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International Journal of Community Medicine and Public Health
Sankhala SS et al. Int J Community Med Public Health. 2020 Apr;7(4):1547-1554
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20201472

Original Research Article

Determining bioenergy field of autistic and normal healthy children: an electrophotonic imaging study

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Received: 08 January 2020
Revised: 12 February 2020
Accepted: 28 February 2020

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ABSTRACT

Background: Currently assessment of autistic behavior is done based on learning disabilities, personal observation of behavioral patterns and standard autistic scales. Electrophotonic imaging (EPI) instrument is used to assess health status based on bio-energy field of various organ and organ system of human body. And can be useful to determine the early diagnosis of autistic symptoms and degree of improvement for any therapeutic intervention given to these autistic children on a regular basis. This study aimed to investigate the differences of EPI parameters of autistic children and healthy children of the same age group.
Methods: This study was carried out by taking the EPI images of 33 autistic and 36 healthy children of age group 4 to 14 years from an autistic center and nearby school in Bangalore. The statistical analysis on acquired data were done using IBM SPSS Version 20.0.
Results: The variables activation coefficient, integral area, sacrum, hypothalamus, thyroid gland, pancreas and coronary vessels showed a significant statistical difference in their mean value for autistic and healthy children ($p<0.05$).
Conclusions: The EPI parameters for autistic and healthy children open up the possibility of using EPI based instrument for early diagnosis. Deeper analysis of the differing parameters gave us more insight into the type of intervention to be selected for improving the health of autistic children.

Keywords: Electrophotonic imaging, Autism spectrum disorder, Gas discharge visualization, Autistic children

INTRODUCTION

Autism spectrum disorder (ASD) is a set of neurodevelopmental disorders (NDDs), including restricted, repetitive behavioral, communication and social impairments. During past decades, the epidemiological studies showed an increase in the prevalence of autism worldwide.[1] An autism survey in India estimated about 1 in 100 children under age 10 years have autism.[2] Research studies reported that children with ASD have unclear pathophysiology and may be associated with several risk factors including alterations of gut microbiota, genetic, environmental toxicants and nutritional factor.[3-5] Further, few other associated risk factors are age, gender, parental education and behavior. Apart from core symptoms of ASD, such as socialization, communication and repetitive behavior, the clinical symptoms are usually present by the age of 3 years. The symptoms may worsen in delayed diagnosis and initiation of ASD-specific intervention. However, the timing and developmental course of ASD symptoms vary across children.[6]

An early and reliable diagnosis and appropriate interventions may reduce the progressive symptom development in ASD children. There are various screening methods developed by clinicians and psychiatrists across the world and come up with a common underlying criterial for ASD given in the diagnostic and statistical manual fourth edition (DSM-IV). Apart from DSM-IV, many clinicians have been using self-screening methods such as childhood autism rating scale (CARS), behavior problems inventory-short form (BPI-S), autism behavior checklist (ABC), autism diagnostic interview-revised (ADI-R), autism diagnostic observation schedule (ADOS) to assess individual with ASD.[7-11] These scales are having suitable validity and sensitivity but criticized due to more number of items, time-consuming, and scoring methods. Therefore, leading medical experts and psychiatrists across the world seeking a specific screening method to identify autistic traits in their early stages and subsequently, necessary medication can be provided without delay.

Electrophotonic imaging (EPI), is a non-invasive user-friendly biometric device to assess the human bioelectromagnetic field under different psycho-physiological and pathophysiological conditions.[12,13] Generally, a living system emits spontaneous biophoton that is linked to the endogenous states of biological processes.[14] These biophotons are ultra-low rate emission of electromagnetic energy associated with cell functioning including cell metabolism, growth, phagocytosis, neural activity, and oxidative stress.[15-17] EPI instrument captures coronal discharges from the fingertips induced by applying underside high voltage (10-15 kV) and high frequency (1024 Hz) for less than a millisecond. The dielectric glass plate of EPI accelerates a high electric field, generating electronic avalanches which cause glow in the surrounding of fingertips. This can be captured as an image by using an optical charge-coupled camera (CCD) placed underneath the glass place.[18] The image will be captured from all 10 fingertips of both hands through the EPI software. Based on Chinese acupuncture meridians theory, each fingertip is divided into sectors that represent different organs and human systems.[19] The acquired image formation may change due to the mental state and psychic energy of the individual.[20] The EPI parameters successfully reported a balanced or disturbed state of the organ and organ system.

