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Effect of yoga asana and pranayama on P300- an event related potential in type 2 diabetes

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Abstract

Background: The P300 (Event related potential) occurs almost 300msec subsequent to the given stimulus, a precise measure of neuronal functioning. The shorter latencies are associated with superior cognitive performance. In diabetes mellitus hyperglycemia has the strongest association in developing the risk of cognitive impairment and prolonged P300 latencies. **Objective**: To observe the effect of yogasana and pranayama on P300 latencies and amplitudes in diabetic patients. **Method**: An interventional study was done in Physiology Department, Rajastana University Health Science(RUHS) college of medical science(CMS), Jaipur, India. Total 120 patients with type 2 diabetes of both sexes aged 40 to 60 years d 60 were recruited by simple random sampling and randomized equally into two groups. study group included 60 patients assigned with yoga intervention for 45 days and control group included 60 patients without yoga. An event related potential P 300 was measured by NCV/EMG machine, Clarity India After collecting baseline data of all diabetic patients, yoga intervention was given for 45days in study group subjects only. Post yoga data was collected in study group and post 45 days data in control group. Data was statistically analyzed using student paired and unpaired t test. **Result**: Mean P300 latency in study group significantly decreased from baseline after yoga (at Cz-A1322.14±18.95 to 312.96±13.31msec p-value 0.002 and at Cz-A2 331.64±19.60 to 319.17±11.75 msec p-Value0.0001). Mean P300 amplitude significantly decreased in control group after 45 days. (atCz-A216.49±5.09µV to 14.77±4.30µVpValue 0.047). **Conclusion:** This study concluded that yoga can effectively reduce event related potential P300 latencies and enhance amplitude in type 2 diabetes mellitus patients..

Keywords: Diabetes, Event Related Potential, P300-Latency, P300Amplitude,Yogasana.

Introduction

P300 is neuro physiological tool to assess cognitive function. It is long latency Auditory Evoked potential which is represented by a series of positive and negative waves.There are two components of event related potential, the N200 and P300. N200 wave is associated with the perception, discrimination, recognition and classification of an auditory stimulus and P300 occurs when the individual consciously recognizes the change in the auditory stimulus[1].The wave amplitude is expressed in microvolts and latency in milli seconds[2,3,]. P300 latency is an indicator of processing time required before producing are sponsetorate stimulus. It is a measure of neuronal functioning which is responsible for the processing of immediate memory[4].P300 latency has a negative correlation with intellectual functions in normal subjects[5].In diabetes mellitus hyperglycemia mediated advanced glycosylated end product production and oxidative stresses are considered as the factors that can damage neurons and vascular endothelium leading to cognitive dysfunction[6]. Hyperglycemia has the strongest association with the risk of developing cognitive impairment[7]. P300 has been shown to be more sensitive in detecting cognitive deficits than psychometric tests in type 2 diabetesmellitus[8]. Yoga is often depicted metaphorically as a tree that comprises eight aspects, or limbs (asthanga).They are Yama (universal ethics), niyama (individual ethics), asana (physical postures), pranayama (breathcontrol), pratyahara (control of the senses), dharana (concentration), dyana (meditation) and Samadh i(bliss)[9]. Each limb is connected with the whole, in the same way that bodily limbs are all connected with each other[9]. Regular practices of yoga is associated with the reduction of basal cortisol and catecholamine secretion, a decrease in sympathetic activity with the corresponding increase in parasympathetic activity. It also reduces metabolic rate and oxygen consumption that has salutary effect on cognitive functions and cerebral neurophysiology[10].

Hence in present study was done to see beneficiary effects of yoga on cognitive parameter P300 latencies and amplitude in type 2 diabetic subjects.

Method

Design and Setting

The present study was an interventional in design and conducted in the Department of Physiology and Department of Medicine of RUHS College of Medical Sciences, Jaipur, Rajasthan between period of April 2022 to January 2023.

Study participants

Totall 120 patients of both sexs aged 40-60 years who had history of type2 diabetes mellitus>5years, participated in this study**.** They were recruited from the OPD of the Department of Medicine of RHS-CMS, Jaipur by simple random sampling. They were randomized into two groups. Study group included 60 patients assigned for Yoga whereas control group included 60 diabetic patients without yoga.

