HHS Public Access

Author manuscript

Natl J Physiol Pharm Pharmacol. Author manuscript; available in PMC 2017 March 13.

Published in final edited form as:

Natl J Physiol Pharm Pharmacol. 2017 ; 7(3): 232–235. doi:10.5455/njppp.2017.7.0825508092016.

Beneficial Effects of Yogasanas and Pranayama in limiting the Cognitive decline in Type 2 Diabetes

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Abstract

Background—Out of many complications that were observed in type 2 diabetes, cognitive impairment is the most neglected.

Aim and Objectives—The aim of the present study is to assess the cognitive decline in type 2 diabetes and to observe the role of yogasanas and pranayama in ameliorating the cognitive decline.

Materials and methods—Sixty eight type 2 diabetic subjects were recruited in the study, 34 of them did specific yogasanas and pranayama (test group) for six months and the remaining age and sex matched 34 subjects were recruited as (control group) who were not on any specific exercise regimen. Glycaemic index was estimated by measuring the glycosylated haemoglobin (HbA_{1c}) concentration with Bio-Rad apparatus and cognition was assessed by using Addenbrook's Cognitive Examination-Revised (ACE-R), which is a neuropsychological battery.

Statistical analysis—Data was analysed with unpaired student t test. P value<0.05 is considered as statistically significant. Validity was assessed by receiver operating characteristics

Results—Analysis of data indicated more cognitive scores in the test group when compared with the control group. In test group six months practice of yogasanas and pranayama has also significantly brought down the high glycaemic values which were observed in the control group.

Conclusion—These findings allow the study to conclude that regular practice of yogasanas and pranayama has a beneficial effect on cognitive performance in type 2 diabetic subjects by stabilizing blood glucose.

Keywords

Addenbrook's Cognitive Examination-Revised; Cognition; HbA1c; Type 2 diabetes; Yogasanas and pranayama

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Conflict of interest: None.

Introduction

Type 2 diabetes mellitus is the result of non-responsiveness by the peripheral tissues to the secreted insulin or because of decreased insulin production from the pancreas, it is also called as noninsulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes [1]. Globally 382 million people are suffering with diabetes and 90% of them are type 2 diabetics, it is expected that 592 million people are going to be affected with diabetes by 2035 [2]. Diabetes affects central nervous system, which includes damage to cranial nerves, brain, spinal cord and autonomic neuropathy. Apart from these many specific regions of the brain gets damaged either by demyelination, atrophy or by accumulation of oxidative end products resulting in alteration in brain metabolites [3]. All of these can result in cognitive decline. Cognition can be defined as the processes an organism uses to organize information, which includes perception, attention, understanding and retaining information, and it can be used to guide the behavioural aspects of the persons [4]. Cognitive decline is 1.2 to 1.5 fold more in diabetic patients than the normal individuals [5]. Cognitive function assessed by addenbrooke's cognitive examination revised. Since its inception a decade ago, ACE-R has been translated into various languages and widely used in detecting cognitive impairment. Unfortunately clinicians are not advising cognitive screening for diabetics as many of them are blindly ignoring the significance of cognition rather understanding its role in one's life. Earlier studies have proven that specific yogasanas and pranayama can be used as therapeutic measure in treating endocrine, physical, physiological, psychological elements if it is done over a period of time [6, 7]. Stabilization in basic biochemical levels of the parameters and correcting the metabolic derangement might have contributed to the positive outcomes that were observed with yogasanas and pranayama [8]. Therefore the present study was under taken to assess the cognitive decline in type 2 diabetics and also to observe the beneficial effects of specific yogasanas and pranayama in limiting the cognitive decline in type 2 diabetes.

