International Journal of Community Medicine and Public Health
Hegde JR et al. Int J Community Med Public Health. 2020 Jul;7(7):2770-2777
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20203013

Original Research Article

A randomized study on the energy difference measured by electro photonic image on caregivers practiced Indian aesthetic dance and yoga

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Received: 04 April 2020
Revised: 18 May 2020
Accepted: 19 May 2020

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ABSTRACT

Background: Electro photonic image (EPI) technique based on the bio-energy field, is growing as a novel technique in the fields of alternative medicine, conventional practices, psycho-physiology, psychology, and consciousness. In this study, the EPI instrument is used to assess emotional pressure which is termed as activation coefficient (AC), communication energy (C) level of various organ systems, and entropy (E) in the human energy field is assessed in the caregivers (CGs) of children with neurodevelopmental disorders (NDDs).
Methods: Immediate effect of Indian aesthetic dance (n=31) and yoga (n=30) practices for 75 minutes were assessed in two randomized experimental groups that are later compared with the control group (n=30). The statistical analysis was done using IBM SPSS Version 21.0.
Results: The activation coefficient of intervention groups showed a significant reduction in stress levels ($p<0.001$). Indian aesthetic dance intervention group showed significant improvement in the energy level of the organ systems namely respiratory, endocrine, musculoskeletal and digestive system ($p<0.001$); cardiovascular, nervous and immune systems ($p<0.01$) and yoga group in respiratory, musculoskeletal, nervous system ($p<0.001$); and cardiovascular, endocrine, and immune system ($p<0.01$). Both the intervention groups showed a significant reduction in entropy ($p<0.001$) post-intervention compared to the control group.
Conclusions: The EPI parameters used for CGs of children with NDDs explore the possibility of using this instrument for measuring the bioenergy field that infers the health status of CGs before and after dance and yoga interventions.

Keywords: CGs, Electro photonic imaging, Gas discharge visualization, Indian aesthetic dance, Neurodevelopmental disorders, Yoga

INTRODUCTION

Caregivers (CGs) are the main supporters concerning education, shelter, food, and protection to grow and develop children with NDDs with full potentials.[1] The prevalence of NDDs in children is increasing at 1-3% globally and in India, nearly 12% of children aged 2-9 years are prone to it.[2,3]

The stressors created on family members by persistent caring of the children with NDDs, is referred to as a caregiver's burden, that affects their health physically, psycho-emotionally, socially, and financially.[4] Such conditions pose CGs prone to negative attitudes such as stress, worries, sadness, rejection, pessimism about future, aggression, avoidance, irrational belief in a child's disability, greater risk for higher levels of hostility, and

social withdrawal.[1] These negative attitudes can lead them to a higher level of perceived stress, depression, anxiety, and lower levels of subjective well-being.[5] Previous studies have mentioned that uncontrolled mental agitation finds the channel in physical force resulting in the form of muscle strain, skeletal injury, and chronic illnesses, vascular disorders, etc.[6,7]

At this juncture, a first-hand reliable diagnosis would help to reduce the growing subjective burden in CGs. The Diagnostic and Statistical Manual fourth edition (DSM-IV) mentions a few screening methods developed by clinicians and psychiatrists across the world. Apart from DSM-IV, many clinicians have been using self-screening methods such as carer QOL, perceived burden scale (PBS), perceived caregiver burden (PCB) Barthel index (BI), subjective burden scale (SCB), short portable mental status questionnaire (SPMSQ), cummings neuropsychiatric inventory (CARS), brief COPE, caregiver strain index (CSI) and Hamilton anxiety rating scale (HARS).[8] Though these scales have required validity and reliability, CGs have shown resentment due to higher number of items and the understanding of the content and scoring methods being time-consuming.

On the other hand, the requirement of the CGs' subjective burden needs well structured, goal-oriented, and time-limited interventions which are in infancy stage.[9] At present, various treatment modalities, such as interpersonal therapy, family/couple therapy, supportive therapy, cognitive-behavioral therapy, and several other complementary and alternative medicine interventions for informal CGs are prevailing.[10,11] Nevertheless, these interventions have shown limited benefits. Few studies reported the effectiveness of creative movements in dance and yoga intervention, enhancing positive emotions and mental health scores among CGs.[12,13] Both the interventions have found to be safe, practicable, acceptable, and subjectively useful for the physical and psychological health of CGs.[14,15] Therefore, the present study is attempting to explore the impact of Indian aesthetic dance (IAD) based on Indian dramaturgical text "Natya-Sastra" and yoga interventions for mental health in CGs of children with NDDs.