Exclusion criteria

Subject aged>60 years were excluded to avoid age related cognitive impairment. Subject with nasal obstruction and laryngeal obstruction, who had performing yoga since last 6 months, who had any hearing or visual impairment, previous history of neurological illness eg. stroke, paraplagia, mental illness e.g. depression, psychosis and cardiovascular disease eg. MI were excluded. Pregnant and lactating females were also excluded.

Sample Size

Sample size was calculated as 60 diabetic subjects in each group, including10% drop out rate, at95% confidence interval and considering 80% power by using primer of statistics 6.0 version software.

Data collection procedure

Subjects were pre-informed about study by participant information sheet in Hindi and English both languages. Written informed consent form

was taken from all subjects. Baseline and post yoga data collection was done by taking history, biochemical test fasting plasma sugar, HbA1C.

P300 recording

Neurophysiological parameter P300 (Event Related Potential)was recorded by using NCV/ EMG machine-make clarity at Neurophysiology lab in the Department of Physiology. The subjects were asked not to consume caffeine and tannin containing drinks before the test and until the completion of the test. The P 300recording was done in the morning hours. It was recorded on the basis of ast and ard auditory odd ball paradigm. Disc type of Ag/AgCl electrodes were used to pick up the evoked responses from scalp. Skin preparation(cleansing and degreasing)was done by Ten 20 jelly. Recording electrodes was placed on the scalp at Cz position and reference were at post auricular position. All electrodes were connected to a junction box. The impedance was kept below 5K ohms. Patients were instructed to keep their eyes closed, avoid eye movement to reduce artifact. One or two trial sessions was given till discrimination of target and non target stimuli.

Intervention

Study group was intervened with yoga for 45 days daily for 50-60 min (Table I)[11]. Video clip of yoga asana and pranayama was made by certified yoga instructor and provided to the subjects. Follow up was done on daily text messages and self recorded clips on Whats app group.

Outcome measure

P300 latency and amplitude was of recorded at electrode A1 and A2 of central zone (Cz) of scalp

Statistical analysis

Student t test(both paired and unpaired)was used for statistical analysis. Relationship between the variables was assessed by Karl Pearson's correlation test. P value<0.05 was considered statistically significant.

Results

Demographic and biochemical data of all participants of both group was presented in table II. There was no significant difference in all these data between groups. Comparison of baseline P300 parameters of between study and control group found no significant difference.(table III) Paired group comparison showed mean P300 latency significantly decreased after yoga in study group diabetics at both montage(p-0.002; p-0.0001) whereas P300 latency significantly (p 0.026) increased and P300 amplitude significantly (0.047) reduced at Cz-A2 in diabetic control group after 45 days of follow up. No significant change in P300 amplitude was noted in study diabetics after yoga. (Table IV). Comparison of data after 45 days of yoga and follow up showed P300 latencies at both montages, was significantly lower whereas P300 amplitude at Cz-A2 was significantly higher in yoga group diabetics compared to diabetic patients without yoga. (Table V).

Table I: Various Pranayama and Asanas followed by study group subjects for 45 days (50-60 minute daily)

Pranayama	Duration
Bhastrika	3-5 min
Kapal Bhati	10 min
Anuloma- viloma	5-10 min
Bhramari	5 times
Om Uccharan	5 times
Asanas	
Suryanamaskar	3-7 min
Tadasana	15 sec - 1 min
Trikona- asana	15 sec - 1 min each side
Paschimottanasana	15 sec - 1 min each side
Bhujangasana	3-7 turns
Shavasana	2-5 min

Table II: Demographic and biochemical data of all participants of both group(N=120)

Parameters	Study(n=60)	Control(n=60)	P value
Male no.(%)	25(41.66)	24(40)	0.068
Female no.(%)	40(56.33)	31(43.66)	0.073
Age(Yrs)	50.51±6.87	52.68±6.85	0.085
BMI(Kg/m^2)	23.87±4.29	23.24±4.87	0.457
Fasting plasma Glucose (mg/dl)	122.96±65.24	132.51±69.71	0.440
HbA1C(%)	8.76±1.77	8.84±1.88	0.810