There are a few studies that have demonstrated the usefulness of EPI for early diagnosis than conventional methods.[13,21] The psycho-emotional state of children with the autistic disorder can be diagnosed through EPI that concomitantly improves the interventional strategy for symptoms control.[22] Few other studies reported the usefulness of EPI in the screening and early diagnosis of diabetes, asthma, cancer, autism and clinical conditions.[22-26] The parameters of EPI showed high functional energy reserve in meditators which reflect better psycho-physiological levels following anapanasati meditation.[27] There have been very few studies in capturing EPI parameters related to autism. The study of these parameters could pave way for coming up with a yogic exercise that could facilitate in improving any of those parameters to bring about a positive change in autistic children for their cognitive development.

There is a dearth of data reporting the difference in EPI parameters of autistic children matched with the age-gender healthy control group. Therefore, the present study aimed to capture the EPI image of autistic and healthy children of the same age and gender.

METHODS

Participants

A total of 69 children were recruited, during September 2018 to April 2019 in the study. Thirty-three previously diagnosed autistic children who were diagnosed with Indian scale for assessment of autism (ISAA) from various autistic centers in Bangalore. Another group of 36 healthy children recruited from nearby schools as control. However, the mean age of autistic (8.9±3.6 years) and healthy control (9.3±2.8 years) was not significantly different.

Inclusion criteria

Only those children were recruited whose teachers and parents given their consent for participation. The autistic children receiving stable medication or behavioural interventions. They all were able to understand and followed the instructions. The age range were ≥7 years to 14 years.

Exclusion criteria

Children with significant behaviour problems, auditory or impairments, severe neurological or physical deformities were excluded from the study.

Study design

A cross-sectional study design was adopted, where two groups i.e., autistic children and healthy controls were compared using selected parameters of EPI. Each child had to keep all the ten fingers one by one on the glass surface of the EPI equipment and data were recorded.

Ethical approval

All participants were explained about the nature of the study and were given basic information about the EPI technique as well as the procedure for assessment. This study was approved by the institutional ethical committee of the university and registered in the clinical trial registry of India (CTRI).

Informed consent was obtained from the teachers and parents of the participants after explanation about the nature of the study and were given basic information about the EPI technique as well as the procedure for assessment.

Instruments and procedure for data collection

The reading from 10 fingers of each child was collected using EPI technology developed by Saint-Petersburg, Russia (GDV camera pro with an analog video camera, model number: FTDI.13.6001.110310). Data collection was done in the morning with a gap of 3 hours from meal. All data were recorded as per the stipulated guidelines for EPI measurements that helped to maintain the reliability and reproducibility of the acquired data. Each participant was asked to remove all metallic objects from their body 24 hours before data collection. Calibration of the equipment was carried out before acquiring data. Further, during data collection, participants stood on an electrically isolated surface and placed their fingertip on the dielectric glass to capture the image. After each recording, the dielectric glass surface was cleaned by an alcoholic solution. Atmospheric temperature and humidity were monitored by hygrometer (Equinox, EQ 310CTH) and it was maintained 26.8°C and 52.2%, respectively.

Parameters analyzed

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. Each record had 82 variables (parameters) per subject. The parameters were: (a) activation coefficient (AC): measure the level of stress and range between 2-4 in healthy people; (b) integral area, measure of general health index with a range of -0.6 to +1, that indicate the presence of structural and functional state of mind-body of healthy people; (c) integral entropy: evaluate the disorderliness in human energy field with normal range 1-2 and indicate the presence of deficiencies in the organs measured in healthy people. The above parameters correspond to different organ system including kidney, liver, immune system, pancreas, cerebral and coronary vessels.

Data analysis

Data analysis was done using IBM SPSS software version 21.0. The parameters of acquired data were segregated for autistic and healthy children and tested for normality. A parametric independent sample t-test was carried out between EPI parameters of autistic and non-autistic children. All statistical analyses were computed at $p \leq 0.05$. The Pearson correlation was done between age and EPI parameters.

