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Original Research Article

Immediate Effect of Isha Kriya Meditation on Heart Rate Variability and Its Sequential Changes among Healthy Adults

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Abstract:

Introduction: Yoga being promoted as a path for a healthy lifestyle to improve quality of life, is found to have beneficial effects in individuals practicing yoga, they reap the long-term benefits of practice in the form of reduced stress levels, well equipped coping mechanism, nature of calm and composed, enhanced cognitive abilities by affecting the autonomic function. Considering this we were interested in exploring the immediate effect of yogic techniques on autonomic function, so we intended to study the immediate changes in autonomic function test in the form of Heart Rate Variability (HRV) due to Isha Kriya Meditation (IKM).

Materials and Methods: Continuous HRV recording for 45 minutes was done in volunteers between the age of 20-40 years, The recording was segregated into 3 phases of 15 minutes each including Pre-IKM, During IKM and Post IKM respectively. HRV analysis was done, data was compiled in excel sheet and statistical analysis was done using Jamovi to compare the changes in HRV parameters induced by IKM.

Results: 42 volunteers willing to practice IKM were included with an average age of 23 ± 1.2 years. There was an increase in time domain parameter SDNN and the frequency domain parameter the power of LF which was significant with confidence interval of 95% and p value of 0.03 immediately after the practice of isha kriya.

Conclusion: Practice of IKM sequentially tilts the autonomic balance towards sympathetic predominance, providing better attention and mental clarity.

Keywords: Isha Kriya Meditation, Yoga, , Heart Rate Variability, Autonomic response.

Introduction

We all are in stressful times and recovering from the challenges posed by pandemic, which has impacted the quality of life across all strata of society. [1] The hazardous impact of the pandemic on the health of an individual is at an all-time high. Studies conducted during covid-19 pandemic, quarantine and lockdown had psychological impact and revealed increase in prevalence of stress, anxiety, and symptoms of depression.[1,2] In view of attaining stability and overcoming the underlying stress, meditation can be a useful tool.[3]

Yoga is a way of life described by Patanjali in his work "Patanjali yoga sutras". Here it's described that there are eight limbs of yoga that includes, Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana and Samadhi.[4] Each limb paves the way for optimizing one's body to start functioning efficiently both at physical and mental level. Studies have shown the regular practice of yoga has helped the individual to improve their quality of life and to overcome stress.[5] Meditation is considered to give clarity of perception without distortion and peace of mind.[3] Isha Kriya Meditation (IKM) is one of the potent meditations practiced by people. IKM is a meditation technique, has three steps and requires 15 minutes for practice. Step one individual sits comfortably with cross leg posture and gently breathes with awareness during each inhalation and exhalation.

Inhalation is done with the awareness that "I am not this body" and exhalation is done with the awareness that "I am not even the mind" for 8 minutes. [6] Step two is uttering 'Aaa" 7 times with mouth wide open, exhaling fully into each sound. [6] Step three continue to sit for 5-6 minutes with a slightly upturned face, by keeping a mild focus

between eyebrows.[6] It is recommended to practice 15 minutes twice a day for 48 days for 1 full cycle.[7] IKM is found to reduce tension, anger, fatigue, depression, and confusion in a questionnaire-based study.[7] long term regular IKM practitioners found to have balanced vagal efferent activity compared to non-practitioners at rest.[8]

Heart Rate Variability (HRV) is a useful mode of assessing the underlying autonomic stress in an individual, even when at the outset appearing healthy and normal. HRV decay is a clinical predictor of cardiac-related death.[9] HRV measures beat to beat variation in the heart rate, it analyses variation in successive heart beats recorded on a normal electrocardiogram (ECG). HRV measures the variability of the RR intervals. This difference is assessed in both the temporal and frequency domains.[9] These measurements were used to evaluate cardiac autonomic regulation, which is the balance of the heart's sympathetic and parasympathetic regulators.[9]

Time Domain Parameters of HRV includes standard deviation of normal RR Interval (SDNN) indicates overall heart rate variability, square root of the mean squared differences of successive RR intervals (RMSSD), RR interval more than 50 milli second (NN50), Percentage of RR interval more than 50 milli second (PNN50), indicates the parasympathetic activity.[9]

Frequency Domain Parameters of HRV includes low frequency (LF) indicating neuronal sympathetic activity, High frequency (HF) indicating neuronal parasympathetic activity; very low frequency (VLF) indicates non-neuronal sympathetic activity. LF/HF ratio indicating the neuronal autonomic balance.[9]

The studies have shown the increase in baseline parasympathetic tone in individuals practicing yoga regularly.[10] Increase or decrease in LF component of HRV is inversely correlated to baseline reading of LF in subjects practicing yoga.[11] A study done by Telles S et al. reported decrease in LF and increase in HF component of HRV during mediative thinking in contrast non-meditative thinking.[12] Markil N emphasized increase in heart rate variability during Yoga Nidra Relaxation.[13]

Yoga is being promoted as a path for a healthy lifestyle to improve quality of life. Though there are research studies assessing the long-term benefits of yoga/ meditation on autonomic functions, we substantially lack knowledge about the immediate sequential changes that ensue during the process which results in desired effects.

