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Effects of Yogasana Practice and Gymnastics on Reaction Times

Noorjehan Begum*, Sandhya H.P M.S. Sathish**, V.S. Baljoshi***, S.B. Kulkarni******

Abstract

Early man's ability to survive depended primarily on physical fitness. It is known that a number of indices of physical fitness are influenced by yogasana and gymnastics. Aim of the study is to find out, effects of these short term exercises on Auditory reaction time, visual reaction time and cutaneous reaction time in healthy young volunteers.

The protocol of the study involved measurement of ART, VRT and CRT in both hands separately; before and after one month of yoga and gymnastics training in two groups. Each consisting of 25 healthy male volunteers, in the age group of 18- 23 years. Response – analyzer [YSRT – 0101] instrument was used for the measurements of ART, VRT and CRT.

The results of study showed that, the random and alert RTs, were decreased after both yoga and gymnastics training ($p<0.001$). Right hand RTs were significantly shorter than the left hand RTs before and after yoga as well as gymnastics training (random and alert, $p<0.001$). There was a greater reduction in random RTs after gymnastics training whereas, a greater reduction in alert RTs was found after yoga training but the p value was not significant.

To conclude, yogasana and gymnastics training, both have showed the improvement in the RTs.

Keywords: ART; CRT; VRT; Gymnastics; Yogasana.

Introduction

Yoga is not just about bending or twisting the body in different shapes. It is giving care, to our body, mind and the breath. It includes postures (asanas), breathing techniques (pranayama), and meditation. Through these the body, mind and the breath come in harmony with each other; the very moment yoga happens.[1]

Gymnastics is a sport involving the performance of exercises requiring physical strength, flexibility, power, agility, coordination, grace and balance.[2]

It is known that a number of indices of physical fitness are influenced by yogasana and gymnastics. These exercises improve the sensory motor performance, and hence reaction time (RT) also called response time, provides a quantitative measurement of these beneficial effects.[3] Reaction time is an interval of time between the signal to begin and the response by the subject.[4]

Only limited studies are available on the physiological effects of short term yogic practice[5] and gymnastics.

Aim of the study is to find out the effects of these short term exercises on Auditory reaction time (ART), visual reaction time (VRT) and cutaneous reaction time (CRT) in healthy young volunteers.

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Materials and Methods

The present study was conducted on volunteers comprising 50 apparently healthy male of age group 18-23 years, according to their preferences, they were devided into two groups, a yoga group (Y), and a gymnastics group (G). They had clinically normal hearing, vision and cutaneous (touch) sensations and were absolutely sound physically and mentally. Their history and thorough clinical examination did not reveal any abnormality of any system. Past and family history of subjects did not suggest any neurological abnormality or any diseases which tend to affect CNS or any other system directly or indirectly, e.g.: diabetes mellitus, hypertension or mental apathies.

All subjects were right handed, non smokers, non alchohlics, non-tobacco product chewers, took no drugs, and had a uniform pattern of diet and activity. They were not exposed to any long term exercises, sports, or yogic postures previously. The yoga and gymnastics trainings were given to them for about 60 minutes between 5 to 7 am, except on Sundays for one month, under the supervision of two qualified persons, and the subjects were asked not to change their lifestyle over the one month duration of the study.

This being a self control study, no control group was kept. Subjects were explained about the study protocol and, informed consent was obtained from them before taking part.

Two groups of subjects, Y and G, each consists of 25 subjects, their physical parameters such as height, weight, BSA, were recorded. Their reaction times ART, VRT and CRT were measured before and after the training in both the hands separately; in both the groups with instrument Response-Analyser.

"Response- Analyser" manufactured by "Yantrashilpa" Electronics- 0101/Pune [YSRT-0101]. This instrument works with a working supply of 10v.DCand equipped with a very sensitive quartz clock which can measure up to $1/10^{th}$ of a millisecond. Display accuracy of the instrument is + 0.001 sec and display range is 9.999 seconds maximum. It is a micro-processor based system that can be programmed to measure the response times of the subject to various sensory stimuli, eg: vision, sound, electrical etc.

Different programmes are used for producing auditory, light and cutaneous stimuli; subjects are instructed to press a response microswitch (thumb switch) as quickly as possible after the presentation of the stimuli but never before. The intensity of stimuli was kept constant for all the subjects.

Results

The results are expressed as mean + SD [n=25].

Right hand RTs were shorter than the left hand RTs before and after yoga training, the differences were statistically significant ($p<0.001$ in both random and alert).

Right hand RTs were shorter than the left hand RTs before and after gymnastics training (in both random and alert). The differences were statistically significant ($P<0.001$).

The reaction times were found to be shorter after yoga training (random and alert) which was significant ($p<0.001$).

The reaction times were found to be shorter after gymnastics training (random and alert) which was again significant ($p<0.001$).

