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Correlation of Electrophotonic Imaging Parameters With Fasting Blood Sugar in Normal, Prediabetic, and Diabetic Study Participants

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Abstract

Introduction. Electrophotonic imaging (EPI), also known as gas discharge visualization, is a technique of capturing images of phenomena not quantifiable by the naked eye. Different sectors at the tip of fingers represent various organs and systems as per the Chinese system of acupuncture. The images from these fingertips can be used to determine the state of health. This is done with the help of a CCD camera fitted in the EPI equipment and the specific software relevant for analysis. *Aim.* To observe the correlation between EPI parameters and fasting blood sugar (FBS) levels in normal, prediabetic, and diabetic study participants. *Materials and Methods.* A total of 102 participants were selected for this study from various yoga camps and Arogyadham at Swami Vivekananda Yoga Anusandhana Samsthana Yoga University, Bengaluru, India. The selected participants belonged to 3groups—normal, prediabetic, and diabetic—depending on the FBS levels. The distribution of participants was 29 normal, 13 prediabetic, and 60 diabetic. *Results.* Regression analysis in the case of prediabetics showed a significant relationship of FBS with pancreas and right kidney. In the case of normal participants, a significant relationship of FBS was found with area and form coefficient of the EPI gram. For diabetics, regression analysis showed significant relationship of FBS with immune organs, left kidney, area, intensity, and entropy of EPI grams. *Conclusion.* FBS correlates differently in the normal, prediabetic, and diabetic groups. In the prediabetic group, correlation of FBS with EPI parameters pancreas and right kidney is noteworthy and in line with latest findings in medical research.

Keywords

electrophotonic imaging, fasting blood sugar, diabetes, parameters, correlation

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Diabetes is a condition in which either the body produces insufficient insulin or it produces sufficient insulin but body cells are not able to use it properly.[1,2] There are 2 types of diabetes: type 1, which is called insulin-dependent diabetes mellitus, and type 2, which is called non-insulin-dependent diabetes mellitus.[3] Type 2 is more prevalent and is rapidly increasing in number across the globe. Undiagnosed and untreated, this disease leads to a host of serious conditions in which multiple organs are affected. Worldwide, diabetes has raised concern and is receiving increased attention.[4] With the limitations of modern medical system in containing diabetes, there is great momentum in the direction of holistic approach of treatment.[5,6] This is because diabetes is greatly linked to stress. Alternative/supplementary medicine is a proven therapy against stress. Yoga has a prominent place in the area of complementary medicine.[7] It works both at the gross and subtle levels.[8] Most of the physical problems in the human body have its origin in the mind, which is subtle in nature. As per yoga and ayurveda, disturbances in mind result in the disease and further progression leads to chronic illness.[9] There are innumerable studies on the effects of yoga on various ailments and stress levels.[10] Modern research has demonstrated interrelatedness of various disciplines from the

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level of basic biological processes to a dynamic system or "biofield" level.[11] Molecular, cellular, organic function, and regulation are thus interwoven with and can be influenced by emotion, cognition, and psychosocial factors, suggesting the existence of a "subtle," that is, low-energy system of biofield interactions connecting these activities. The term *biofield* is defined as "an organizing principle for the dynamic information flow that regulates biological function and homeostasis."[12] Another development in the field of subtle energies is electrophotonic imaging (EPI), which is a biofield device. This equipment is used widely in Russia for measuring subtle phenomena in the body.[13] Subtle changes in the body result in Chi energy disturbances and these are captured through the images taken from tips of 10 fingers. The mechanism of working of EPI is simple. The fingertips represent various organs/systems within the human body. This is as per the Chinese medical system of acupuncture.[14] The finger is placed on a glass surface and a high-voltage pulse of amplitude 10 kV, with a frequency of 1024 Hz, is applied. A very small and safe level of current, in milliamperes, is applied for less than a millisecond at the fingertips of the human body.[15] The electrons extracted thus form an image that is captured by a camera in EPI. The images are analyzed and processed with the help of software, and data are generated in the form of energy diagrams, numerical data, and some other parameters. Values of different parameters are indicative of the health profile.[16,17] The prominent parameters are area, entropy, form coefficient, fractility, and intensity.[18] There are parameters specific to organs and systems. So every organ/system is evaluated through integral area and entropy specific to it. Based on the literature on type 2 diabetes mellitus in the modern medical system, we have considered integral area parameter of liver, pancreas, and immune organs[19]; coronary vessels[20]; cerebral vessels[21]; left kidney and right kidney[22] for our study. Literature survey has revealed that EPI can be used for the study of effects of conventional/alternative medicine on asthma, cancer, autism, among other diseases.[23-25] There are studies on the effects of music and meditation on stress levels as measured by EPI. The parameter used in these studies is activation coefficient.[26,27] The parameters of EPI are standardized for the European population. However, there is a recent study on the standardization for the Indian population as well.[28] It is easier for the scientific community to accept new concepts if there is a degree of correlation with established norms or parameters. The present study is focused on this aspect.