To address this lacune we are exploring one aspect of ashtanga yoga that is dhyana in the form of IKM and its immediate effect on autonomic function. We intend to observe, quantify, and note the sequential changes in autonomic activity which facilitate the desired effect and would like to deduce the physiological basis for these effects.

Methodology:

This is prospective observational research designed and carried out in a private medical college of Jharkhand. The institutional research committee authorized the project and provided ethical approval; number IEC 306/2022 dated 16.10.2022. The Study duration was for 4 months.

Enrolment of volunteers: A call for registration to participate was given and among the registered individuals 42 volunteers, who fulfilled the inclusion and exclusion criteria participated in the study. This study was undertaken after obtaining written consent from the volunteers.

Inclusion Criteria: volunteers with

- Age between 20-40 years
- Willingness to practice IKM.
- No prior experience of IKM

Exclusion Criteria: volunteers with following trails were excluded from the study.

- Fever, cough, vomiting, or any other illness interfering with their daily routine.
- History of daily alcohol consumption, tobacco chewing, smoking; systemic diseases such as diabetes, hypertension, thyroid disorders
- Medications such as antipsychotic and psycho-tropic drugs.

Tools used for the study:

- Digital Weighing Scale
- Wall mounted measuring tape
- Non-Mercury Sphygmomanometer
- 3-channel Digital Physiograph by Recorders & Medicare Systems, India & Software for analysis with ECG Leads.

Anthropometric, IKM and HRV recording:

Volunteers were requested to report to the department at 8:00 a.m., when they will be briefed on the recording technique and given informed written consent. Basic personal information will be obtained, followed by anthropometric measurements of the subjects including weight, height, and Blood pressure. The body mass index was calculated and tabulated in an excel sheet. The volunteers were made to sit comfortably and allowed to stabilize for 15 minutes; meanwhile, electrodes from a 3-channel Digital Physiograph by Recorders & Medicare Systems, India, was attached to the patient to record ECG in lead II.

A Continuous ECG was recorded for 45 minutes. The recording had 3 phases, that included base line

or pre IKM, then the volunteers practiced audio guided IKM and followed by post IKM, each phase was of 15 minutes duration. ECG was analyzed for HRV in 3 blocks as pre IKM, During IKM and Post IKM. The time domain parameters (SDNN, RMSSD, NN50 and PNN50) and frequency domain parameters (LF, HF, VLF and LF/HF rat) of HRV were tabulated in an excel sheet.

Statistical Analysis:

The compiled data in excel sheet was statistically analyzed by Jamovi software.

The mean and standard deviation for all parameters were calculated in all the 3 blocks. The paired t-test was used to compare the time and frequency domain characteristics of HRV between each phase. The sequential change in the mean and standard deviation parameters of HRV were noted and analyzed. With confidence interval of 95%, p - value < 0.05 was considered to be statistically significant.

Results

Anthropometric details of the volunteers include average age (23 ± 1.2 years), height (166.3 ± 12.6 cm), weight (73 ± 10.2 kg) and BMI (22.6 ± 1.6) respectively.

Average systolic blood pressure at rest was 118.7 ± 12.4 mmHg and average diastolic blood pressure at rest was 74 ± 8.2 mmHg.

Table 1: Mean and standard deviation of HRV parameters in Pre IKM, IKM and Post IKM

HRV Parameters	Pre IKM		IKM		Post IKM	
	Mean	SD	Mean	SD	Mean	SD
SDNN (ms)	62.65	21.39	64.10	18.35	72.82	27.92
RMSSD	41.22	17.13	40.55	16.56	42.14	14.18
NN50	179.21	139.44	190.02	141.39	185.83	128.68
PNN50 (%)	23.60	17.52	23.14	16.69	24.72	14.79
LF (%)	24.95	11.37	31.94	17.17	30.62	16.14
HF (%)	16.31	13.53	15.46	9.58	16.35	12.05
VLF (%)	58.74	20.66	54.04	22.03	53.25	22.74
LF/HF	2.10	0.99	3.08	5.14	2.33	0.90

There was a sequential increase in the value of SDNN from 62.65 ± 21.39 to 64.10 ±18.35 to 72.82 ± 27.92 from pre IKM to IKM to post IKM state, resulting in increased variability of heart.[14,15] **(Figure: 1)**

