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EFFECT OF RAJA YOGA MEDITATION ON AUDITORY REACTION TIME

Physiology

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ABSTRACT

Background: In today's modern scenario, stress is a part of day to day life. Stress gives rise to various diseases e.g. diabetes mellitus, hypertension, psychosomatic diseases. In diabetes mellitus (T2DM) reaction time, which is a reliable indicator of attention and fine motor skills, was found to be slowed. Hence ways to relieve stress are gaining importance. The Meditation is considered as an antidote to minds vulnerability to toxic emotions and stress. Raja Yoga meditation is simple, and easy to practice method of meditation. The present study is done to find out effect of Raja yoga meditation on auditory reaction time and blood glucose level in T2DM patients.

Material and Methods: Study was conducted on three groups, Group I: 30 Non diabetic, non meditators, Group II: 30 Non-meditators, diagnosed T2DM for more than 5 yrs, Group III: 30 diagnosed patients of T2DM for more than 5 yrs and practicing Raja yoga meditation for more than 5 yrs. Their blood glucose level and Auditory Reaction Time (ART) was recorded.

Results: The mean value of the ART for High frequency sound (HFS) and Low frequency sound (LFS) were significantly high in diabetic non-meditators as compared to controls ($p<0.05$) and significantly low in diabetic meditators as compared to diabetic non-meditators. Blood glucose level and glycated hemoglobin levels were significantly lower in diabetic meditators.

Conclusion: Practice of Raja yoga meditation may have extensive positive effects on many factors important in T2DM management and prevention, including glycaemic control and ART.

KEYWORDS

Raja Yoga Meditation, Diabetes mellitus, Auditory reaction time, Glycaemic status

Anxiety, stress and mental tensions have become almost foreseeable companions of human life at all cross sections of populations (1).Diabetes poses a major life stress that requires considerable physical, emotional, and psychological accommodation and coping. Diabetes has also been shown to affect peripheral nerves in the somatosensory (2) and auditory system (3), slows psychomotor responses (4),and has cognitive effects, all of which may affect reaction time

The time interval between the application of a stimulus and the emergence of appropriate voluntary response by a subject is called Reaction time (RT). It involves stimulus processing, decision making, attention mechanism, and response programming (5).

The use of meditation as an intervention in mental health and health care has grown significantly; it reduces stress and improves the health and well-being of individuals with diabetes. Wallace et al, termed meditation a "wakeful, hypometabolic state of parasympathetic dominance" (6).A vast complexity of biological organization indicates that the physiological response to meditation probably occurs on a multidimensional, interactive basis. Further, meditation produces specific neural activation patterns involving decreased limbic arousal in the brain, which in turn results in reduced stress and increased autonomic stability (7,8). With this point of view, this study was undertaken to see the effects of practice of Raja yoga meditation on glycaemic control and on auditory reaction time in T2DM patients.

Material And Methods

The present study was carried out in Department of Physiology. After approval from institutional ethics committee written informed consent was obtained from all the participants of the study. The sample size needed was calculated to 30 per group considering the mean ± S.D. of the parameters with α Error (%) -5%, Power - 80%, ½ sided test -2.

Participants were asked to report to the Dept of physiology at 9:00 am. The participants were divided into three groups (n= 30).Group I: Healthy participants (nondiabetic, nonmeditators) were selected randomly from the non teaching staff of the institution. Group II: Non-meditators diagnosed Type II DM for more than 5 yrs visiting diabetic OPD of our institute. Group III: Diagnosed type II DM for more than 5 yrs. and practicing Raja yoga meditation for one hour every morning for more than 5 years, at the local Bramhakumari center (Mahal), Nagpur. Participants with history of sports training, previous experience of yoga, history of hearing disability, musculoskeletal disorder, hypertension, type I DM, history of major surgery in the recent past, smoking, alcohol consumption and non-vegetarian diet, pregnant and lactating women were not included in the study.

The participants were asked to remain to fast for 10-12 hours. After detailed history and clinical examination anthropometric parameters were recorded. Fasting blood sample was collected. The Post prandial blood sample was collected 2 hours after meal on the same day. Fasting blood sugar (FBS) and postprandial blood sugar (PPBS) was quantitatively estimated using semiauto analyzer (Transasia, ERBA, Chem-5 plus). For auditory reaction time- Apparatus used in this study was the portable simple audiovisual timer or 'Response Analyzer' by INCO "Yantra Shilpa" Systems, Pune. Mean and Std. deviation was calculated using SPSS software. One-way analysis of variance was performed to find the significance between the means. In addition, Bonferroni test of multiple comparisons was used to identify pairs in which means were significantly different.

Results

Table 1: Group wise comparison of Anthropometric parameters

Variables	Group I (n=30) (mean ±SD)	Group II (n=30) (mean ±SD)	Group III (n=30) (mean ±SD)	P value I Vs. II	P value I Vs. III	P value II Vs. III
Age (Yrs)	51.43±5.39	50.33±6.21	53.23 ±5.43	1.000	0.672	0.155
Height (cms)	157.71±6.20	158.58±6.68	157.16±6.20	1.000	1.000	1.000
Weight (kgs)	64.16±7.22	66.06±11.00	66.16±9.77	1.000	1.000	1.000

$p<0.001$ very highly significant, $p<0.01$ highly significant, $p<0.05$ significant, $p>0.05$ non significant

The differences in mean age, height and weight of all participants were not statistically significant ($p>0.05$) Table 1.

