difference between the maximal HR and the resting HR.

Minute Volume at VO_2 max (V_E max): It is calculated from the respiratory rate and the tidal volume recorded.

Breathing Reserve (BR) at VO_2 max is calculated using the formula.

$$\text{BR at } VO_2 \text{ max} = \text{MVV} - V_E \text{ max}$$

Dyspnoeic Index (DI) at VO_2 max is calculated using the formula

$$\text{DI at } VO_2 \text{ max} = \text{BR at } VO_2 \text{ max} / \text{MVV}$$

Recovery Heart Rate: This is recorded after a period of 1 minute from the cessation of maximal exercise. Lead II is selected in the E.C.G. machine and E.C.G. is recorded for 15 seconds.

Recovery heart rate is obtained by using the formula,

Recovery HR=15–sec HR × 4

Maximum oxygen pulse is calculated by using the formula,

$$\text{Maximum } O_2 \text{ pulse} = \frac{VO_2 \text{ max (ml/min)}}{\text{Max HR}}$$

All these set of recordings were done on both the non-athlete as well as the athlete groups. Statistical analysis was done by using un-paired student's test.

Results

	No. of Cases	Age (yrs)	Height (cm)	Weight (kg)	BMI (kg/m^2)	Body surface area (m^2)
Controls	30	20.10 ± 2.32	165.40 ± 8.20	55.00 ± 7.10	20.17 ± 2.00	1.60 ± 0.13
Gutkha Chewers	30	21.73 ± 2.28	165.30 ± 6.80	53.00 ± 4.40	19.23 ± 1.87	1.67 ± 0.59
P - Value		>0.05	>0.05	>0.05	>0.05	>0.05

Table 1: Anthropometric data of controls & gutkha chewers (mean ± SD). In this table it is observed that the resting heart rate was significantly higher in gutkha chewers. There is no statistically significant difference in sub-maximal heart rate, maximal heart rate and recovery heart rate The anthropometric data reveal that the study group and controls are age and gender matched with no statistically significant difference in height, weight, body mass index and body surface area.

Parameter	Controls n=30	Gutkha Chewers n=30	P - Value
Resting Heart Rate [bpm]	75.00 ± 5.10	96.70 ± 10.80	<0.01
Sub-maximal Heart Rate [bpm]	151.00 ± 8.26	153.00 ± 5.15	>0.05
Maximal Heart Rate [bpm]	176.00 ± 8.01	178 .80 ± 7.79	>0.05
Recovery Heart Rate [bpm]	137.60 ± 8.26	139.90 ± 6.26	>0.05

Table 2: Various Heart Rates of controls & gutkha chewers (mean ± SD).

Parameter	Controls N=30	Gutkha Chewers N=30	P - Value
MHR-RHR Bpm	38.40 ± 8.57	38.90 ± 7.10	>0.05
ΔHR Bpm	101.00 ± 12.10	82.06 ± 13.14	<0.05
Maximum Oxygen Pulse	12.75 ± 1.20	12.35 ± 0.94	>0.05

Table 3: In this table it is seen that there is no significant difference in maximum oxygen pulse and difference between maximum heart rate and recovery heart rate. But there is a statistically significant difference in the δ heart rate between the two groups.

- **Comparison of the differences between** Maximum heart rate and Recovery heart rate (MHR-RHR)
- Maximum heart rate and resting heart rate (δ HR)
- Maximum oxygen pulse of controls and gutkha chewers

Parameter	Controls N=30	Gutkha Chewers N=30	P - Value
VO_2 max l/min	2.21 ± 0.19	2.21 ± 0.15	>0.05
VO_2 max ml/kg/min	41.00 ± 5.56	42.24 ± 4.53	>0.05
VO_2 max ml/cm/min	13.50 ± 1.31	13.32 ± 1.01	>0.05
VO_2 max l/m²/min	1.39 ± 0.14	1.39 ± 0.10	>0.05

Table 4: Comparison of Maximal Oxygen Consumption (VO_2 max) of controls and gutkha chewers. This table shows that there is no significant difference in VO_2 max between the two groups irrespective of the method of presentation of VO_2 max

Parameter	Controls N=30	Gutkha Chewers N=30	P - Value
MVV l/min	100.10 ± 7.70	103.20 ± 6.80	>0.05
VE max l/min	49.70 ± 4.32	51.99 ± 4.23	>0.05
BR liters	50.00 ± 5.80	51.10 ± 4.02	>0.05
DI %	49.80 ± 3.20	49.59 ± 1.91	>0.05

Table 5: Comparison of the differences between.

- Maximum Voluntary Ventilation (MVV)
- Maximum Minute Ventilation (VE max)
- Dyspnoeic Index (DI) of controls and gutkha chewers

This table shows that the study and control group showed no significant difference in maximum voluntary ventilation, minute volume at VO_2 max, breathing reserve and dyspnoeic index.

Discussion

The greatest concern for nicotine related effects is acceleration or aggravation of cardiovascular disease [11]. In a study of the cardiovascular effects of daily smokeless tobacco use, the prominent effects of nicotine use viz., heart rate acceleration and increased urinary catecholamine excretion were similar throughout the day in people smoking cigarettes and those using smokeless tobacco [10]. The study group of gutkha chewers was made to chew the same before recording in order to know the acute effects of chewing gutkha on cardio respiratory system. In the present study, the resting heart rate was found to be statistically significantly higher in the study group. This is attributable to the lower vagal tone in gutkha chewers as a result of nicotine use even in the short term of 3-5 years which becomes apparent as an acute effect. This finding is in agreement with other studies [12]. The delta heart rate was found to be statistically significantly lower among gutkha chewers. Delta HR is a long term predictor of cardiovascular mortality independent of age, physical fitness and conventional coronary risk factors [13]. The lower delta HR suggests that gutkha chewers are at a higher risk for cardiovascular mortality. There was no significant difference seen in parameters like VO_2 max, maximum oxygen pulse, MVV, VE max as an acute effect of gutkha chewing. Most of the workers had attributed decreased VO_2 max among smokers to the carbon monoxide saturation and less hemoglobin availability to carry oxygen. Our study group did not show any significant change in VO_2 max as carbon monoxide is nonexistent in smokeless tobacco.

In this study it appears that tobacco chewers are physically fit like controls, but after immediate tobacco chewing a lesser delta HR suggests a higher risk for cardiovascular mortality. Respiratory parameters show marginal increase in values. This could be due to bronchodilatation due to the release of epinephrine or stimulation of sympathetic system or both. Stopping tobacco chewing at this juncture can be helpful in reverting back the risk and parameters like resting HR, recovery HR, and delta HR can be used as prognostic assessment tools for any intervention therapy to stop gutkha chewing in asymptomatic individuals.

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