There was a marginal fluctuation in the values of RMSSD, NN50 and PNN50 from pre IKM to IKM to post IKM state implicating not much impact on parasympathetic activity. [14,15] There was a sequential increase in the power of LF from 24.95 ± 11.37 to 31.94 ±17.17 to 30.62 ± 16.14 from pre IKM to IKM to post IKM state, resulting in increased neuronal sympathetic activity.[14,15] **(Figure: 2)**

There was a marginal fluctuation in the values of HF, VLF and LF/HF from pre IKM to IKM to post IKM state suggesting not much impact on parasympathetic activity, non-neuronal sympathetic activity, and the autonomic balance respectively.[14,15]

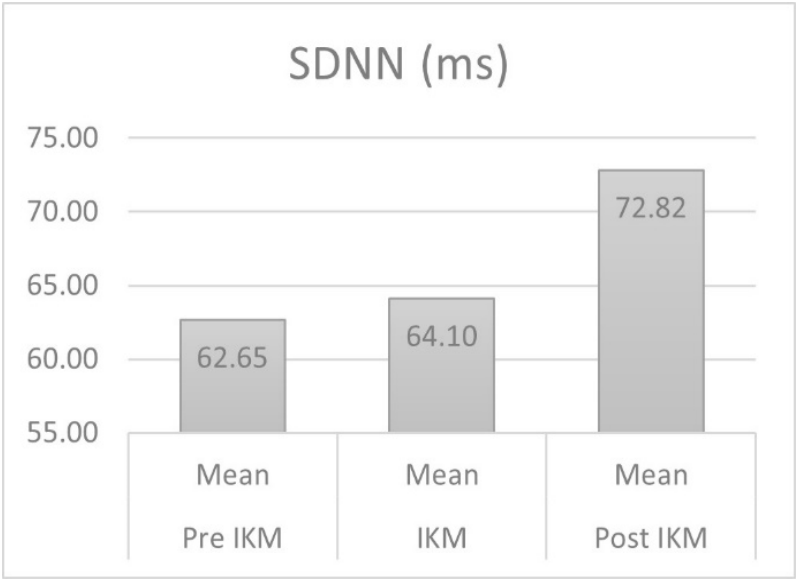

Figure 1: Changes in SDNN due to IKM

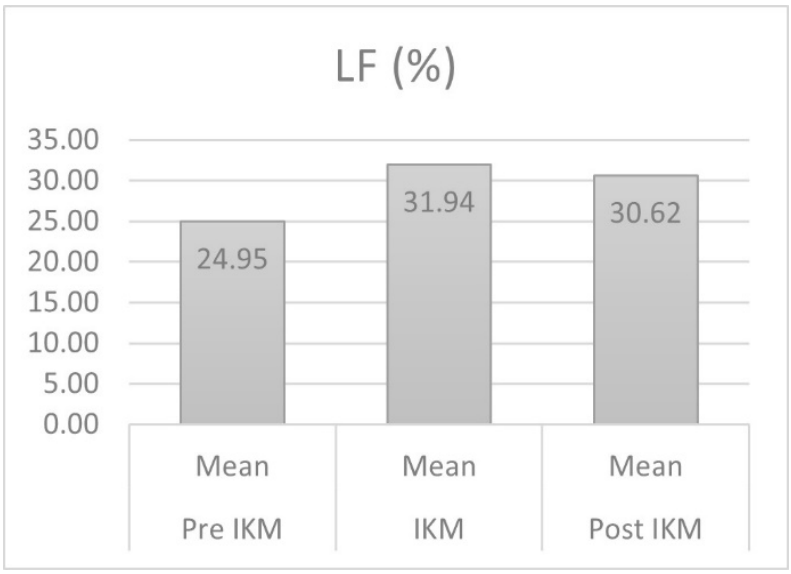

Figure 2: Changes in LF% due to IKM

Table: 2 Paired T test

HRV Parameters	Paired T test		
	Pre IKM vs IKM	IKM vs Post IKM	Pre vs Post IKM
SDNN (ms)	0.577	**0.035***	**0.034***
RMSSD	0.663	0.518	0.695
NN50	0.466	0.849	0.736
PNN50	0.594	0.937	0.635
LF	**0.016***	0.641	**0.035***
HF	0.64	0.547	0.986
VLF	0.142	0.827	0.145
LF/HF	0.214	0.333	0.256

P-value <0.05 was taken as significant. * Indicates significance.