Materials and methods

Present study was approved by the institutional ethical committee, and the subjects were recruited after obtaining the written informed consent. Sixty eight type 2 diabetic subjects were recruited in the study, 34 of them (test group) practiced specific yogasanas and pranayama for 45–60 minutes per day, for six days in a week, over a period of 6 months. They did yogasanas namely, dhanurasana, naukasana, arthamasthendrasana, bhujangasana which were mentioned in table 1, and pranayama namely, anuloma-viloma, surya anuloma-viloma, chandra anuloma-viloma and nadishuddi pranayama which were mentioned in table 2, for a period of 6 months under the supervision of yoga expert. These yogasanas and pranayama were selected based on their beneficial effects in diabetes by the earlier research work by Sahay BK et al., 2007. Age, sex and years of education matched 34 type 2 diabetic subjects who were not on any specific exercise regimen were included in the study as control group. Control group subjects were selected from the same locality, this precaution was taken to minimize the effects of cultural, socio-economical and educational status on cognition between the test and control groups. Both test and control group subjects are taking oral hypoglycemic agents since they were diagnosed as diabetic patients. Inclusion criteria: type 2 diabetes patients aged between 35–65 years, both the sex, minimum duration

of diabetes is 2 years, HbA1c > 6 were included in the study. And the exclusion criteria: cognitive impairment from childhood, other endocrine disorders, recent history of major surgeries, ACE-R score less than 82, smoker's, alcohol consumer's and type 2 diabetics who are on insulin treatment.

Glycosylated haemoglobin (HbA_{1c}) levels were estimated by using the Bio-Rad D-10™ HbA1c program, and it is intended for the percent determination of HbA1c in human whole blood using ion-exchange high-performance liquid chromatography (HPLC). Cognition will be assessed by using Addenbrook's Cognitive Examination-Revised (ACE-R), a neuropsychological battery, by considering attention/orientation (18 points), language (26 points), memory (26 points), verbal fluency (14 points) and visuospatial (16 points) domains. It takes around 15 minutes to administer the test and having a maximum score of 100. Scores above 88 are considered as normal cognition. Scores from 88 – 83 are considered with mild cognitive impairment and scores ≤ 82 are with dementia [5]. ACE and ACE-R were been translated into many languages worldwide, including Indian regional languages like Malayalam, [9] Hindi and Telugu and thus these translations are useful in assessing the cognition in a large number of independent cohort studies. Additionally yoga has been studied for controlling both the symptoms and the complications associated with type 2 diabetes mellitus [10]. For those who can speak only local language (Telugu), we adopted Addenbrooke's Cognitive Examination Revised.

Setting

Study was conducted at MediCiti Institute of Medical Sciences, Hyderabad and intervention was given at Yogi Vemana Yoga Research Institute, Hyderabad.

Statistical analysis

Statistical analysis was conducted by using Med Calc Statistical Software version 12.7.8 (Med Calc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2014). Unpaired student t test was done to observe the differences in mean values in between test and control group, p value <0.05 was considered as statistically significant. Then Receiver Operating Characteristics (ROC) was done.

Results

Area under the ROC curve is a measure of diagnostic accuracy and it was found out to be 0.88. The cut off scores were got to be 88/100 and it is justified on the basis of this study that it didn't include a normal control group and hence it shows more representative of day to day clinical practice. ACE-R is effective in diagnosing cognitive impairment in type 2 diabetics with a sensitivity of 82.35 (95% CI 65.5–93.2) and specificity of 85 (95% CI 68.9–95.0) at a cut of value of 88. Sensitivity of the test is less compared to the previous studies and that is because of the less sample size (34). Sensitivity is 100% at a cut of value of 82 but showed a poor specificity. Sensitivity and specificity were not done at all ACE-R scoring levels, as our sample size is less and also the study did not include the subjects with lesser ACE-R scores that is <82.