The degree of reduction in RTs in the yoga training group was compared with that of gymnastics training group for the random RTs as well as alert RTs by using t- test and z-test. On analyzing this, it is found that there is a greater reduction in random RTs after gymnastics training whereas there is a greater reduction in alert RTs after yoga training.

Table I: Random Reaction Time [RRT] for Right Hand

Measurements	Before yoga training [Y_1] Mean + SD [in msec]	After yoga training of one month [Y_2] Mean +SD [msec]
ART RA	206.52 + 28.21	192 + 29.31
VRT RA	229 + 31.19	212.39 + 30.26
CRT RA	255.40 + 39.28	234.42 + 33.58

ART Y_1 –Y_2 P< 0.001[HS]
VRT Y_1 –Y_2 P<0.001[HS]
CRT Y_1 –Y_2 P< 0.001[HS]

Table II: Random Reaction Time [RRT] for Left Hand

Measurements	Before yoga training [Y_1] Mean +SD [in msec]	After yoga training of one month [Y_2] Mean +SD [msec]
ART LA	216.79 + 29.89	200.9 +30.81
VRT LA	242.16 + 35.53	224.14 + 29.61
CRT LA	264.79 +40.63	245.08 + 38.20

ART Y_1 –Y_2 P< 0.001[HS]
VRT Y_1 –Y_2 P<0.001[HS]
CRT Y_1 –Y_2 P< 0.001[HS]

Table III: Alert Reaction Time [ALRT] for Right Hand

Measurements	Before yoga training [Y_1] Mean +SD [in msec]	After yoga training of one month [Y_2] Mean +SD [msec]
ART RA	180.26 + 16.79	168.66 +15.91
VRT RA	184.96 + 16.49	173.62 + 16.64
CRT RA	190.34 + 16.00	179.11 + 16.75

ART Y_1 –Y_2 P< 0.001[HS]
VRT Y_1 –Y_2 P<0.001[HS]
CRT Y_1 –Y_2 P< 0.001[HS]

Table IV: Alert Reaction Time [ALRT] for Left Hand

Measurements	Before yoga training [Y_1] Mean +SD [in msec]	After yoga training of one month [Y_2] Mean + SD [msec]
ART LA	181.27 + 16.71	169.58 + 15.76
VRT LA	186.26 + 16.33	174.42 + 16.48
CRT LA	191.50 + 15.74	180.13 +16.47

ART Y_1 –Y_2 P< 0.001[HS]
VRT Y_1 –Y_2 P<0.001[HS]
CRT Y_1 –Y_2 P< 0.001[HS]

Table V: Random Reaction Time [RRT] for Right Hand

Measurements	Before gymnastics training [G_1] Mean +SD [in msec]	After Gymnastics trainingof one month [G_2] Mean + SD [msec]
ART RA	210.68 + 39.33	189.34 + 29.10
VRT RA	233.92 + 43.37	204.27 + 31.15
CRT RA	259.60 + 47.77	223.68 + 36.72

ART G_1 –G_2 P< 0.001[HS]
VRT G_1 –G_2 P<0.001[HS]
CRT G_1 –G_2 P< 0.001[HS]

Table VI: Random Reaction Time [RRT] for Left Hand

Measurements	Before gymnastics training [G 1] Mean +SD [in msec]	After Gymnastics trainingof one month [G2] Mean + SD [msec]
ART LA	221.77 + 39.32	197.51 + 30.03
VRT LA	242.2 +/- 47.24	211.82 + 34.86
CRT LA	273.24 + 55.83	230.70 + 42.14

ART G_1 –G_2 P< 0.001[HS]
VRT G_1 –G_2 P<0.001[HS]
CRT G_1 –G_2 P< 0.001[HS]

Table VII: Alert Reaction Time [ALRT] for Right Hand

Measurements	Before gymnastics training [G 1] Mean +SD [in msec]	After Gymnastics trainingof one month [G2] Mean + SD [msec]
ART RA	174.41 + 23.10	165.53 + 22.41
VRT RA	181.97 + 22.55	173.33 + 22.22
CRT RA	190.90 + 24.27	182.15 + 24.42

ART G_1 –G_2 P< 0.001[HS]
VRT G_1 –G_2 P<0.001[HS]
CRT G_1 –G_2 P< 0.001[HS]

Table VIII: Alert Reaction Time [ALRT] for Left Hand

Measurements	Before gymnastics training [G 1] Mean +SD [in msec]	After Gymnastics training of one month [G2] Mean + SD [msec]
ART LA	175.38 + 20.45	166.61+ 22.41
VRT LA	183.39 + 22.17	174.54 + 22.13
CRT LA	192.23 + 24.37	183.49+ 23.91

ART G_1 –G_2 P< 0.001[HS]
VRT G_1 –G_2 P<0.001[HS]
CRT G_1 –G_2 P< 0.001[HS]

Abbreviations:
ART – auditory reaction time
CRT – cutaneous reaction time
G – gymnastics group
LA – left arm
RA – right arm
RT – reaction time
VRT – visual reaction time
Y – yoga group