Paired t test between Pre IKM & IKM: (Table 2): A statistically significant increase in the mean value of LF from Pre IKM to IKM with a p value of 0.016. [14,15]

Paired t test between IKM & Post IKM: (Table 2): A statistically significant increase in the mean value of SDNN from IKM to Post IKM with a p value 0.035. [14,15]

Paired t test between Pre IKM & Post IKM: (Table:2): There was an increase in the mean value of SDNN Post IKM compared to IKM, and the change was statistically significant. [14,15] There was a marginal increase in mean value of RMSSD, NN50 and PNN50 Post Isha kriya meditation compared to Pre Isha kriya and is not statistically significant. [14,15] There was an increase in mean value of LF post Isha kriya meditation compared to Pre Isha kriya and the change was statistically significant. [14,15] There was a marginal fall in mean value of VLF post Isha kriya meditation compared to Pre Isha kriya and is not statistically significant. [14,15]

Discussion

Long-term regular practice of yoga including a set of asanas, pranayama and mediation practice improves physical wellness. Regular yoga practitioners showed improvements in pulmonary functioning, cardiorespiratory fitness, endurance, and flexibility. [16] studies have found that short term practice of integrated yoga module helps in balancing autonomic function. [10]

A few studies assessing the immediate effect of yogic practices includes one by Tong et al, showed immediate stress reduction was more salient in the yoga group than that in the fitness group along with increase in mindfulness. [17] A study by Telles S et al, demonstrated reduced anxiety immediately in response to 18 minutes practice of high frequency yoga breathing and breathes awareness in pre-teen children. [18]

There is scarcity of data assessing the immediate changes induced by yogic methods in silo .A study was designed to assess the immediate changes induced by mediation in the form of IKM on autonomic balance. SDNN is an indication of total heart rate variability; an increase in SDNN

characteristics suggests that the heart is better able to adjust. [9] In this study, we found that immediately after practicing IKM, the mean value of SDNN increased compared to the pre-IKM value, and the difference was significant. This suggests that IKM has a positive influence on cardiac autonomic function. Muralikrishnan et al. found that persons who practice IKM had a greater resting SDNN value than non-practitioners. [8] The remaining time domain metrics showed a small increase in mean values of RMSSD, NN50, and PNN50 post-IKM compared to pre-IKM, which was not statistically significant. These findings are consistent with those of Muralikrishnan et al, who found that RMSSD, NN50, and PNN50 were greater in practitioners than in non-practitioners.[8]

In this study, we observed the immediate effect of IKM on first-time practitioners, and this trend of increased time domain parameters of parasympathetic markers RMSSD, NN50, and PNN50 will persist and strengthen with regular practice of IKM as corroborated by the study done by Muralikrishnan et al,.[8] Among the frequency domain metrics, the power of LF and HF reflects the influence of neuronal sympathetic and parasympathetic activity respectively.[9] The power of the VLF value reflects how hormones affect autonomic function. [10]

In this study, we found that the mean value of LF rose considerably during IKM and persisted even in post-IKM as compared to the pre-IKM value. This implies that neuronal sympathetic activity increases during IKM, and this effect persists in post-IKM. This impact on LF contradicts the data obtained by Muralikrishnan et al, who found that LF values were low in those practicing IKM, indicating reduced sympathetic activity. [8]

A study by Kozasa EH et al, explains meditation training increasing efficiency, in attention and impulse control, [19] that can be attributed to optimal increase in sympathetic activity. Isha kriya includes repeating a concept throughout each inhalation and exhalation, which demands more attention to practice. The alterations found throughout this investigation can be linked to this mechanism, which impacts concentration capacities and enhances sympathetic drive to deliver improved mental clarity. Sepideh Harir et al. found that practicing isha kriya decreased anxiety and depression symptoms in self-reported instances. [20] Other frequency domain metrics such as HF, VLF, and LF/HF ratio remained unchanged, indicating that IKM had no direct influence on these parameters.

This suggests that regular practice of isha kriya is required to have any effect on parasympathetic frequency domain parameters such as HF, as reported by Muralikrishnan et al, who demonstrated that individuals practicing isha kriya have an increase in resting HF value, tilting the autonomic balance towards parasympathetic predominance. [8] The sequential analysis of HRV parametric in this study we found early changes in frequency domain parameters LF power during the IKM. There was a delayed change in time domain parameters SDNN that was found post IKM, indicating that the practice of isha kriya tends to boost sympathetic activity immediately after isha kriya, implying sequential changes in resting sympathetic activity following isha kriya practice.

Conclusion

In this study, we noticed an overall increase in heart rate variability in the form of SDNN as well as an instantaneous increase in neuronal sympathetic activity via LF parameter after performing IKM. This implies that performing isha kriya has a positive effect on cardiac autonomic function while simultaneously increasing sympathetic activity to an ideal level, resulting in improved attention and mental clarity immediately following practice.

Limitations of the study: The Study did not include control group and other autonomic function tests.

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