Discussion

One of the serious complications of long standing type 2 diabetes is diabetic neuropathy, the result of decreased neuronal activity. One such debilitating effect of neuropathy is cognitive decline. In the present study HbA1c levels were less in test group than the controls. There are studies available where HbA1c were decreased in diabetes [10, 11]. In type 2 diabetic subjects increased brain glucose levels were observed [13] that alter the brain metabolites and may impair cognitive function. In our study HbA_{1c} levels were less in test group than in the controls, because yogasanas and pranayama normalized the increased plasma glucose levels by increasing the peripheral uptake of glucose or by increasing the pancreatic insulin secretion Table 4. In control group the mean HbA1c levels are higher than the test group, and these high levels may increase the brain glucose and increased brain glucose levels alters the brain metabolite levels like NAA (N-acetyl aspartate), glutamate and glutamine [12]. Altered brain metabolite levels would alter the cognitive abilities [14]. In type 2 diabetes brain metabolites are altered and thus resulting in cognitive decline [15], and this cognitive decline can be ameliorated with yogasanas and pranayama [16]. Normal glucose levels will stabilize the brain metabolites near normal levels and decreases the production of advanced glycosylated end products. ACE-R scores were significantly more in test group than the control group, and this can be attributed to the high HbA1c levels in control group. These findings clearly emphasize that yogasanas and pranayama has a positive effect on overall cognitive performance in type 2 diabetes subjects Table 3. Memory, language, visuospatial and attention/orientation domain scores were also better individually in test group than in controls. As ACE-R is sensitive to mild cognitive impairment [8]. It can also be used in diseases where cognition is affected such as Parkinson's, fronto temporal dementia and Alzheimer's [17, 18]. Further studies are required to analyse the verbal fluency scores in detail. In future we look forward to find the relation among plasma HbA_{1c} levels, brain metabolites and cognitive function. For this we are determined to estimate the brain metabolite levels in particular their ratios by using highly sophisticated methods like Proton Magnetic Resonance Spectroscopy (^{1}H-MRS).

Conclusion

Designed yogasanas and pranayama in the present study have restricted the cognitive decline in type 2 diabetic subjects, and therefore this study advises all the type 2 diabetic subjects should undertake the yogasanas and pranayama as their daily routine.

Limitations

Difficult to measure the number of hypo/hyperglycaemic attacks/day in the subjects, as these attacks can have a role in pathophysiology cognitive decline in type 2 diabetes.

Quantitative analysis of stress was not done. Before the commencement of yogasanas and pranayama we didn't measure cognition. Selecting the subjects from the same locality does not guarantee same cultural, socio-economical or educational status. Participants were not randomly allocated to test and control groups.

Acknowledgments

Research reported in this publication was conducted by scholars at the Fogarty International Centre of the NIH training program under Award Number D43 TW 009078. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Health.