Discussion

Right hand RTs were significantly shorter than the left hand RTs both before and after yoga and gymnastics training (in both random and alert).[6] This may be due to the fact that, the right handers possess a right shift factor which predisposes them to performance of skilled movements by right hand.[7]

The reaction times were found to be shorter after yoga training (random and alert) which was significant (p<0.001). A decrease in RTs indicates an improved sensory-motor performance and could be due to an enhanced processing ability of the CNS.[8] This could be due to 1) greater arousal and faster rate of information processing and 2) improved concentration power and ability to ignore and / or inhibit extraneous stimuli. Yoga practitioners are known to have better attention and less distractibility due to a decrease in mental fatigability and an increase in performance quotient.[9]

The reaction times were shorter after gymnastics training (random and alert) which was again significant (p<0.001).[10] It is believed that neuromuscular speed may be maintained by high levels physical fitness. The improved psychomotor performance of the aerobically trained subjects was related to enhanced cerebral metabolic activity such as an increased turnover of neuromuscular transmitters. Exercise induced increase in aerobic efficiency facilitate the transport of oxygen from the environment to the consumer cells in the brain which in turn may improve psychomotor aspects of brain function. Exercise may have beneficial effects on sensory motor factors which contribute to the improvement in the RTs.

Alert RT depends upon the ability to focusing, and a reduction in alert RT means better or improved ability to focus attention. [11,12]

Random RT depends on general level of preparedness or alertness, so reduction in random RT means a general increase in the level of readiness to respond or a general increase in the alertness.

In yoga training a silent zone is maintained; as it is done in isolation, it will improve the concentration power. This may be the reason for greater reduction in alert RTs and less reduction in random RTs.Whereas gymnastics is done in a noisy zone which is more conductive than silent zone. Hence it causes a greater reduction in the random RTs and less reduction in alert RTs.

Conclusions

Right hand RTs were shorter than left hand RTs, this may be due to the right handers possess a right shift factor which predisposes them to performance of skilled movements by right hand.

Yoga practice have reduced the RTs, which may be due to one of the followings:

1) Decreased mental fatigability
2) Better or improved ability to focus attention.

Gymnastics exercises have reduced the RTs which may be due to one of the following:

1) Increased transport of oxygen to the brain cells
2) Enhanced metabolic activity.

There is a greater reduction in numerical values of alert RTs after yoga training, which may be due to better or improved ability to focus attention. While there is a greater reduction in random RTs after gymnastics training, which may be due to a general increase in the level of readiness to respond. Further studies are needed to throw more light in this regard.

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Pulmonary Function Tests in Competitive Cricket Players

Varsha Vijay Akhade*, Muniyappanavar N. S.**

Abstract

Introduction: Increasing evidence suggests that playing competitive cricket produces many health benefits which include endurance, stamina, balance and physical fitness. Even though cricket is one of the oldest organized sports, there are very few studies on the association between playing competitive cricket and pulmonary functions. ***Aims and Objectives***: To study the pulmonary functions in competitive cricket players and to compare the same with matched sedentary control group. ***Materials and Methods***: In this study pulmonary functions such as FVC, FEV_1, FEV_1/FVC, MVV, PEFR parameters were studied in 48 competitive cricket players in the age group of 18- 26 years. These parameters were compared with matched apparently normal healthy sedentary medical students using unpaired t test. ***Results***: In our study significant increase was observed in pulmonary function parameters of competitive cricketers than sedentary controls. Competitive cricketers had higher mean of percentage value of Forced Vital Capacity (FVC) (P=0.0122), Forced expiratory volume in first second (FEV_1) (P=0.0129), Maximum Voluntary Ventilation (MVV) (P=0.0249) and Peak Expiratory Flow Rate (PEFR) (P=0.0119) than controls. However there was no significant difference in FEV_1/FVC ratio (P=0.3404) between the study groups. ***Conclusion***: The current study has shown that, there is significant positive relationship between playing cricket and pulmonary function in healthy young men. The improvement in pulmonary function could be due to increased strength of respiratory muscles.

Keywords: Cricket; FEV1; FVC; PEFR; Pulmonary function.

Introduction

Although cricket has origins in the British Empire, it is followed as a religion in South Asia, probably due to the influence of the former during their rule. The sport is equally popular among all groups of the society, and is not subject to gender or age constraints.

Impaired pulmonary functions are associated with increased mortality and morbidity.[1-3] Physical activity is known to improve physical fitness and to reduce morbidity and mortality from numerous chronic ailments.[4]

Sports encourage healthy lifestyle choices among people belonging to all ages and genders. They exert beneficial effects on bone metabolism, promote cardiovascular and respiratory health and contribute to improvements in motor and cognitive functions. [5-6] Regular physical activity reduces the risk of premature mortality.[7] Substantial evidence exists for the beneficial effects of regular exercise on cardiopulmonary, metabolic and neoplastic disorders.[8-9]

Cricket has been shown, in various studies, to improve stamina and endurance. Most professional cricketers undergo rigorous training periods before they are considered fit to play.[10] The training exercises that form part of the normal conditioning of these individuals help them attain endurance levels comparable to those of players from other, more intense sports.