Materials and Methods

This study was carried out on participants who attended various yoga camps connected with the "Stop Diabetes Movement" campaign of Swami Vivekananda Yoga University, Bengaluru, India. Besides, there were participants from Arogyadham, a residential health center of Swami Vivekananda Yoga University. The study was to observe correlation between fasting blood sugar (FBS) and EPI parameters. Participants were divided into 3 groups depending on the FBS level: normal, prediabetic, and diabetic. Normal and prediabetic participants had reported no health problems. In fact, the prediabetic participants came to know of their FBS level for the first time. In the diabetic group, there were some whose FBS level was within normal limits and some whose FBS level showed uncontrolled diabetes. Some diabetics were on medication and yet had persistently FBS levels greater than 126 mg/dL. For our study, both the groups (with medication and with or without control of diabetes) were considered as one and designated as type 2 diabetes mellitus. The FBS level for normal participants was 70 to 100 mg/dL, prediabetes 100 to 125 mg/dL, and diabetes 126 mg/dL and more.[29] The data were taken from June 2015 to September 2015.

Participants

Two hundred participants from various yoga camps in the rural areas of Bengaluru and Arogyadham at Swami Vivekananda Yoga University were scrutinized. Out of these, 102 participants were selected for the study. Those for whom there were defects in the electrophotonic image and/or biochemical (FBS) reports were not available did not qualify for the study. Of those selected, 42 participants were in the category of no health problem. The sample comprised 29 normal and 13 prediabetic participants; 60 participants were in the category of diabetics irrespective whether the diabetes was under control or uncontrolled. The 3 groups were designated as normal, prediabetic, and diabetic. Out of 42 (mean age 46.5 $\pm$ 11.7) in the nondiabetic group, 17 were males (mean age 48.47 $\pm$ 13.26) and 25 were females (mean age 45.2 $\pm$ 10.6). The normal group consisted of 29 (mean age 44 $\pm$ 11), and the prediabetic group consisted of 13 (mean age 51.2 $\pm$ 12.3). In the diabetic group of 60 (mean age 54 $\pm$ 9.6), there were 35 males (mean age 56.83 $\pm$ 8.72) and 25 females (mean age 50 $\pm$ 9.4). Participants in the age range of 18 to 75 years, male or female, and willing to participate were included in the study.

Exclusion Criteria

The following subjects were excluded from the study: participants with comorbidity[30] and taking any medicine in the case of normal and prediabetic participants; diabetic participants taking medicines apart from diabetes medications; participants suffering from any infectious or contagious diseases; physically handicapped persons with missing fingers; and females having menstruation or pregnancy on the day of measurement.

Sampling Time

The data were taken in the morning hours with a gap of at least 3 hours after the last meal. The data in the camps were taken on the inaugural day of the camp. Data at Arogyadham was taken in the morning as well in the evening but ensuring a gap of 3 hours after the last meal. EPI was calibrated each time the place of taking measurement changed or as required. Informed consent was taken from all the participants before conducting the study. The study was approved by the institutional ethics committee of the university.

Instrument

Kirlionics Technologies International (St Petersburg, Russia; GDV camera Pro with analog video camera, model number: FTDI.13.6001.110310) was used for the assessment purpose. Along with the EPI software, it provided various features such as EPI screening, EPI scientific laboratory, EPI diagram.