Support: None.

References

1. World Health Organization. [26/02/2015] Diabetes Fact sheet No. 312 [article online]. 2011. Available from http://dwatch.spikar.gr/who-key-facts-about-diabetes-mellitus-october-2013
2. International Diabetes Federation. [Retrieved 29 November 2014] http://www.idf.org/diabetesatlas/update-2014.
3. Rajani, Santhakumari, Indla, Yogananda Reddy, Archana, R. Effect of Type 2 Diabetes Mellitus on Brain Metabolites by using Proton Magnetic Resonance Spectroscopy - A Systematic Review. Int J Pharm Bio Sci. 2014 Oct; 5(4):(B) 1118–(B) 1123.
4. Kandel, Eric R.Schwartz, James H., Jessell, Thomas M.Essentials of neural science and behavior. 1995; 319
5. Cukierman TN, Gersteig HC, Williamson JD. Cognitive decline and dementia in diabetes—systematic overview of prospective observational studies. Diabetologia. 2005; 48:2460–2469. [PubMed: 16283246]
6. Patel C. Randomized control trial and biofeedback in management of hypertension. The Lancet. 1975; 19:93–95.
7. Rugmini, PS., Sinha, RN. Seminar on Yoga Man and Science, Delhi India. New Delhi: Yoga Research hospital, Vishwayatan Yogashram, CCRIMH; 1976. The effect of yoga therapy in Diabetes Mellitus; p. 175-189.
8. Mioshi E, Dawson K, Mitchell J, Arnold R, Hodges JR. The Addenbrooke's Cognitive Examination Revised (ACE-R): a brief cognitive test. Int J Geriatr Psychiatry. 2006; 21:1078–1085. [PubMed: 16977673]
9. Mathuranath PS, Hodges JR, Mathew R, et al. Adaptation of the ACE for a Malayalam speaking population in southern India. Int J Geriatr Psychiatry. 2004; 19(12):1188–1194. [PubMed: 15526301]
10. Kyizom, Tenzin, Singh, Savita, Singh, KP., Tandon, OP., Kumar, Rahul. Effect of pranayama & yoga-asana on cognitive brain functions in type 2 diabetes-P3 event related evoked potential (ERP). Indian J Med Res. 2010 May.131:636–640. [PubMed: 20516534]
11. Sahay BK. Role of yoga in diabetes. J Assoc Physicians India. 2007; 55:121–126. [PubMed: 17571741]
12. Malhotra V, Singh S, Sharma SB, Gupta P, Prasad A, Tandon OP, Madhu SV, Jai Ganga R. The Status of NIDDM patients after yogasanas: Assessment of Important parameters. Journal of Clinical and Diagnostic Research [serial online]. 2010 Jun.4:2652–2667. [cited: 2010 June 30]
13. Sinha, et al. Assessment of changes in brain metabolites in India patients with type 2 diabetes mellitus using proton magnetic resonance spectroscopy. BMC Research Notes. 2014; 7:41. [PubMed: 24433580]
14. Ferguson, Karen J., Mac Lullich, Alasdair MJ., Marshall, Ian, Deary, Ian J., Starr, John M., Seck, Jonathan R., Wardlaw, Joanna M. Magnetic resonance spectroscopy and cognitive function in healthy elderly men. Brain. 2002; 125:2743–2749. [PubMed: 12429601]
15. Rajani, Santhakumari Nagothu, Indla, Yogananda Reddy, Archana, R., Ravi, Varma. Right Dorsolateral Frontal Lobe N-Acetyl Aspartate and Myoinositol Concentration Estimation in Type 2 Diabetes with Magnetic Resonance Spectroscopy. JCDR. 2015; 9(7):16–19.
16. Rajani, Santhakumari, Indla, Yogananda Reddy, Satish, Kumar, Archana, R. Study of cognition in type 2 diabetes with yoga asana and pranayama. RJPBCS. 2013; 3(2):1637–1641.
17. Bak TH, Rogers TT, Crawford LM, et al. Cognitive bedside assessment in atypical parkinsonian syndromes. J Neurol Neurosurg Psychiatry. 2005; 76(3):420–422. [PubMed: 15716539]