As an answer to the requirement of non-invasive methods in the identification of health status and measurement of the effectiveness of the intervention, the electro photonic imaging (EPI) technique is growing as a novel technique for a health assessment with its versatile applications and unique features.[16] Few studies have explored the usefulness of EPI in psycho-physiology, psychology, and consciousness researches.[17]

There is no study found on the EPI instrument used to measure the baseline health status and post-intervention effect among CGs of NDDs. Hence, the present study aimed to investigate the health status among CGs of children with NDDs following IAD and yoga interventions with EPI parameters.

METHODS

Study design

This was a randomized control design.

Study period, settings and location

This paper is part of the main study wherein subjects from three different special schools situated at the Bengaluru urban district of Karnataka, a state located in the southern part of India. Subjects were enrolled from August to November 2018. Trial was done in December 2018 assembling all the subjects in a common place to avoid temperature differences and bring common atmosphere.

Participants

Totally 91 subjects between 28-65 years (males=2; and female=89) of age participated in the study. The mean age of the IAD group (41.04±9.17 years), yoga group (40.86±8.95 years), and control group (42.27±9.08 years) were not significantly different. However, to ensure the underlying conditions not to affect the outcome or limit the benefits of intervention, few exclusion criteria were set. The exclusion criteria for the subjects were subjects consuming medication influencing cognitive abilities, mood balance, or coordination, prone to hearing impairment, having another relative with neurologic and psychiatric illness, had formal yoga training, or practicing yoga regularly for the past one month. Subjects were qualified without having exclusion criteria and agreed for randomization into any of the three groups with a commitment to attend classes.

Procedure for allocation of subjects

The institutional ethics committee of S-VYASA approved the research study and a clinical trial registered in the Clinical Trial Registry of India (CTRI/2018/08/015256), Government of India. The study objectives were explained to CGs, and written informed consent was obtained. All the subjects completed the socio-demographic questionnaire and the Zarit burden scale. The demographic information of participants is given in Table 1. Based on the scores of the burden scale, participants were randomized into three groups, i.e., (i) IAD (n=31), (ii) yoga (n=30), and (iii) control (n=30), using the website randomizer.com. Further, the allocation was concealed for participants using sealed, opaque envelopes generated by a statistician, and the randomization was blinded to prevent them from predicting caregiver's allocation.

Interventions

There were three groups in the study, of which two were active interventions, i.e., IAD and yoga; and the third group was the control group. Interventions were given by

more than 10 years of experienced trainers in different halls of the same premise simultaneously to match the timings. The control group was engaged in the way they wish, such as some were reading newspapers, books of their choice, knitting, etc. The duration of practices was for 75 minutes.

Table 1: Baseline characteristics of CGs (n=91).

	Dance	Yoga	Control	Total
Age group (mean±SD)	41.04±9.17)	40.86±8.95)	42.27±9.08)	41.51±9.07)
Relation with child, N (%)				
Mother	28 (89.29)	30 (100)	29 (96.56)	87 (95.60)
Other relative	3 (10.71)	0 (0)	1 (3.44)	4 (4.40)
Employment status, N (%)				
Homemakers	22 (70.97)	29 (96.67)	24 (80.00)	75 (82.42)
Employed	9 (29. 03)	1 (3.33)	6 (20.00)	16 (17.58)
Education, N (%)				
Illiterate	1 (3.23)	1 (3.33)	2 (6.67)	4 (4.40)
Primary school	0 (0%)	0 (0%)	1(3.33)	1 (1.1)
Middle and high school	7 (22.78)	15 (50.00)	18 (60.00)	40 (43.95)
Secondary school	15 (48.39)	7 (23.33)	5 (16.67)	27 (29.67)
Graduation	7 (22.78)	7 (23.33)	5 (16.67)	19 (20.88)
Income, N (%)				
High income group	1 (3.23)	0	0	1 (3.23)
Mid income group	12 (38.71)	11 (36.67)	13 (43.33)	36 (39.56)
Low income group	18 (58.06)	19 (63.33)	17 (56.67)	54 (59.34)
Languages known, N (%)				
Single	10 (32.26)	12 (40.0)	20 (66.67)	42 (46.15)
Multiple	19 (61.29)	20 (66.67)	10 (33.33)	49 (53.85)
Child with neurodevelopmental disorders, N (%)				
Single disorder	17 (54.84)	10 (33.33)	17 (56.67)	44 (48.33)
Multiple disorder	14 (45.16)	20 (66.67)	13 (43.33))	47 (51.67)