Parameters Analyzed

From the EPI scientific laboratory the following parameters were analyzed: *Total area* is an absolute value and is measured as the number of pixels in the image having brightness above the threshold; *intensity* is

Table 1. Electrophotonic Imaging Diagram/Screening Analysis (Independent Samples *t* Test).

Variables	Normal, Mean ± SD	Prediabetic, Mean ± SD	Diabetic, Mean ± SD
Average liver	−0.05 ± 0.47	0.10 ± 0.33	0.27 ± 0.53
Average immune organs	−0.20 ± 0.31	−0.17 ± 0.29	0.08 ± 0.38
Average pancreas	−0.26 ± 0.59	0.10 ± 0.39	0.22 ± 0.53
Average coronary vessels	−0.13 ± 0.37	−0.05 ± 0.24	0.21 ± 0.32
Average cerebral vessels	−0.02 ± 0.29	0.01 ± 0.31	0.26 ± 0.35
Average left kidney	−0.05 ± 0.44	0.05 ± 0.39	0.26 ± 0.43
Average right kidney	−0.09 ± 0.36	−0.06 ± 0.38	0.24 ± 0.46

Table 2. Electrophotonic Imaging Scientific Laboratory Analysis (Independent Samples *t* Test).

Variables	Normal, Mean ± SD	Prediabetic, Mean ± SD	Diabetic, Mean ± SD
Average area	11487.62 ± 1416.98	11597.54 ± 1425.695	12003.11 ± 1451.19
Average intensity	78.0867 ± 5.863	77.3890 ± 8.345	84.06 ± 7.62
Average form coefficient	14.9347 ± 4.792	15.5009 ± 6.065	11.34 ± 3.24
Average entropy	1.8603 ± 0.161	1.7691 ± 0.180	1.96 ± 0.16
Average fractility	1.9229 ± 0.174	1.9860 ± 0.120	1.85 ± 0.05

the evaluation of light intensity averaged on the area of the image; *form coefficient* and *fractility* are measures of irregularity in the image external contour; *entropy* reflects the level of nonuniformity of image, in other words, the level of stability of the energy field. EPI diagram/EPI screening grams give the *integral area* parameter, which is an index of the particular sector of image related to the organ in accordance with the principles of traditional Chinese medicine. This parameter, corresponding to organs *liver*, *pancreas*, *immune organs*, *coronary vessels*, *cerebral vessels*, *left kidney*, and *right kidney*, were analyzed. *Integral area* is a relative value and shows the extent to which the EPI gram deviates from an ideal model. It is an indicator of general health.

Data Analysis

Data analysis was done with the help of Microsoft Office Excel 2007 and R studio along with R cmdr. Statistical tests were conducted for correlation and linear regression.

Results

The participants were divided into 3 groups: normal, prediabetic, and diabetic. Independent samples *t* test showed change in average values of the selected parameters in these groups (Tables 1 and 2). First, correlation analysis was done between FBS and each of the selected EPI parameters in the 3 groups (Table 3). In normal subjects, a high correlation (but not significant) was observed between FBS and form coefficient ($P = .06$, $r = .35$). Significant correlation was found between FBS and right kidney ($P = .03$, $r = -.60$) in the prediabetic group. In the case of diabetics, a high correlation (but not significant) was observed of FBS with immune organs ($P = .06$, $r = -.25$), with coronary vessels ($P = .09$, $r = .22$), and with entropy ($P = .08$, $r = .23$). Noteworthy results of correlation analysis are given in Table 4 and summarized in Table 5. Negative sign indicates that the predictor variable and the responding variable increase in opposite directions. In the diabetic group, further analysis was done separately for males and

Table 3. Correlation Analysis (All Parameters).