The mean value of FBS, PPBS and glycated hemoglobin were significantly higher in diabetics as compared to controls ($p<0.05$), but these values in diabetic meditators was significantly lower than in diabetic non- meditators ($p<0.05$). Table 2

Table 2: Comparision of Glycemic status in groups (Mean±SD)

Variables	Group I (n=30) (mean ±SD)	Group II (n=30) (mean ±SD)	Group III (n=30) (mean ±SD)	P value I Vs. II	P value I Vs. III	P value II Vs. III
FBS (mg/dl)	85.83± 8.12	160.66±33.0	132.75±36.43	0.000	0.000	0.001
PPBS (mg/dl)	120.93±8.79	263.8±35.29	198.47±40.11	0.000	0.000	0.000
GHb (%)	-----	8.13 ± 0.82	7.2 ±2.00	----	-----	0.030

$p<0.001$very highly significant, $p<0.01$ highly significant, $p<0.05$ significant, $p>0.05$ non significant

The mean value of the reaction time for HFS and LFS were significantly high in diabetic non- meditators as compared to controls ($p<0.05$) and significantly low in diabetic meditators as compared to diabetic non- meditators. There were no significant differences in the mean values of HFS and LFS between Control and diabetic meditators. Table 3

Table 3: Group wise comparison of auditory reaction Time (Mean±SD)

Variables	Group I (n=30) (mean ±SD)	Group II (n=30) (mean ±SD)	Group III (n=30) (mean ±SD)	p-value I Vs. II	p-value I Vs. III	p-value II Vs. III
HFS(Sec)	0.158 ± 0.018	0.210 ± 0.051	0.150 ± 0.033	0.000	1.000	0.000
LFS (Sec)	0.161 ± 0.088	0.205 ±0.049	0.161 ± 0.034	0.020	1.000	0.020

$p<0.001$very highly significant, $p<0.01$ highly significant, $p<0.05$ significant, $p>0.05$ non significant. HFS- High frequency sounds, LFS- Low frequency sounds

Discussion:

Reaction time is a measure of function of sensory-motor association and performance of an individual. It is a simple and non-invasive test for peripheral as well as central neural structures.

In the present work, it has been demonstrated that practicing Raja yoga meditation produces a significant shortening in ART in diabetic patients. Shortening of ART can be explained by increase in sensory-motor conduction velocity and/or faster information processing in the central nervous system.

This may be due to greater arousal, faster rate of information processing, improved concentration and/or an ability to ignore extraneous stimuli. Raja yoga Meditation results in decreased mental fatigability and increase in performance quotient. Similar findings were reported by Udupa KN et al (9), Malathi A et al (5), Madanmohan et al (10), Borkar AS et al (11) and Madanmohan et al (12) where they reported yoga produces a significant decrease in visual and auditory reaction time. Narayana N.V.V.S. (13) observed significant ($p<0.01$) effect of yoga on visual reaction time. In 2010 Biswas D. A. (14) observed significant ($p<0.01$) declined in visual reaction time and significant ($p<0.05$) change in auditory reaction time after 4 weeks of Yoga. Visual reaction time declined significantly ($p<0.01$) after 4 weeks of Raja yoga Meditation in healthy volunteers.

The link between mind & the body has been scientifically related. The role of limbic system of the brain in regulating the homeostatic condition in the body by influencing the visceral mechanism through the automatic nervous outflow & endocrine secretions are now well known. The proper conditioning of the nervous system can maintain the normal homeostasis. The process of mental relaxation may thus be expected to produce such conditioning .Regular practice of meditation is linked with increased thickness in a subset of cortical regions associated with somatosensory, auditory, visual, and interoceptive processing.(15,16)

Activation of right hemisphere is seen during the actual act of meditation. (15,16) It is especially fascinating to find that a lot of changes linked with the active meditation state were noted in the frontal lobe. This area is involved with the focus of attention. (17) Regular meditation practice may bring down age-related thinning of the frontal cortex. Increased cortical thickness could be owing to greater arborization per neuron, increased glial volume, or raised regional vasculature.(18,19,20) The right anterior insula is associated with bodily attention and raised visceral awareness. Increased thickness in this region is associated with increased capacity for awareness. (21) The right hemisphere is essential for sustaining attention, which is a center for insight meditation. It has been hypothesized that by becoming increasingly more aware of sensory stimuli during formal practice, the meditation practitioner is progressively able to use this self-awareness to more successfully navigate through potentially stressful encounters that emerge throughout the day.(22,23) Long-term meditation practice is linked with modified resting electroencephalogram patterns, indicative of long-lasting alterations in brain activity.(16) Meditation reflects cognitive brain functions such as sequential information processing, stimulus discrimination, and short-term memory.(24)

Fasting as well as post-prandial blood glucose levels decreased significantly in meditators. This is consistent with earlier studies that have reported that yoga training results in a reduction in both FBG and PPBG levels and better glycemic control. (25,26) Sahay (27) has reported an improvement in insulin sensitivity and decline in insulin resistance in subjects practicing yoga while Manjunatha et al.,(28) reported that the performance of asanas leads to an increased sensitivity of the ß cells of pancreas to glucose signals. It is possible that a similar mechanism is responsible for the improvements in blood sugar levels of our participants. Increased sympathetic activity, enhanced cardiovascular reactivity and reduced parasympathetic tone have been strongly implicated in the pathogenesis of insulin resistance syndrome, atherosclerosis and cardiovascular diseases. Innes and Vincent (29) have suggested that yoga reduces this risk profile by decreasing activation of the sympatho-adrenal system and the hypothalamic-pituitary-adrenal axis and also by promoting a feeling of wellbeing along with direct enhancement of parasympathetic activity via the vagus nerve. All these factors are applicable to our study and may explain the positive changes produced T2DM patients doing Raja yoga Meditation.

Conclusion

In conclusion, our study shows that there is significant decrease in auditory reaction time and blood glucose level in diabetic Raja yoga meditators as compared to diabetic non-meditators. Meditation has beneficial effects of standard medical management of T2DM and can be used in a successful complementary or integrative therapy program.

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