IAD

Dance group began the intervention with warm-up exercises to train the physical constitution of the participants facilitating flexibility of joints, reduce lethargy.[18,19] That followed varieties of hand gestures and various body movements, namely hand, neck, head, eyebrows, eyes, shoulder, chest, waist, thighs, shanks, and feet, as described in Nātyaśastra a magnum opus, dates back to 1500 B.C.[20] Those who wished to mime the negative incidents with the child were provided an opportunity. Then steps and song with lyrics were taught. At the end relaxation was given.

Yoga protocol

Yoga group participants started to practice with loosening exercise (shithila), physical stances (asana) in standing, sitting, supine and prone postures, continued breathing practices (pranayama), meditation, and instant and quick relaxation techniques.

Procedure for data collection

The baseline data collected by reading from 10 fingers of each subject using EPI technology by compact GDV BIOWELL camera. Data collected from the participant with a sitting position. Calibration of the equipment was carried out before acquiring data. After each recording, the dielectric glass surface was cleaned by an alcoholic solution.

Outcome measure

Electro photonic imaging (EPI) technique

The EPI technique is a scientific method based on the Kirlian effect on coronal electrical discharge surrounding an object when exposed to a high electrical field.[21] The EPI facilitates the assessment by placing the fingertips on a dielectric glass plate of the instrument and stimulation of electrons at the fingertips. It happens by applying a short electric pulse of a high voltage (10 kV) at high frequency (1024 Hz) but the low current that is in micro Amperes.[22] These jerked out electrons induce ionization of the air molecules and produce a glow around the finger. This glow, captured by a CCD-camera placed underneath the glass plate, is known as the electro-photonic image.[23] The data collected from each finger, which was divided into sectors, and each sector correspond to one organ and organ system. https://www.bio-well.com.

Parameters analysed

The captured EPI Images were loaded into the EPI software, and the coronal discharges corresponding to the organs and organ systems were exported into a spreadsheet. The relevant variables used to this study were (a) activation coefficient (AC): measure the level of stress and range from 2-4 in healthy people. (b) Communication energy (C): measures the total energy of communication for each organ system. The energy of light in Joules. 5 Joules are considered normal. A range of 4-6 is considered a normal zone. Less than 4 indicates weakness, and more than 6 indicates hyperactivity caused by an imbalance in the organ systems. In due course, the organ system tries to fix this imbalance naturally to bring back normal range. If it does not happen, the organ system gets weakened day by day. In this regard, a change of 0.5 Joules can pose the intervention as effective. (c) Entropy (E): indicate the coherence of the energy. It means less entropy specifying more energy.

Data analysis

The statistical analysis was done using SPSS 21.0 (IBM Corp., Armonk, NY). The normality test for the data showed no significant difference in age. Repeated measures of ANOVA were carried out separately, followed with Bonferroni correction for each assessment. The statistically significant value was considered at $p<0.05$.

RESULTS

The data analysis was done using repeated-measures ANOVA with two factors: Factor 1: Levels (pre and post), and Factor 2: Groups (dance, yoga, and control). The means and standard deviation of the outcome measures are given in Table 2.

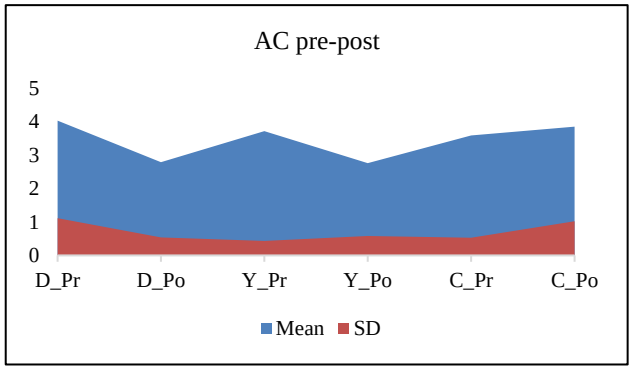

Figure 1: Activation coefficient of dance and yoga groups before and after the intervention compared to the control group.