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Cricket game has an impression it is a relatively undemanding sport. However, cricket is a physically demanding sport and that one-day cricket is a far consuming format, which requires the players to be athletic.[11]

The study conducted by A.K. Ghosh *et al*, on sportsmen playing different games including cricket showed significant increase in pulmonary functions.[12] There are several studies that have shown significant improvement in pulmonary functions as a result of the effect of exercise.[13-14] However, there are studies which show non -significant change in pulmonary functions in athletes.[15-17] Sedentary life styles could be associated with less efficient pulmonary functions and regular competitive cricket practice could produce a positive effect on the lungs by increasing pulmonary capacity and thereby improving the lung functioning.

Even though cricket is one of the oldest organized sports, there are very few studies on pulmonary functions of cricketers. The present study was therefore designed to study whether playing competitive cricket has any effect on pulmonary function. In this study, we have compared pulmonary functions of healthy cricketers and those with matched sedentary medical students. This is a cross sectional study of competitive cricket players who were playing competitive cricket for different periods of time.

Materials and Methods

This study was conducted in the department of physiology, Dr V M Medical College, Solapur, after obtaining the institutional ethical clearance. The present study included 48 male competitive cricket players, aged between 18-26 years, who were residents of Solapur district and were practicing cricket at Park Stadium and other cricket grounds at Solapur, for about 2-4 hours per day for at least 5 days in a week regularly since 3-6 years. A similar number of age, sex, height and weight matched medical students not directly involved in any kind of sports activity selected as controls. The informed consent was taken after the detailed procedure and purpose of the study was explained.

Those with history of chronic respiratory disorders, cardiovascular disorders, systemic diseases affecting respiratory system, alcoholics and smokers were excluded from the study. A thorough history taking & clinical examination was carried out to rule out the exclusion criteria and the vital data was recorded. Standing Height was measured without foot wear with subjects back in contact with the wall and with both heels together and touching the base of the wall. Weight was recorded with light clothing using a digital weighing machine. Both the height and weight were measured to the nearest 0.1cm and 0.5 kg respectively.

Spirometry was done on both competitive cricket players and control groups with Medspiror a portable, computerized pneumotachometer (Manufactured by Medsystems Pvt. Ltd. Chandigarh). The recordings were carried out at an average temperature of 28 degree C between 9am-11am. All the maneuvers were performed with the subjects in sitting position. Thorough instructions were given to each subject regarding the test and sufficient time was provided for them to practice the maneuvers. A soft nose clip was put over the nose to occlude the nostrils and disposable mouthpieces were used to minimize cross infection. Three readings were taken and maximum reading was selected to print.

The data obtained were expressed as mean and standard deviation and student unpaired t-test was applied for comparison between two groups. A p value less than 0.05 was considered to be statistically significant.

Table 1: Anthropometric Data

Parameters	Cricketers Mean ± SD	Controls Mean ± SD	P value
Age (yr)	20.20 ± 3.20	21.02 ± 2.28	P=0.1515
Height (cm)	168.23 ± 8.49	167.29 ± 5.49	P=0.5211
Weight (kg)	64.35 ± 7.38	65.66 ± 11.36	P=0.5045

Table 2: Pulmonary Function Parameters Cricket Players and Controls

Parameters (Ltrs)	Cricketers Mean ± SD	Controls Mean ± SD	P value
FVC(L)	2.93 ± 0.45	2.62 ± 0.71	P=0.0122
FEV_1(L)	2.71±0.64	2.43±0.42	P=0.0129
FEV_1/FVC	97.34 ± 6.71	98.37 ± 3.23	P=0.3404
PEFR(L)	9.15 ± 0.76	7.58 ± 1.34	P=0.0119
MVV(L)	142.44±23.47	131.23 ±24.71	P=0.0249

Results

The recorded anthropometric data in cricket players and control groups did not show any statistical significance as shown in Table 1. The present study shows that among cricket players and sedentary controls, competitive cricketers have significantly higher values of forced vital capacity (FVC) (P=0.0122), Forced expiratory volume in first second (FEV1) (P=0.0129), and Maximum Voluntary Ventilation (MVV) (P=0.0249) and Peak Expiratory Flow Rate (PEFR) (P=0.0119). There was no significant difference in FEV1/ FVC ratio (P=0.3404) in cricket players and controls as shown in Table 2.

Discussion

Cricket has been an established team sport for hundreds of years and is one of the most popular sports in the world. It originated in England and is now very popular in countries such as India, Pakistan, Sri Lanka, Australia, the West Indies and South Africa. Competitive cricket is essentially a bat and ball sport. It is played by two teams and involves batting, fielding and bowling. There are 11 players a side and a game can last anywhere from several hours to several days. Cricket matches come in three formats: test, one-day and twenty-twenty. The former is usually considered a trial of a player's psychological strength, whereas the latter two usually judge his corporeal strength.