RESULTS

The statistical analysis of autistic and control children data is given in (Table 1). The independent sample t-test and effect size (Cohen's *d*) of selected parameters demonstrated a statistically significant difference ($p<0.05$) for the meridians associated with sacrum, pancreas, liver, thyroid, hypothalamus, left eye and coronary vessels. Also, there were significantly different ($p<0.05$) values in RMS of integral area for both the right and left side of the body. The autistic children showed a statistically higher value in the activation coefficient than healthy control children ($p<0.01$). The effect sizes were measured using the Cohen's *d*; if effect size 0.2 is considered small, 0.6 is medium and 0.8 is large.

The Pearson's correlation showed that there was a statistically positive correlation between healthy children age and scores of integral area, $r = 0.51$, $p<0.001$, RMS of integral area, $r = 0.38$, $p<0.001$, sacrum, $r=0.28$, $p<0.02$, thyroid gland, $r=0.3$, $p<0.05$, left eye = 0.29, $p<0.05$, liver, $r = 0.32$, $p<0.01$, pancreas, $r = 0.24$, $p<0.05$. In contrast, the autistic children showed marginal correlation in integral area, $r=0.39$, $p<0.05$ and liver, $r=0.347$, $p<0.05$ with age as shown in Table 2 (autistic children) and Table 3 (healthy children). Since all correlations were having similar graphs, a subsample of correlation graph between age and integral area is presented in (Figure 1).

Table 1: Electrophotonic imaging parameters (EPI) analysis using independent sample t-test. Value are mean, standard deviation, and effect size.

S. no.	Variables of EPI	Group		t value	df	P value	95% confidence interval of the difference		Cohen's *d*
		Healthy control (n=36)	Autistic (n=33)				Lower	Upper	
1	Activation coefficient	2.95±1.36	3.73±2.22	-1.77	67	0.081	0.66	2.70	-0.427
Left hand									
2	RMS of integral area	0.31±0.08	0.39±0. 11	3.12	67	0.002	0.12	0.03	0.76
3	Sacrum	0.52±0. 33	0.80±0.72	2.10	67	0.04	0.54	0.01	0.51
4	Hypothalamus	0.47±0.21	0.33±0.23	2.59	67	0.01	0.03	0.25	0.63
5	Thyroid gland	0.34±0. 26	0. 51±0. 26	2.82	67	0.006	0.30	0.05	0.68

Continued.

S. no.	Variables of EPI	Group		t value	df	P value	95% confidence interval of the difference		Cohen's *d*
		Healthy control (n=36)	Autistic (n=33)				Lower	Upper	
Right hand									
6	RMS of integral area	0.29±0. 07	0.35±0. 09	2.92	67	0.005	0.10	0.02	-0.703
7	Left eye	0.60±0.29	0.79±0.40	2.18	67	0.03	0.35	0.02	-0.526
8	Liver	0.66±0.44	0.89±0.40	2.26	67	0.02	0.43	0.03	-0.544
9	Pancreas	0.37±0.40	0.63±0.60	2.13	67	0.03	0.50	0.02	-0.512
10	Coronary vessels	0.31±0.25	0.44±0.15	2.57	67	0.01	0.23	0.03	-0.618

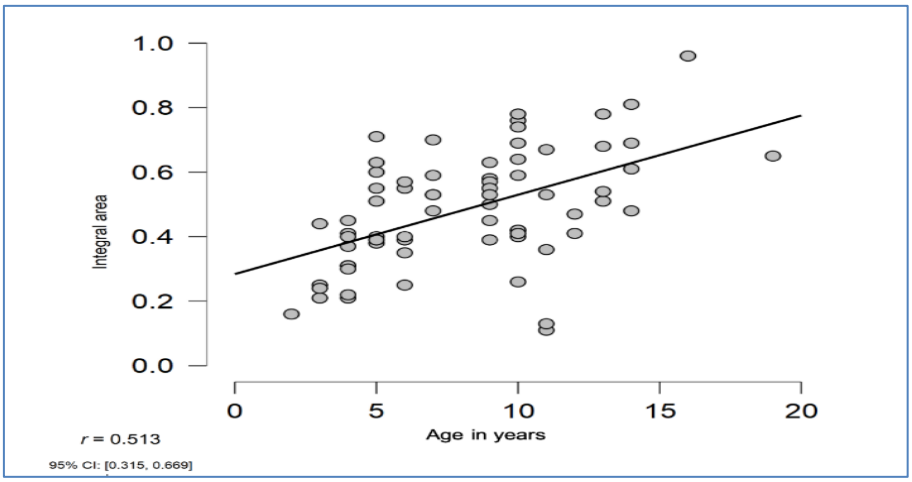

Figure 1: A subsample of correlation graph between age and integral area of normal healthy children.