The repeated measure analysis of ANOVA for AC showed a significant difference ($p<0.001$) in the post scores of dance and yoga with a reduction of 31% and 26%, respectively, compared to the control group, which showed increased AC of 7% (Figure 1).

Table 2: Pre and post values of activation coefficient, energy of organ systems and entropy.

Vari-ables	Dance (n=31)			P value	Yoga (n=30)			P value	Control (n=30)		
	Mean±SD				Mean±SD				Mean±SD		
	Pre	Post	% change		Pre	Post	% change		Pre	Post	% change
AC	4.023± 0.827	2.785± 0.538	-31	0.001***	3.709± 0.432	2.754± 0.580	-26	0.001***	3.580± 0.530	3.845± 1.020	7
C of											
Cardv	4.901± 1.112	5.688± 0.921	16	0.01**	4.820± 0.837	5.700± 0.986	18	0.01**	4.723± 0.870	4.536± 0.980	-4
Resp	6.663± 1.171	5.127± 0.584	-23	0.001***	6.449± 1.053	5.159± 0.626	-20	0.001***	6.504± 1.564	6.352± 1.320	-2
Endo	4.927± 0.740	5.903± 0.963	20	0.001***	4.869± 0.831	5.719± 0.869	17	0.01**	4.762± 1.030	4.767± 1.032	0.1
Musk	6.585± 0.931	5.139± 0.870	-22	0.001***	6.252± 0.678	5.326± 0.583	-15	0.001***	6.252± 1.104	6.270± 0.997	-0.28
Digst	4.719± 0.669	5.938± 0.750	26	0.001***	6.834± 0.990	5.130± 0.697	-24	0.09	4.716± 1.364	4.692± 0.883	-0.5
Nrvs	4.107± 0.954	4.941± 0.937	20	0.002**	4.283± 0.985	4.968± 1.003	16	0.001***	4.245± 0.999	3.990± 1.136	-6
Imn	4.031± 0.976	4.737± 1.093	18	0.005**	4.020± 1.053	4.799± 0.975	19	0.003**	4.047± 1.078	3.841± 1.185	5
E	2.494± 0.610	1.833± 0.468	-27	0.001***	2.520± 0.560	1.868± 0.508	-26	0.001***	2.319± 0.417	2.339± 0.312	-0.86

Note: SD-standard deviation; AC-Activation Coefficient; C-Communication energy; CARDV-Cardiovascular system; RESP-Respiratory system; ENDO-Endocrine system; MUSK-Musculoskeletal system; DIGST-Digestive system; NRVS-Nervous system; IMN-Immune system; E-Entropy. *Significant difference in Dance group and Yoga over control group *=p<0.05; **= p<0.01; ***=p<0.001. Significance levels are after Bonferroni correction.

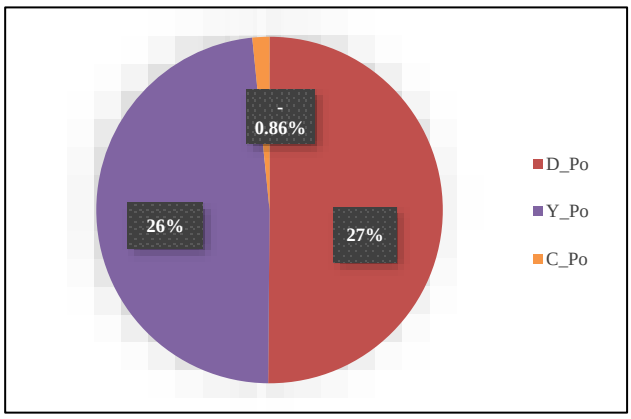

Figure 2: Percentage change in entropy after the interventions compared to control.