During the span of one match, the bowlers, batsmen, fielders and the wicket-keepers are subjected to tremendous physical and mental stress. For example the bowler in this sport usually bowls from a variable run-up. This run-up may range from a few feet to several meters.

Similarly, the batsman has to judge the pitch of the ball, and then use his muscles to artistically divert it to his location of choice. He then has to crossover to the other side and completes a run. The fielders have to remain vigilant throughout the course of the innings, and once the ball finds their territory, have to run on to gather it and then throw it back. These, along with the boons similar to those associated with other strategic team sports, imply that each cricket game is an intense and involving experience, and every minute spent on the field requires an intricate balance between the mind and the body.

Pulmonary function is governed by genetic, environmental and nutritional factors and confirms that physical training during growth help in developing a greater endurance in Respiratory muscles. Lung size may increase by a strenuous and prolonged strength training regimen during adolescence.[17]

Our study clearly shows that among competitive cricketers and sedentary controls, cricketers have statistically significant values of forced vital capacity (FVC) (P=0.0122), Forced expiratory volume in first second (FEV1) (P=0.0129), Maximum Voluntary Ventilation (MVV) (P=0.0249) and Peak Expiratory Flow Rate (PEFR) (P=0.0119). There was no significant difference in FEV1/FVC (P=0.3404) between two groups.

In the present study, it is observed that there is significant increase in Forced vital capacity in cricketers than controls. Muscular exercise increases the rate and depth of respiration and so improves FVC, the consumption of O2 and the rate of diffusion.[18] In the Amsterdam Growth and Heart study, physical activity was observed to be positively correlated to changes in FVC between ages 13-27 years over a period of 15 years.[19]

Forced expiratory volume in first second (FEV1) was significantly high in cricketers than controls. Hence, it can be stated here that the physically trained individuals, may have higher ventilatory capacity as well as FEV1. This might have been brought about by the fact that physical training not only improves the strength of skeletal limb and cardiac muscle, but also improves the accessory muscles for inspiration and expiration.[12]

Maximum voluntary ventilation (MVV) which depend both on the patency of airways and strength of respiratory musculature was significantly high in cricketers. MVV improvement might be due to superior expiratory power and overall low resistance to air movement in the lungs. The higher MVV value is advantageous for physical work capacity.[20-21]

The mean expiratory flow rate (PEFR) of cricket players was significantly higher than matched control group. The PEFR is an effort dependent parameter emerging from the large airways within about 100–120 ms of the start of the forced expiration.[22-23] PEFR can be therefore, be an easy test for quick assessment of improvement of an overall pulmonary function of the sportsmen. A continued high physical activity is associated with lower mortality, and delays decline in the pulmonary functions and therefore should be encouraged.[24]

Although there is some standing around, to play cricket the player need to be fit and strong. Cricket involves sprinting between wickets and running to stop balls, as well as bowling and throwing. Hence results from the present study suggest that playing competitive cricket 2-3 hours per day for minimum of 5 days a week for 3-6 years could cause strengthening of respiratory muscles with resultant increase in pulmonary function.

One limitation of our study is that most of our healthy subjects were from mid to upper socioeconomic strata and only male subjects were included in the study. This shortcoming may affect the generalization of the results to other sections of society. Our study was a cross sectional study. A follow up study with larger sample size is needed.

Conclusion

The current study has shown that, there is significant positive relationship between playing cricket and pulmonary function in healthy young men. The improvement in pulmonary function could be due to increased strength of respiratory muscles. So playing cricket can be recommended so as to improve the pulmonary function of an individual.

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Original Article

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Evaluation of Effects of Tobacco Chewing on Reaction Times

Noorjehan Begum*, V.S. Baljoshi, Sandhya H.P.***, Sathish M.***, S.B. Kulkarni******

Abstract

Background: India has one of the highest rates of oral cancer in the world, partly attributed to high prevalence of tobacco chewing. The WHO predicts that tobacco deaths in India may exceed 1.5 million annually by 2020.[1] **Aims and objectives:** 1) To study the ART, VRT, CRT, in tobacco chewers of duration 1-5 years. 2) To study the immediate effects on ART, VRT, CRT after chewing a packet of Gutka in tobacco chewers. **Materials and methods:** The study was conducted on 25 apparently healthy male tobacco chewers of age group 20-25 years and equal number of healthy age and sex matched controls. Simple (random and alert) and discrimination times were recorded in both groups using response analyzer (YSRT- 0101). **Results and Conclusions:** Simple reaction times (random and alert) were shortened in tobacco chewers before and after chewing a packet of Gutka due to the stimulatory effect of nicotine. The discrimination reaction times were prolonged in tobacco chewers before chewing a packet of Gutka and reason is not known. Further studies are needed in this regard. After chewing a packet of Gutka the discrimination reaction times were shortened in the cases; again this is attributable to stimulatory effect of nicotine.