18. Mathuranath PS, Nestor PJ, Berrios GE, et al. A brief cognitive test battery to differentiate Alzheimer's disease and frontotemporal dementia. Neurology. 2000; 55(11):1613–1620. [PubMed: 11113213]

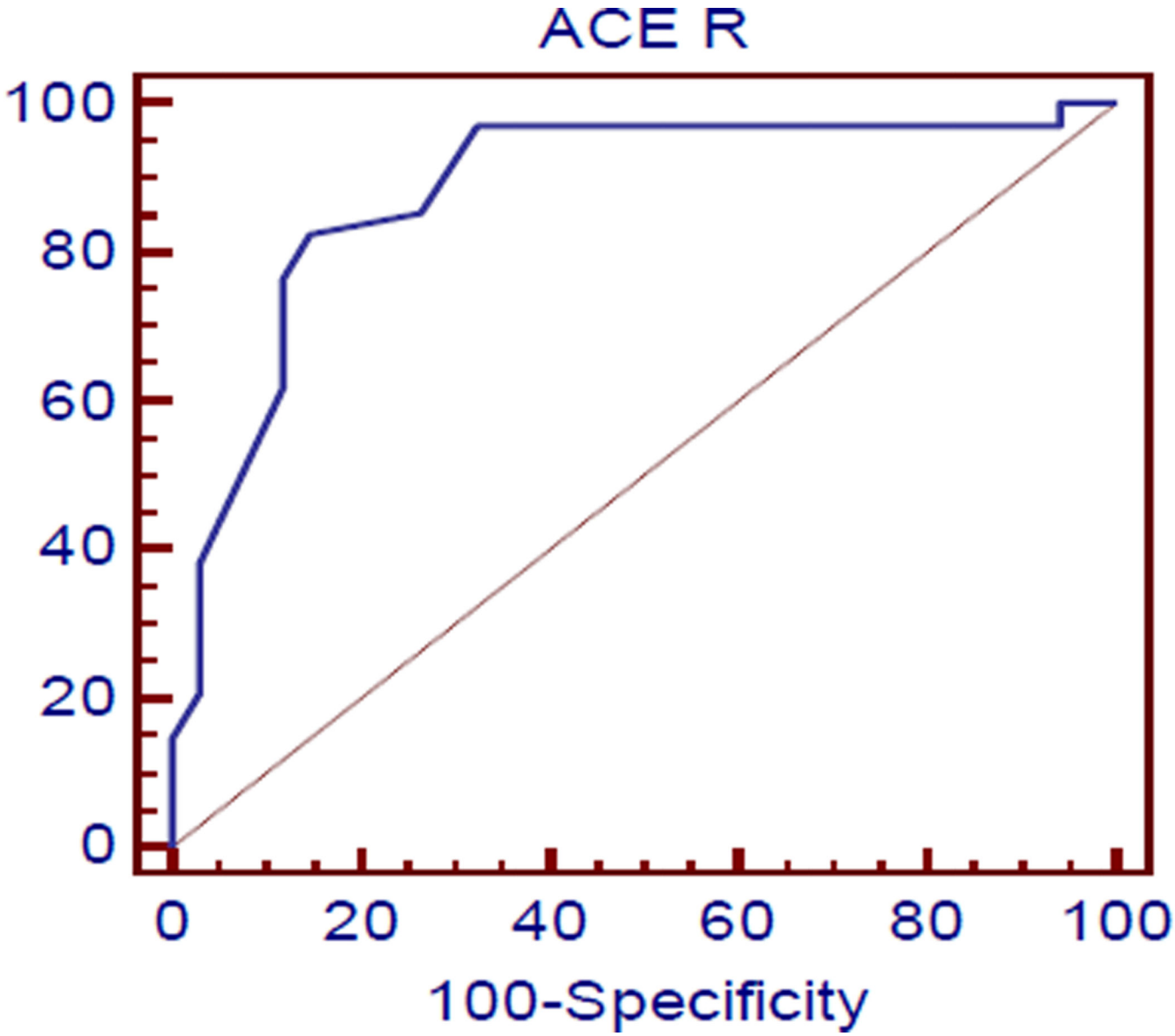

Figure 1. Illustrates the Sensitivity and Specificity of ACE-R

ACE-R also includes Mini Mental State Examination (MMSE), so comparison of the MMSE scores of test and control groups was also done. MMSE scores, Individual attention/ orientation scores, Verbal fluency scores Language scores, Visuo-spatial scores HbA_{1c} levels were significantly improved in test group followed by intervention.

Table 1

List of Yogasanas and their duration

S. No	Name of Yogasana	Duration
1	Dhanurasana	1/2 minute to one minute for the pose being maintained, adding 1/2 minute per week
2	Naukasana	2 – 4 turn of each, the pose being maintained for ten seconds adding one turn each, every fortnight
3	Arthamasthendrasana	¼ minute to one minute for each side, adding ¼ minute per week
4	Bhujangasana	2–4 turn of each, the pose being maintained for ten seconds adding one turn each, every fortnight
Name of Relaxation Asana		
5	Shavasana/Makarasana	3 turn of each, the pose being maintained for 30 seconds

Table 2

List of Pranayamas and their duration

S. No	Name of Pranayama	Duration
1	Anuloma-viloma	2–5 min
2	Surya anuloma-viloma	5 min
3	Chandra anuloma-viloma	5 min
4	Nadishuddi pranayama	10 min

Table 3

Cognitive Test Scores

Cognitive scores	Control group	Test group	P Value
ACE-R	85.3±2.4	92.88±4.49	<0.0001*
MMSE	24.9±1.8	27.29 ±1.75	<0.0001*
Attention/ Orientation	15.38±1.8	16.76±1.3	<0.001*
Memory	21.38±2	24.02±0.31	<0.0001*
Fluency	12.35±1.8	12.91±1.4	<0.16
Language	23±2.1	24.9±0.93	<0.0001*
Visuospacial function	12.85±2.4	14.32±1.6	0.005*

Unpaired student t test was done to observe the differences in mean values in between test and control group.

(*P value <0.05 was considered as statistically significant)

Table 4

Different parameters of study subjects

Parameter	Control group	Test group	P Value
Age (in years)	49.05±0.5	47.4±7.98	0.41
Duration (in years)	5.56±2.6	5.57±2.7	0.78
SBP (mm Hg)	134.12±12	120.60±10	0.04*
DBP (mm Hg)	80.2±6.6	74.8±6	0.01*
HbA1c	7.79±1.84	6.02±0.49	0.0001*
Pulse/ min	82.11±8	78.4±5	0.02*

Unpaired student t test was done to observe the differences in mean values in between test and control group.

(*P value <0.05 was considered as statistically significant)