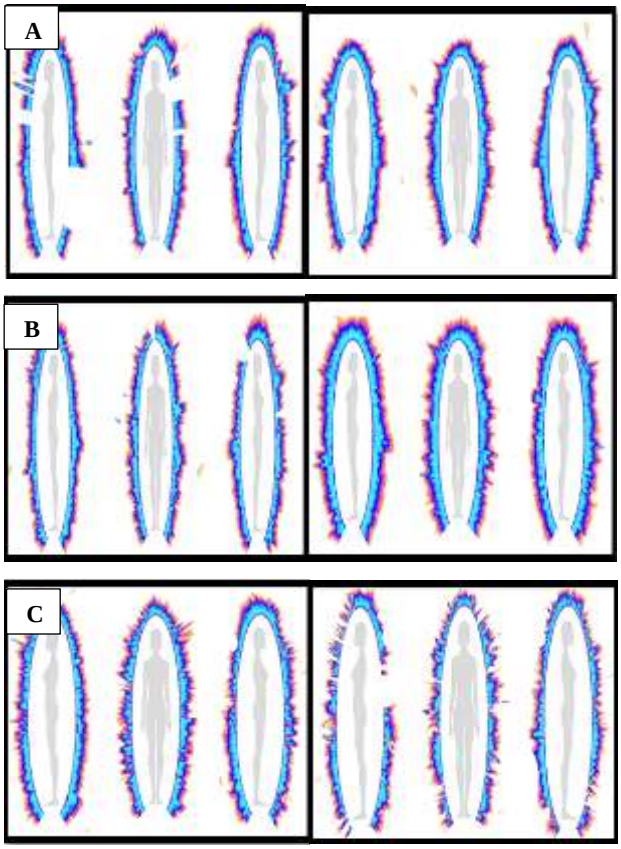

Figure 3: Subsample images of energy difference of IAD, yoga and control group captured by EPI instrument pre-measurement and post-intervention. (A) A subsample energy field of a subject of IAD group; (B) A subsample energy field of a subject of yoga group; (C) A subsample energy field of a subject of control group.

A: pre- energy 52 Joules (×10-2). post- energy 70 Joules (×10-2); B: pre- energy 59 Joules (×10-2). post- energy 79 Joules (×10-2). C: pre- energy 48 Joules (×10-2). post- energy 37 Joules (×10-2).

Further, post-assessment of dance group showed a difference in communication energy (C) level of the internal organ systems, namely, respiratory (23%) endocrine (20%), musculoskeletal (22%) and digest systems (26%) with significant level ($p<0.001$); cardiovascular (16%), nervous (20%) and immune systems (18%) with $p<0.01$ independently compared to control group. Further, post-assessment of yoga group showed a difference in the energy level of respiratory (20%), musculoskeletal (15%), nervous system (16%) with a significant level ($p<0.001$); and cardiovascular (18%), endocrine (17%), and immune system (19%) with $p<0.01$. The result table of mean, standard deviation is given in Table 2.

Concerned with the entropy (E), both the intervention groups showed a significant difference ($p<0.001$) post-intervention compared to the control group. Figure 2 shows the percentage change of E after the intervention compared to the control group. Figure 3 displays the subsampled image of the energy difference of all three groups at pre and post captured by the EPI instrument.

DISCUSSION

The present study aimed to investigate whether EPI parameters can be used for the analytical purpose of the baseline health status of CGs and to measure the immediate effect of IAD and yoga intervention compared to the control group. The scores of activation coefficient (AC) is concurrent with the findings by non-EPI scales of previous studies, that repeated physical movements in dance are associated with improvement in mental functioning by enhancing the coordination in different parts of the body and mind.[24,25] This coordination brings positive effect in CGs in reducing emotional pressure in CGs.[24] Compared to the subjects of the control group, IAD intervention showed a significant reduction of AC which is 31%, which indicates that the dance backed by music could facilitate the hippocampus to inhibit defensive behaviours by modifying the cortisol level in response to the psychological burden.[26]

The substantial reduction (26%) in the AC parameter of the yoga group suggests the eight weeks of intervention showing a significant effect on the CGs of NDDs. Previous findings support the asanas relaxing muscles and nerves, which are under stress and strain constantly.[27] Regular practice of yoga could bring chemical changes such as increasing serotonin levels in the blood which reduces AC, and release of phenyl-ethylamine, which is converted to phenylacetic acid, which elevates mood and relieves from depression.[27]

The C measured by EPI showed a regulation in the communication energy level in the organ systems, namely, cardiovascular, respiratory, endocrine, musculoskeletal, digestive, nervous, and immune systems in both the intervention groups compared to control group.