Keywords: Gutka; Reaction time; Tobacco chewers.

Introduction

Humans have used tobacco for about a thousand years.[2] In India tobacco is usually taken along with pan (beetel quid) either as powdered dried leaves (patti) or as a paste (kiwam, zarda). A new form of smokeless tobacco was developed which is a low noicotine product sold in small pouches of the size of tea bags.[3] An increase in consumption of smokeless tobacco is apparent among children and adolescents. Increasing trends in the use of smokeless tobacco have been noted among high school and college students. Use of smokeless tobacco indeed represents a healthy concern of growing magnitude for children and adolescents. As a consequence of its addictive qualities, the consumption of smokeless tobacco often becomes a lifelong habit with cumulative and deleterious effects on health.[4]

In contrast to the voluminous literatures on the health effects of smoking, relatively little attention has been directed at smokeless tobacco and the factors that promote its use.[5]

More than 2000 chemical compounds have been identified in processed tobacco. Nicotine is a major component of tobacco. Nicotine administration has an effect on the functioning of the CNS.[4]

Reaction time has been defined as the time interval between the application of a stimulus and the response by the subject[6];

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or as the interval between go signal and onset of movement of electromyographic activity.[7] It evaluates performance of peripheral as well as central neural structures. It is an index of the biological efficiency of the brain mechanism and also reflects the effects of brain damage, mental disorders and other psychopthologies.[8]

Hence the present study was undertaken to evaluate the effects of chewing tobacco on reaction times.

Materials and Methods

The present study was conducted on twenty five apparently healthy male tobacco chewers of age group 20-25 years and equal number of healthy age and sex matched non tobacco chewers as controls(C). All of them were right handed and selected randomly. Duration of tobacco chewing was around 1-5 years and the number of packets being chewed were in the range of 2-10 packets per day. On an average the subjects chewed one packet of Gutka for 20-30 minutes.

Those subjects with history of diabetes, hypertension, mental apathies, neurological abnormalities or any diseases which affects the functioning of CNS, either in themselves or in their families were excluded from the study.

On the day before the study, Gutka chewers were instructed to abstain from Gutka chewing for at least three hours prior to the conduct of tests to avoid residual effects of their last Gutka chewing dose. And then the reaction times (ART, VRT, CRT, both simple and discrimination) were measured before(T1) and after 20 minutes of chewing a packet of Gutka(T2), in cases to determine the acute effects of the same on their reaction times.

The reaction times were measured using "Response-Analyzer" manufactured by "Yantrashilpa" electronics- 0101/pune [YSRT-0101]. This instrument works with a working supply of 10v.DC and equipped with a very sensitive quartz clock which can measure up to 1/10th of a millisecond. Display accuracy of the instrument is + 0.01 sec and display range is 9.999 seconds maximum. It is a micro-processor based system that can be programmed to measure the response times of the subject to various sensory stimuli, eg: vision, sound, electrical, etc.

Different programmes are used for producing auditory, light and cutaneous stimuli; subjects are instructed to press a response microswitch(thumb switch) as quickly as possible after the presentation of the stimuli but never before. The intensity of stimuli was kept constant for all the subjects.

Data was tabulated and analyzed statistically using paired t test, chi-square test with Yate's correction factor.

Results

The results are expressed as mean + SD.

1) Right hand reaction times were shorter than left hand reaction times; the difference being statistically significant for both simple reactions time and discrimination times.
2) Simple reaction times (random) in T1 group were shorter compared to C group, the difference being statistically significant.
3) Simple reaction times (random) in T1 group were shorter compared to C group, the difference being not statistically significant.
4) Discrimination reaction times in T1 group were longer as compared to C group, the difference being statistically significant.
5) Among tobacco chewers, chewing a packet of Gutka significantly (statistically) shortens both simple and discrimination reaction times.
6) Simple and discrimination reaction

Table 1: Simple Reaction Times: Rght Hand Average Values (in m.sec)

Type of reaction time	Parameters	(C) Control subjects Mean + SD (N=25)	(T1) Tobacco chewers before gutkha chewing Mean + SD (N=25)	(T2) Tobacco chewers after gutkha chewing Mean + SD (N=25)
R.R.T	A.R.T	269.46 + 3.79	266.02 + 3.57	245.07 + 2.93
	V.R.T	276.26 + 3.82	273.46 + 3.43	250.72 + 3.83
	C.R.T	282.24 + 4.90	279.62 + 3.72	255.81 + 3.57
AL. R.T	A.R.T	198.97 + 2.6	197.16 + 3.84	178.84 + 4.52
	V.R.T	205.07 + 4.45	203.33 + 3.71	182.77 + 4.4
	C.R.T	209.68 + 6.48	207.60 + 3.93	186.62 + 4.53

