

Research Article

A Study of Heart Rate Variability among Gutkha Chewers from a Rural Farming Background in India

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Abstract

Background: Modernisation of life style has affected the population even in rural areas leading to addiction. Smokeless tobacco is presumed to be less of an evil by the rural folk. Gutkha addicts are likely to suffer from mental and physical exhaustion leading to stress. This is important in view of the prevailing socio-economic as well as the healthcare system available in any developing country. Therefore the present study is designed to measure heart rate variability among this special group of population.

Methods: 15 male subjects were enrolled from among the rural farm labors who regularly chewgutkha. They were free from any type of physical and mental health issues, non smokers. Each individual volunteer was subjected to HRV analysis on three occasions: the first record was performed on the first day of their arrival in the hospital as subjects during the lean season. The second observation was recorded after 3 months of farming activity. The final HRV analysis was done after 6 months of farming activity. Two types of parameters were analysed: time domain and frequency domain. Statistical analysis was done using paired t-test.

Results: Both the HRV parameters – time and frequency domain, showed decreased values during the third month and sixth month recording as compared to the first week recording. The decrease is much more during the sixth month recording as compared to the third month recording. Statistically significant decrease is observed in mean RR interval, heart rate, VLF and LF only when the first week recording is compared with the third month recording but when the first week recording was compared with the sixth month recording significant decrease was found in mean RR interval and heart rate.

Conclusion: Subjects involved in taking gutkha are likely to undergo a lot of physical and mental stress, thus affecting their autonomic status. This adds up to the stress induced by their occupation. HRV analysis using short term ECG recording was used to detect changes consequent to this stress.

It was found that almost all HRV parameters measuring heart rate complexity were decreased in the period of farming activity.

Keywords: Heart rate variability; Care giver; RMSSD; NN50; RR interval; Frequency domain; Farming; Occupational stress; Gutkha chewing

Introduction

Lifestyle in present day is full of stresses even in the rural setting. This is an important cause for the rural folk engaged predominantly in farming activity, a form of manual labour in India to take up addiction. Gutkha chewing, a form of smokeless tobacco is viewed to be relatively harmless by the rural folk. The negative consequences of stress as a risk factor for cardiovascular disease and reduced human performances are well studied [1]. Stress is known to change the balance existing between the sympathetic and parasympathetic divisions of the autonomic nervous system [2]. Gutkha chewers are likely to suffer from mental and physical exhaustion leading to stress. Heart rate variability [HRV] is a non-invasive study of variation over a period of time between consecutive heart beats and has been proved to be a reliable marker of autonomic nervous system activity [ANS] [3]. HRV analysis is one of the best parameter available today for evaluation of stress.

The level of heart rate variability and the underlying stress is not well studied in developing countries. This is important in view of the prevailing socio-economic as well as the healthcare system available in a developing country like India. Therefore the present study is designed to measure heart rate variability among this special group of population.

Material and Methods

The data was acquired from 15 male subjects in the age group of

22 to 25 years free from any type of physical and mental health issues as determined by taking a detailed history and a thorough physical examination. All subjects were non smokers and had a history of gutkha chewing of 3 to 5 years duration.

These subjects were enrolled from among farm labour in an Indian village. Informed consent was obtained from the subjects. It was not possible to estimate the relative dosages in the subjects in view of their poor educational background. Ethical clearance was obtained from the institutional ethical committee. Each volunteer was subjected to HRV analysis on three occasions: the first record was performed in the first day of their arrival in the hospital. They volunteered for the study and were called to the hospital as the necessary infrastructure was available there. Otherwise the subjects did not have any health issues.

The second observation was recorded after 3 months of farming

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activity. The final HRV analysis was done after 6 months of farming activity. All recordings were obtained under similar conditions of time and body position after an adaptation time of 30 minutes.

The anthropometric parameters of each subject were recorded. This was followed by a short term 5 minute three lead electro cardiogram recording [ECG] using Biomed polygraph. From the data thus obtained HRV analysis was done. The RR interval time series were extracted from ECG records using Biomed HRV analysis software.

Two types of parameters were analysed. Time domain parameters like mean RR interval, RMSSD (ms): square root of the mean of the sum of the squares of differences between adjacent NN intervals. This gives information regarding HRV in short time interval, NN50 : number of pairs of adjacent NN intervals differing by more than 50 ms in the entire recording, pNN50 (%) : NN50 count divided by the total number of all NN intervals and frequency domain parameters like VLF (ms²) : power in very low frequency range (<0.04Hz), LF (ms²) : power in low frequency range (0.04-0.15 Hz), HF (ms²) : power in high frequency range (0.15-0.4 Hz), LF/HF ratio.

The fraction of total RR intervals labelled as normal to normal [NN] intervalswas computed as NN/RR ratio. This ratio has been used as a measure of data reliability with the purpose to exclude records with a ratio less than 90% of threshold [4-6].

Statistical Analysis

HRV features were depicted as mean \pm standard deviation during the three set of recordings. Non linear properties of HRV were analysed by the following methods: Time domain parameters and frequency domain parameters were compared using paired t-test.