The C of the respiratory system of the dance group is regulated after the intervention. Concerning C, a score of

more than 6 indicates hyperactivity caused by an imbalance in the organ systems. After the intervention, scores of C is reduced by 23%, in the dance group that might be the indication of the respiratory system in a balanced state.

The 18% changes found in the cardiovascular systems of the dance group are concurrent with the findings of the earlier studies that the consistent practice of dance help enhanced vital respiratory capacity of the respiratory system. And FEV1values suggesting the relationship of dance with pulmonary functions of the cardiovascular system.[28] Also, diaphragmatic stretching practiced in yoga, improves respiratory and abdominal cavity expansion, and breath control and concentration might clear the blockages in the energy channels (also called nadis) of the body to balance the energy system of the body.[29,30] Additionally, deep breathing (pranayama) mechanism assists in the reduction of blood pressure, which tends to reduce sympathetic activity and restores baroreceptor sensitivity in the cardiovascular system.[31] Just 75 minutes of yoga intervention showed an enhanced C level of 18% in the cardiovascular system.

Furthermore, the study scores showed the enhanced C level of the endocrine system of intervention groups (20% and 18% of dance and yoga, respectively) compared to the control group at -0.1%. This effect is coexisting with the earlier studies, which mentions that dance and yoga can modulate the concentration of serotonin and dopamine neurohormones by stabilizing the sympathetic nervous system towards regulating mood and social behaviour.[32,33] Further, the balanced energy of dance (with -22%) and yoga (-15%) level of the musculoskeletal system is concurrent to the fact that dance and yoga improves the volume of the postcentral gyrus and, somatosensory fibers end in this area which conveys information from proprioceptive organs such as neuromuscular spindles, joint, and sinew receptors felicitating musculoskeletal system.[34,35]

Similarly, the digestive system of both the intervention groups of the study showed a regulated C score in dance (26%) and yoga (-24%). Whereas the control group showed reduced C of 0.5% with sitting and doing regular activities. It may be because, dance and yoga can regulate the weight and body fat, and can even control diabetes mellitus by negating the property like glycosylated hemoglobin.[36,37]

Further, the central nervous system tends to generate new neurons spontaneously during new learning and memory. These neurons, being natured with plasticity, could help the CGs on managing stressful situations even after the intervention period, as reflected in the nervous system.[38] The study results coexisted with the earlier findings with enhanced C of dance group by 20% and yoga group 16% compared to the control group at -6%.

Like other body systems, the C level of the immune system of intervention groups is concurrent to the earlier studies that dance and yoga can strengthen the immune system by way of muscular action and physiological processes.[33,39] Even a change of 0.5 Joules in the result is considered as significant effect to make the intervention eligible for regular practice.[40] In this study, the dance group showed 18% and yoga group 19% of enhanced C to immune systems compared to the control group at 5%.

The reduced E level showed an immediate effect of interventions (dance group with 27% and yoga 26% ($p<0.001$). Reduced E level and coherence of the energy to the organ system are inversely related. It means less entropy specifying more energy.[40]

The IAD, backed by the varied movements and expression supported by Natyasastra a traditional scripture for dramaturgy in India, needs to be explored more for the therapeutic intervention in many treatment areas.

However, we could list some limitations in the study. They were as follows: we could not generalize the effect of EPI parameter to male subjects as just two males joined the study. Secondly, we could study only the immediate effect but not the long lasting effect of the intervention, as the EPI parameters are sensitive to various conditions.

CONCLUSION

In conclusion, the study pointed out the significance of using the EPI instrument in measuring the variation in subtle energy of the psychological and functional state of organ and organ system with the intervention of IAD and yoga compared to the control group of CGs of children with NDDs. Further, this device is an entirely non-invasive, less time consuming, and safe method where the electric current flow through a pulse current in micro amps that does not affect any cell and tissue or other physiological changes. However, a longitudinal study may help to know the better effect of interventions.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee of University and registered in the Clinical Trials Registry - India (CTRI) [CTRI/2018/08/015256]

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Cite this article as: Hegde JR, Melukote SK, Vijayendra K, Singh D. A randomized study on the energy difference measured by electro photonic image on caregivers practiced Indian aesthetic dance and yoga. Int J Community Med Public Health 2020;7:2770-7.