R.R.T C – T1 P < 0.05 (S) T1 – T2 P < 0.001 (H.S) C – T2 P< 0.001 (H.S)
AL. R.T C – T1 P > 0.05 (N.S) T1 – T2 P < 0.001 (H.S) C – T2 P< 0.001 (H.S)

Table 2: Left Hand Average Values (in m.sec)

Type of reaction time	Parameters	(C) Control subjects Mean + SD (N=25)	(T1) Tobacco chewers before gutkha chewing Mean + SD (N=25)	(T2) Tobacco chewers after gutkha chewing Mean + SD (N=25)
R.R.T	A.R.T	272.92 + 3.48	269.32 + 4.05	247.80 + 3.42
	V.R.T	279.00 + 4.57	276.25 + 3.64	253.73 + 3.02
	C.R.T	285.133 + 5.37	282.08 + 3.68	258.46 + 3.49
AL. R.T	A.R.T	201.73 + 3.14	200.18 + 3.95	180.42 + 4.62
	V.R.T	206.96 + 4.84	205.44 + 4.03	184.73 + 4.58
	C.R.T	211.9 + 7.11	210.26 + 7.30	188.82 + 4.59

R.R.T C – T1 P < 0.05 (S) T1 – T2 P < 0.001 (H.S) C – T2 P< 0.001 (H.S)
AL. R.T C – T1 P > 0.05 (N.S) T1 – T2 P < 0.001 (H.S) C – T2 P< 0.001 (H.S)

Table 3: Discrimination Reaction Times: Right Hand Average Values (in m.sec)

Type of reaction time	Parameters	(C) Control subjects Mean + SD (N=25)	(T1) Tobacco chewers before gutkha chewing Mean + SD (N=25)	(T2) Tobacco chewers after gutkha chewing Mean + SD (N=25)
D.R.T	A.R.T	307.51 + 6.02	312.52 + 7.41	290.4 + 7.79
	V.R.T	316.3 + 6.37	323.7 + 6.34	300.63 + 8.51

C – T1 P < 0.001 (H.S) T1 – T2 P < 0.001 (H.S) C – T2 P< 0.001 (H.S)

Table 4: Left Hand Average Values (in m.sec)

Type of reaction time	Parameters	(C) Control subjects Mean + SD (N=25)	(T1) Tobacco chewers before gutkha chewing Mean + SD (N=25)	(T2) Tobacco chewers after gutkha chewing Mean + SD (N=25)
D.R.T	A.R.T	309.91 + 5.98	316.23 + 6.93	294.05 + 8.14
	V.R.T	318.18 + 6.10	326.75 + 6.58	304.46 + 7.05

C – T1 P < 0.001 (H.S) T1 – T2 P < 0.001 (H.S) C – T2 P< 0.001 (H.S)

Abbreviations
ART – auditory reaction time
CRT – cutaneous reaction time
N – number of subjects enrolled for the study
RT – reaction time
VRT – visual reaction time

times in T2 group were shorter as compared to C group, the difference being statistically significant.

Discussion

Right hand RTs were significantly shorter than the left hand RTs (in both random and alert). This may be due to the fact that, the right handers possess a right shift factor which predisposes them to performance of skilled movements by right hand.[9]

Simple reaction times (random and alert) in T1 group were shorter compared to C group, the difference being statistically significant. Also the reaction times (both simple and discrimination) in T2 group were shorter after chewing a packet of Gutka. This is because the subjects were programmed to respond in advance of the stimulus to move i.e., to preprogrammed.[10] Also nicotine in small doses stimulates the CNS.[2] Hence it could be due to the presence of residual amount of nicotine in tobacco chewers. Since preprogramming is an optional strategy, it is the nicotine which excites the nicotinic receptors in the adrenal medulla and causes the release of epinephrine. The increased sympatho adrenal response is also associated with an increase in alertness.[11]

Discrimination reaction times in T1 group were longer as compared to C group, the difference being statistically significant. But the exact cause of this is not known.

Conclusion

Simple reaction times were shortened in tobacco chewers before and after chewing a packet of Gutka. This can be attributed to the stimulant effect of nicotine. But the discrimination reaction times were prolonged in tobacco chewers before chewing a packet of Gutka and reason is not known. Further studies are needed in this regard. After chewing a packet of Gutka the discrimination reaction times were shortened in the cases; again this is attributable to stimulatory effect of nicotine.

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Short Communication

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Endoplasmic Reticulum Stress and Peripheral Neuropathy: A Relation or a Reaction

Kumar Senthil P.*, Adhikari Prabha, Jeganathan*****

Abstract

The objective of this short communication was to provide evidence for cause-effect inter-relationship and action-reaction association between Endoplasmic reticulum stress (ERS) and Peripheral Neuropathy along a structure-function continuum. ERSplayed an important role in pathogenesis of prediabeticand diabetic neuropathy, bortezomib-induced peripheral neuropathy and Familial amyloid polyneuropathy. Whilst the existing evidence confirmed the presence of ERS in peripheral neuropathy, the ERS-based interventions had mixed results.