Data were expressed as mean±SD and in %.For statistical analysis student unpaired t test and chi square test was done.BMI-Body mass index, HbA1C-Glycosylated hemoglobin A1

Table III: l data of P 300 of all participants of both group at baseline (N=120)

Parameters	Study(n=60)	Control(n=60)	P value
P300LatencyCz-A1 (msec)	322.14±18.95	324.55±19.94	0.499
300LatencyCz-A2 (msec)	322.14±18.95	324.55±19.94	0.684
P300Amplitude Cz-A1(µV)	12.62±4.01	14.02±4.36	0.069
P300AmplitudeCz-A2(µV)	16.51±4.19	16.49±5.09	0.983

Data were expressed as mean±SD and in %.For statistical analysis student unpaired t test was done.

Table IV: l data of P 300 of all participants of both group pre and post yoga/follow up (N=120)

Parameters	Study (n=60)		P	Control(n=60)		P
	Pre yoga	Post yoga	value	Pre 45 days	Post 45days	value
P300LatencyCz-A1 (msec)	322.14±18.95	312.96±13.31	0.002	324.55±19.94	330.46±18.04	0.091
300Latency Cz-A2 (msec)	331.64± 19.60	319.17±11.75	0.0001	330.24±17.79	337.23±16.23	0.026
P300Amplitude Cz-A1(µV)	12.62±4.01	13.54±3.95	0.208	14.02±4.36	12.92±3.53	0.131
P300AmplitudeCz-A2(µV)	16.51±4.19	17.68±4.17	0.127	16.49±5.09	14.77±4.30	0.047

Data were expressed as mean±SD. For statistical analysis student paired t test was done.

Table V: P 300 of all participants of both group at post yoga/follow up (N=120)

Parameters	Study (n=60) Post yoga	Control(n=60) Post 45days	P value
P300LatencyCz-A1 (msec)	312.96±13.31	330.46±18.04	0.000
300Latency Cz-A2 (msec)	319.17± 11.75	337.23±16.23	0.000
P300Amplitude Cz-A1(µV)	13.54±3.95	12.92 ±3.53	0.361
P300AmplitudeCz-A2(µV)	17.68±4.17	14.77±4.30	0.000

Data were expressed as mean±SD. For statistical analysis student unpaired t test was done.

Discussion

In present study 120 Diabetic patients were included. Both study and control group consists 60 subjects. Female subjects had higher proportion than male. This result was similar to others.[12] There was significant reduction in P300 latency in diabetics at both montages after yoga intervention. These results agreed to one previous study [11]who also studied yoga effect on event related potential in diabetic subjects. It is also noteworthy that the latency atCz-A2was significantly increased after 45 days in diabetics who were not performing yoga. In addition, yoga significantly increased the amplitude of P 300 at both montages while significantly decreased amplitude atCz-A2 was noted in diabetics after 45 days who did not perform yoga . The explanation for the reduction in P300 latencies and increase in amplitudes after yoga may be linked to the breathing pattern employed in yoga based practice promotes synchronization of cortical areas by stimulation of thalamic nuclei, which has a positive impact on alertness and executive functioning[13,14].These paced breathing also increases the release of prolactin and oxytocin release which can promote feelings of calmness[15].Slow breathing rate in pranayamas with matched inhalations and exhalations decreases chemo reflex sensitivity—i.e., the naturally occurring change in breathing rate in response to changes in the concentration of oxygen and carbon dioxide in the blood[16]. breathing rhythm intervention also decreases oxidative stress—i.e., an imbalance between the production of reactive oxygen species and antioxidant defenses[17].

Conclusion

Present study concludes that yoga has beneficial effect on neurocognitive parameter P300 in type 2 diabetes mellitus subjects. It can be incorporated in these patients as adjuvant therapeutics.

Ethical aspect

This study involving human subjects received ethical approval by the institutional ethical committee of RUHS –CMC Rajasthan, India

Conflict of interest

Authors declare no conflict of interest.

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