DISCUSSION

The aim of study was to investigate whether EPI parameters can be used for the diagnostic purpose of autistic children. The selected parameters were compared with healthy children outcomes. The results showed a significant difference between EPI parameters of children with autistic and healthy. The autistic children showed a higher activation coefficient (AC) when compared with healthy control which suggests the resting cardiac vagal tone was less in autistic children. The outcome of AC can be speculated that autistic children have elevated sympathetic tone suggesting autonomic abnormality.[28] The outcome of AC is concomitant with other findings which suggest that the autonomic nervous system is impaired in children with autism, mainly decreased parasympathetic activity revealed by auto power and coherence spectra analysis.[29,30]

Apart from AC, other parameters of EPI on left and right side showed significant different in autistic and healthy children. The left and right side of RMS integral area showed positively lower energy level in healthy children and significantly higher in autistic children. The higher energy values in integral area in autistic children suggests high load on physiological system, this may be due to poor adaptation.[31] The healthy children showed physiological flexibility which may be helpful for acute stress adaptation in healthy children and impaired in autism children.[32] The poor adaptation is associated with dysregulation of the autonomic activity, particularly sympathetic and parasympathetic outflow that outflows *via* brainstem and sacral spinal region. In the present study, sacrum showed high level of energy in children with autism compared to normal healthy. Previous evidence suggests that ASD may be associated with hyper-arousal of the ANS in ASD children.[33] The hyper-arousal behavior altered hypothalamic-pituitary-adrenal (HPA) axis and diminished grey matter within the hypothalamus in autism disorder[34,35] that can be correlated with marked lower energy level in autistic compare to normal healthy children. The grey matter in the hypothalamus linked with social interaction, restricted and stereotyped pattern of behavior as reported in autistic children.[34] The hypothalamus synthesizes behavior associated hormones like oxytocin and arginine vasopressin. The energy level is higher in thyroid gland, that may suggest ASD is related to thyroid dysfunction, common in children with ASD.[36]

Table 2: Correlation analysis of autistic children.

	Age	Activation coefficient	Integral area	RMS of integral area	Sacrum	Hypothalamus	Thyroid gland	Left eye	Liver	Pancreas	Coronary vessels
Age	Pearson's r	—									
	p value	—									
Activation coefficient	Pearson's r	0.111	—								
	p value	0.537	—								
Integral area	Pearson's r	0.390	*0.210	—							
	p value	0.025	0.241	—							
RMS of integral area	Pearson's r	0.290	0.048	0.268	—						
	p value		0.791	0.132	—						
Sacrum	Pearson's r	0.250	-0.015	0.347	*0.478	** —					
	p value	0.161	0.935	0.048	0.005	—					
Hypothalamus	Pearson's r	0.096	0.194	0.526	** -0.016	0.178	—				
	p value	0.594	0.278	0.002	0.928	0.322	—				
Thyroid gland	Pearson's r	0.267	0.119	0.345	*0.284	0.324	0.265	—			
	p value	0.133	0.508	0.050	0.109	0.066	0.136	—			
Left eye	Pearson's r	0.227	0.321	0.518	**0.029	0.082	0.329	0.066	—		
	p value	0.205	0.069	0.002	0.871	0.650	0.062	0.716	—		
Liver	Pearson's r	0.347	*0.257	0.393	*0.323	0.585	***0.127	0.305	0.193	—	
	p value	0.048	0.149	0.024	0.067	<0.001	0.481	0.084	0.282	—	
Pancreas	Pearson's r	0.270	-0.034	0.226	0.412	*0.564	***0.163	0.749	***0.133	0.322	—
	p value	0.129	0.850	0.206	0.017	<0.001	0.365	<0.001	0.461	0.068	—
Coronary vessels	Pearson's r	-0.191	-0.065	0.164	-0.341	-0.035	0.177	0.123	0.318	0.055	0.051
	p value	0.288	0.720	0.360	0.052	0.846	0.324	0.496	0.071	0.762	

Table 3. Correlation analysis of healthy children.