Keywords: Endoplasmic reticulum stress; Peripheral neuropathy; Neurophysiology; Molecular neurology.

Endoplasmic reticulum stress (ERS) played an important role in pathogenesis of diabetic neuropathy[1] which was reiterated by the findings of Lupachyk *et al*[2] who regarded ERS manifestation in upregulation of multiple components of unfolded protein response in neural tissues (sciatic nerve, spinal cord) of rats with DPN. Interventions using a chemical chaperone, trimethylamineoxide and4-phenylbutyric acidattenuated endoplasmic reticulum stress, peripheral nerve dysfunction, intraepidermal nerve fiber loss, and sciatic nerve and spinal cord oxidative-nitrative stress in streptozotocin diabetic rats.

Lupachyk *et al*[3] evaluated the role for ERS in prediabetic neuropathy using two animal models i.e., Zucker (fa/fa) rats and high-fat diet fed mice and found that ERS manifested in upregulation of the glucose-regulated proteins BiP/GRP78 and GRP94 of unfolded protein response was identified in the sciatic nerve of Zucker rats. "A chemical chaperone, trimethylamine oxide, blunted endoplasmic reticulum stress and alleviated sensory nerve conduction velocity deficit, thermal and mechanical hypoalgesia, and tactile allodynia. A selective inhibitor of eukaryotic initiation factor-2á dephosphorylation, salubrinal, improved glucose intolerance and alleviated peripheral nerve dysfunction in high-fat diet fed mice."

Shin *et al*[4] explained,"bortezomib-induced peripheral neuropathy (BIPN) was characterized by "acute but transient endoplasmic reticulum (ER) damages to Schwann cells. These damaged Schwann cells exhibit abnormal outcomes from healing processes such as the myelination of Remak bundles. A morphometric analysis of polymyelinatedRemak bundles revealed that the pathological myelination was not related to the axonal parameters that regulate the normal myelination process during development. In addition, demyelinating macrophages were focally infiltrated within endoneurium of the sciatic

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nerve. We applied a gene microarray analysis to bortezomib-treated primary Schwann cells and verified the changes of several gene expression in bortezomib-treated sciatic nerves. The analysis showed that bortezomib-induced ER stress was accompanied by the activation of several protective molecular chaperones and the down-regulation of myelin gene expression. ER stress inducers such as thapsigargin and bredelfin A also suppressed the mRNA expression of myelin gene P0 at transcriptional levels. In addition, the expression of chemokines such as the macrophage chemoattractants Ccl3 and Cxcl2 was significantly increased in Schwann cells in response to bortezomib and ER stress inducers. Taken together, these observations suggest that the pathological adaptive responses of Schwann cells to bortezomib-induced ER stress may, in part, participate in the development of BIPN."

Teixeira *et al*[5] investigated the involvement of endoplasmic reticulum (ER) stress response in familial amyloid polyneuropathy (FAP) by showing activation of the classical unfolded protein response pathways in tissues not specialized in transthyretin (TTR)synthesis but presenting extracellular TTR aggregate and fibril deposition. They also proved cytotoxicity by Ca2+ efflux from the ER in cell cultures incubated with TTR oligomers.

ERS played an important role in pathogenesis of prediabetic and diabetic neuropathy, bortezomib-induced peripheral neuropathy and Familial amyloid polyneuropathy. Whilst the existing evidence confirmed the presence of ERS in peripheral neuropathy, the ERS-based interventions had mixed results.

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Reports of randomized clinical trials should be based on the CONSORT Statement (http://www. consort-statement. org). When reporting experiments on human subjects, indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000 (available at http://www.wma.net/e/policy/l 7-c_e.html).

Results

Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text; alternatively, it can be published only in the electronic version of the journal.

Discussion

Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, what this study adds to the available evidence, effects on patient care and health policy, possible mechanisms); Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

References

List references in alphabetical order. Each listed reference should be cited in text (not in alphabetic order), and each text citation should be listed in the References section. Identify references in text, tables, and legends by Arabic numerals in square bracket (e.g. [10]). Please refer to ICMJE Guidelines (http://www.nlm.nih.gov/bsd/uniform_requirements.html) for more examples.

Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006;35:540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003;61:347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997;195 Suppl 2:3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000;71:1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O, Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

More information about other reference types is available at www.nlm.nih.gov/bsd/uniform_requirements.html, but observes some minor deviations (no full stop after journal title, no issue or date after volume, etc).

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Tables should be self-explanatory and should not duplicate textual material.

Tables with more than 10 columns and 25 rows are not acceptable.

Number tables, in Arabic numerals, consecutively in the order of their first citation in the text and supply a brief title for each.

Explain in footnotes all non-standard abbreviations that are used in each table.

For footnotes use the following symbols, in this sequence: *, ¶, †, ‡‡,

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