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Letter to the Editor

Yoga practice (*Sheetali Pranayama*) on cognition in patients with hypertension: A randomized controlled study

The practice of yoga is a custom in India and has been reported to be beneficial for the patients with hypertension (HTN).[1] Sustained and chronic exposure to stress can leads to a destructive process of neuroendocrine, metabolic and neuropsychological changes that results in the development and progression of cardiovascular diseases (CVD) like HTN.[2] The stress dysregulation routes to HTN and affects the cardiovascular system, also reported to impair the cerebrovascular system and cognition decline.[3] Emerging evidences suggests that sustained elevations in blood pressure may results cerebral vessel remodeling and promotes the pathological changes in brain associated with cognitive decline.[4] Overall, HTN is notable and highly associated with cognitive decline, vascular dementia, and Alzheimer's disease.[5] However, the risen issues with resistant HTN i.e. patients that does not responds to medication has led to the search and evolvement of other modalities, such as pranayama, for the effective regulation of blood pressure. Pranayama may also have reported to improve one's memory, concentration, attention, sequential learning, eye-hand coordination and cognitive functions improvement.[6] *Sheetali pranayama* is one of the well-known types cooling pranayama, contains inhalation through mouth and exhalation through nostrils.[7]

Practice of *Sheetali pranayama* has been found to bring about mental relaxation by reducing the stress level in individuals.[7] Hence, the present study was initiated to explore the beneficiary effect of *Sheetali pranayama* in cognition using P300 on patients with primary HTN.

From 150 patients (Figure: 1) who enrolled in the study, only 100 were deemed to be eligible and randomly assigned to HTN with pranayama (*Sheetali*) group (n =50) and HTN without pranayama group (n =50). A qualified yoga and naturopathy doctor taught the *Sheetali pranayama* to the pranayama group participants for 20 rounds for 30 min daily for 4 weeks between 7:00 a.m to 9:00 a.m. in empty stomach. The quality of the pranayama performance was assessed with the help of a checklist booklet received from the patients at the end of 3 months. Blinding was not possible among the participants as it was a yoga intervention. However, the investigator who gave pranayama intervention and assessed the outcome was blinded to both the group participants. HTN without pranayama group did not practice any pranayama or yoga techniques during the study period. According to the International 10–20 systems, peak latency and peak amplitude of P300 Event Related Potentials (ERPs) were recorded using Nicolet Bravo System (Madison, WI). Evoked potentials for P300 were recorded with eyes closed and the 'standard' & 'target' auditory stimuli were delivered through close fitting earphones. Data expressed as mean and SD. Paired and unpaired t test was performed for inter group and intra group comparison using R statistical software version 3.6.1.

In both the groups, age, height and other parameters observation were not significantly different at baseline. Forty patients (n=40) in HTN with pranayama and forty-two (n=42) patient in HTN without pranayama group completed the study (Figure:1)and none of them reported any adverse events during the intervention period. The significant differences ($P<0.05$) were observed between HTN with pranayama and HTN without pranayama group in Peak Latencies and Peak Amplitudes of P300 Auditory-Evoked Potentials (Table 1). Effect size (cohen's d) was found to be large (>0.80) for P300 HTN with pranayama group at the end of 3 months intervention.

Event-related potentials of P300 is an objective non-invasive approach to assess the information processing and cognitive brain functions, such as attention, learning, memory, and decision-making.[8] In general, P300 waves associated with attention & short term memory which may influence the information processing cognition and mnemonic functions in humans.[9] HTN affects the neurocognitive functions through various mechanisms and induces changes in arteriolar endothelial and vascular smooth muscle cells. As the name indicates *Sheetali* meaning cooling enhanced by mouth breathing technique, its cooling effects may also enhance the cerebral blood flow, oxygen delivery and overall enhancement of parasympathetics by modifying sympathovagal tone contribution to relaxation feeling.[7] The increased P300 latency and amplitude also corroborated with the cerebral blood flow. The increase in P300 amplitude further related with the neuronal pool functions and recruitment in the recording area of brain.[9] Regular yoga practise decreases basal cortisol, catecholamine, sympathetic activity and increases parasympathetic activity that shows beneficial effect on cognitive functions and cerebral neurophysiology.[10] However, no other cognitive markers or sympathetic variables were measured in this study to support this observed findings which might act as a limitation to this study to confirm the observed effects. Though the observed findings with P300 are promising, the *Sheetali pranayama* practise can be advised as an adjuvant treatment and hopefully benefitted to the HTN patients with compromised cognition and memory related impairment. Further studies are required to substantiate our findings on the effect of cognitive performance in HTN.

Author contributions

Conceptualization: TJ, MK and KR. Methodology: TJ and ARA. Formal Analysis: MK. Investigation: TJ. Writing – Original Draft: AKC and SL. Writing – Review & Editing: AKC, SL, MK and TJ. Supervision: KR.

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Table 1
Peak Latencies and Peak Amplitudes of P300 Auditory-Evoked Potentials before and after the intervention.

P300 (Cz-A1)	HTN with Pranayama n=40 Before	After	P value /Cohen's d	HTN without Pranayama n=42 Before	After	P value /Cohen's d
Latency (ms)	367.80 ± 29.82	331.53 ± 34.39*	0.01/1.13	371.91 ± 32.97	368.34 ± 31.66	0.54/0.09
Amplitude (μV)	7.88 ± 3.99	11.83 ± 4.56*	0.001/0.92	8.78 ± 5.20	9.24 ± 3.99	0.44/0.1

* unpaired t test was used for the comparison of inter group mean difference.

Conflict of interest

The authors have no conflict of interests to declare.

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Ethical statement

This research has been approved by Institutional Ethics Clearance board (ref: SMC/IEC/2017/203).

Data availability

The date will be made available upon request.

Supplementary material

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.imr.2021.100716.

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Thanalakshmi Jagadeesan*
Department of Physiology, Saveetha Medical College, Chennai, Tamil Nadu, India

Arbind Kumar Choudhary
Department of Physiology, AIIMS, Raebareli, Uttar Pradesh, India

Sundareswaran Loganathan
Department of Physiology, AIIMS Mangalagiri, Andhra Pradesh, India

Kannan Rajendran
Department of Medicine, Saveetha Medical College, Chennai, Tamil Nadu, India

Aadhyyanth R. Allu
MBBS student, Saveetha Medical College, Chennai, Tamil Nadu, India

Maheshkumar Kuppusamy*
Department of Physiology and Biochemistry, Government Yoga and Naturopathy Medical College, Chennai, Tamil Nadu, India

*Corresponding authors at: Department of Physiology, Saveetha Medical College, Chennai 631502, Tamil Nadu, India (T. Jagadeesan); Department of Physiology and Biochemistry, Government Yoga and Naturopathy Medical College, Chennai 106, Tamil Nadu, India (M. Kuppusamy).
E-mail addresses: dhana.ibms@gmail.com (T. Jagadeesan), doctor.mahesh1985@gmail.com (M. Kuppusamy)
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