		Age	Activation coefficient	Integral area	RMS of integral area	Sacrum	Hypothalamus	Thyroid gland	Left eye	Liver	Pancreas	Coronary vessels
Age	Pearson's r	—										
	p value	—										
Activation coefficient	Pearson's r	-0.135	—									
	p value	0.268	—									
Integral area	Pearson's r	0.51	***-0.160	—								
	p value	<0.001	0.189	—								
RMS of integral area	Pearson's r	0.378	** -0.284	* 0.335	** —							
	p value	0.001	0.018	0.005	—							
Sacrum	Pearson's r	0.280	*-0.101	0.349	**0.473	*** —						
	p value	0.020	0.407	0.003	<0.001	—						
Hypothalamus	Pearson's r	0.104	0.156	0.565	***-0.074	0.098	—					
	p value	0.396	0.200	<0.001	0.544	0.424	—					
Thyroid gland	Pearson's r	0.300	*-0.191	0.448	***0.286	*0.308	**0.239	* —				
	p value	0.012	0.116	<0.001	0.017	0.010	0.048	—				
Left eye	Pearson's r	0.278	*0.105	0.479	***0.012	0.072	0.382	** 0.108	—			
	p value	0.021	0.391	<0.001	0.922	0.558	0.001	0.377	—			
Liver	Pearson's r	0.317	**-0.052	0.361	**0.395	***0.532	***0.169	0.208	0.108	—		
	p value	0.008	0.674	0.002	<0.001	<0.001	0.165	0.086	0.378	—		
Pancreas	Pearson's r	0.242	*-0.233	0.323	**0.380	**0.511	***0.165	0.772	***0.128	0.310	** —	
	p value	0.045	0.054	0.007	0.001	<0.001	0.176	<0.001	0.294	0.010		
Coronary vessels	Pearson's r	0.001	-0.170	0.388	***-0.147	0.090	0.277	*0.241	*0.331	**0.042	0.179	—
	p value	0.992	0.161	<0.001	0.227	0.462	0.021	0.046	0.006	0.735	0.140	—

* p < .05, ** p < .01, *** p < .001.

The autistic children also showed gastrointestinal (GI) dysfunction including chronic constipation and diarrhea as well as mitochondrial disorder that leads to pancreatic, liver and coronary insufficiency.[37] These changes affect the GI system as well as alter the gut microbiome in developing infant that is associated with ASD.[38] The alteration in gut microbiota is related to GI problems that may be due to overproduction of bacterial metabolites or altered brain structure and associated functions.[3,39] Few other studies reported that ASD is a highly genetic and multifactorial disease that may affect synaptic maturation and neural effect of gene expression.[40] The synaptic energy support cell metabolism and cell function that is associated with health and disease.[41] The energy level of the pancreas, liver and coronary vessels showed a significant difference between autistic and healthy children. These outcomes can be possibly correlate with other psychological scales of autism in future studies.

However, the findings of EPI parameters are positively correlated with symptoms at organ level as showed in previous findings associated with Autism. Therefore, EPI biometric tool has the potential to identify a dysfunctional state from normal functional state at an early stage in real-time as shown in the present study. It measures the biological and behavioral patterns by biophotons emitted by a living organism that corresponds to the organ and organ system behavior and health. There are other few studies that have been trying to understand the biological pattern specific to the disease. Further, this device is a completely non-invasive, less time consuming and safe method where the electric current flow through a pulse current in microamps that does not affect any cell and tissue or other physiological changes.

CONCLUSION

This study pointed out the significance of using the EPI instrument for assessing the psycho-physiological and functional state of organ and organ system in autistic and normal healthy children. Further investigation could help use this device as a possible diagnostic tool for the diagnosis of ASD. The changes in EPI parameters can be further explored in coming up with an effective interventional strategy to correct the corresponding EPI parameters. However, further study is required to investigate more autistic children and correlate with other quantitative methods to identify the prognosis of autism in children.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Sankhala SS, Deepeshwar S, Kotikalapudi S, Chatterjee S. Determining bioenergy field of autistic and normal healthy children: an electrophotonic imaging study. Int J Community Med Public Health 2020;7:1547-54.