Results

Fifteen males were enrolled in the study with mean age of 22.40 \pm 2.51 years, height 161.08 \pm 0.09 cm, weight 59.49 \pm 1.45 kg and BMI 22.62 \pm 0.02. Both the HRV parameters – time and frequency domain, showed decreased values during thethird month and sixth month recording as compared to the first day recording. The decrease is much more during the sixth month recording as compared to the third month recording. Statistically significant decrease is observed in mean RR interval, heart rate, VLF and LF only when the first day recording significant decrease was found in mean RR interval and heart rate (Tables 1 and 2).

Discussion

In the present study various heart rate variability parameters were computed among gutkha chewers of a rural setting in India. It is difficult to ascertain for sure whether all participants took comparable doses. But in view of similar socio economic and cultural background of the subjects it is safe to estimate that there would not be gross differences in dosage.

Recordings were made within one day of the patient being admitted to the hospital in the lean season. Subsequently repeat recordings were obtained after 3 months and 6 months after the first recording with the subject continuing as active farm labour.

The mental and physical stress associated with intense manual labour is likely to produce a cardio-sympathetic excitation. This has an additive effect on the reaction of the ANS to nicotine in gutkha. Subjects are likely to increase intake of gutkha to overcome work pressure which

Parameter	On first daymean ± SD	After 3 months Mean ± SD	After 6 months Mean ± SD	p-value
RR interval (s)	0.78 ± 0.12	0.71 ± 0.11	0.68 ± 0.11	0.0149* A 0.0020** B 0.3100 C
Mean HR	78.10 ± 11.10	86.51 ± 11.45	88.01 ± 12.77	0.0070** A 0.0030** B 0.3000 C
RMSSD (ms)	22.54 ± 8.81	20.90 ± 8.50	21.18 ± 12.31	0.5700 A 0.6200 B 0.9300 C
NN50 (count)	7.59 ± 4.86	7.62 ± 5.21	7.61 ± 7.22	0.9700 A 0.9800 B 0.9990 C
pNN50 (%)	5.01 ± 3.15	5.02 ± 3.46	5.07 ± 4.76	0.1000 A 0.9710 B 0.9711 C

 Table 1: Comparison of HRV Time domain parameters.

RR interval – Electrocardiogram parameter

HR – Heart Rate

 RMSSD - square root of the mean of the sum of the squares of differences between adjacent NN intervals

NN50-number of pairs of adjacent NN intervals differing by more than 50 ms in the entire recording

pNN50% - NN50 count divided by the total number of all NN intervals

- * Highly Significant A=first day vs. After 3 months
- **Very Highly Significant B=first day vs. After 6 months

C=after 3 months vs. After 6 months

Parameter Power %	On first daymean ± SD	After 3 months Mean ± SD	After 6 months Mean ± SD	p-value
VLF	38.01 ± 16.01	25.01 ± 12.29	30.35 ± 17.94	0.02* A 0.23 B 0.30 C
LF	47.06 ± 13.08	56.01 ± 12.38	54.29 ± 15.49	0.02* A 0.77 B 0.78 C
HF	16.86 ± 11.86	21.34 ± 9.13	17.36 ± 5.87	0.20 A 0.89 B 0.18 C
LF/HF	2.77 ± 1.18	3.21 ± 1.92	3.61 ± 1.18	0.37 A 0.08 B 0.48 C

Table 2: Comparison of HRV Frequency domain parameters.

VLF- Very low frequency

LF – Low frequency

HF – High frequency

LF/HF- Low frequency to high frequency ratio

* Significant A=first

A=first day *vs.* After 3 months B=first day *vs.* After 6 months

C=after 3 months vs. After 6 months

in this case is farming activity and in rural India is predominantly seasonal. Gutkha is not seasonal and available throughout the year.

This is reflected in a significant decrease in the mean RR interval. The mean RR interval is an indicator of the ratio of the cardiac sympathovagal balance. The results suggest an overall sympathetic dominance subsequent to taking up of farming activity among the subjects. The significant decrease in mean RR interval and increase in mean heart rate after 3 months reflects a decreased total HRV in the presence of mental and physical stress. The mean value of the HF power is of lower magnitude after 3 and 6 months of caregiving but the decrease is not statistically significant except in the case of VLF and LF power. However the combined decrease in spectral power of all 3 bands contributes to

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the significant decrease in the total power during the caregiving period. Decreased HRV indicates diminished responsiveness of the cardiac autonomic system to normal physiological stimuli. The frequency and time domain parameters show no change between 3 months and 6 months. The HRV was unchanged during this period probably because the level of stress induced in these subjects for 3 months might have started adaptive mechanisms counteracting the effect of stress.

Conclusion

Subjects involved in taking gutkha are likely to undergo a lot of physical and mental stress paradoxically the very reason for which they presumably began with the habit, thus affecting their autonomic status. HRV analysis using short term ECG recording was used to detect changes consequent to this stress. It was found that almost all HRV parameters measuring heart rate complexity were decreased in the period of farming activity.

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