	FBS/With	*t*	df	*P*	*r*
Normal	Average liver	0.966	27	.342	.182
	Average immune organs	1.392	27	.175	.258
	Average pancreas	0.047	27	.962	.009
	Average coronary vessels	0.995	27	.328	.188
	Average cerebral vessels	−0.157	27	.875	−.030
	Average left kidney	0.832	27	.412	.158
	Average right kidney	0.553	27	.584	.105
	Average total area	1.454	27	.157	.269
	Average intensity	−0.718	27	.478	−.136
	Average form coefficient	1.943	27	.062	.350
	Average entropy	0.066	27	.947	.012
	Average fractility	−0.179	27	.858	−.034
Prediabetic	Average liver	−1.203	11	.254	−.341
	Average immune organs	−0.555	11	.589	−.165
	Average pancreas	0.800	11	.440	.234
	Average coronary vessels	0.921	11	.376	.267
	Average cerebral vessels	0.006	11	.994	.002
	Average left kidney	0.299	11	.770	.089
	Average right kidney	−2.459	11	.031	−.595
	Average total area	0.182	11	.858	.055
	Average Intensity	1.035	11	.322	.298
	Average form coefficient	−0.251	11	.805	−.075
	Average entropy	1.193	11	.257	.338
	Average fractility	−0.773	11	.453	−.227
Diabetic	Average liver	−0.742	58	.461	−.096
	Average immune organs	−1.956	58	.055	−.248
	Average pancreas	−0.578	58	.565	−.075
	Average coronary vessels	−1.752	58	.085	−.224
	Average cerebral vessels	−0.656	58	.514	−.085
	Average left kidney	−0.749	58	.456	−.097
	Average right kidney	−0.979	58	.331	−.127
	Average total area	0.935	58	.353	.121
	Average Intensity	−1.647	58	.104	−.211
	Average form coefficient	0.960	58	.340	.125
	Average entropy	−1.771	58	.081	−.208
	Average fractility	1.621	58	.110	−.226

Abbreviations: FBS, fasting blood sugar; df, degrees of freedom.

Table 4. Correlation Analysis (Noteworthy).

Group	FBS/With	*t*	df	*P*[a]	*r*[b]
Normal	Average form coefficient	1.943	27	.062	.350
Prediabetic	Average right kidney	−2.459	11	.031	−.596
Diabetic	Average immunity	−1.956	58	.055	−.248
	Average coronary vessels	−1.752	58	.085	−.224
	Average entropy	−1.772	58	.081	0.208

Abbreviations: FBS, fasting blood sugar; df, degrees of freedom.
[a]*P*, level of significance, <.05 considered significant.
[b]*r*, correlation coefficient varies between −1 and +1.

Table 5. FBS and EPI Correlation in the 3 Categories.

FBS/With	Normal	Prediabetic	Diabetic
Average area	Yes	No	Yes
Average intensity	No	No	Yes
Average entropy	No	No	Yes
Average form coefficient	Yes	Yes	No
Average Pancreas	No	Yes	No
Average immunity	No	No	No
Average left kidney	No	No	No
Average right kidney	No	Yes	No

females. There is no significant correlation of FBS with any EPI parameter but some correlation with immune organs ($P = .11$, $r = -.27$) in the male subgroup and entropy ($P = .19$, $r = -.26$) and fractility ($P = .17$, $r = .27$) in the female subgroup. Significant results of regression analysis for the 3 different groups done on the basis of the aforementioned results are depicted in Table 6. The detailed gender-based correlation and regression analysis results are reflected in Tables 7 and 8, respectively. Another analysis carried out on the EPI parameters in the 3 groups yielded a significant change from normal to prediabetic to diabetic (Table 9).

Discussion

Fasting blood sugar is an established biochemical test to check the glucose levels in the blood. Research advances for the development of new technologies to provide more accurate diagnosis. EPI is such an approach. This study was carried out to find correlation of various EPI parameters with FBS in different stages of diabetes mellitus type 2. The 3 stages were normal, prediabetic, and diabetic. Summary of results is presented in Table 6.

For normal subjects, the FBS value is in the range of 70 to 100 mg/dL. In this condition, as anticipated, no organ is affected

Table 6. Regression Analysis.

Normal Group	Estimate	Standard Error	*t* Value	Pr(>|*t*|)
Intercept	49.475	10.964	4.512	.000122***
Average area	0.002	0.001	3.085	.004780**
Average form coefficient	0.779	0.229	3.398	.002196**

Residual standard error = 5.167 ***$P < .001$, **$P < .01$

$FBS = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$
Where $\alpha = 49.475$, $\beta_1 = 0.0024$, $\beta_2 = 0.7796$, $\varepsilon = 5.167$; X_1 = total area; X_2 = Form coefficient

Prediabetic	Estimate	Standard Error	*t* Value	Pr(>|*t*|)
Intercept	116.856	7.246	16.126	1.74e-08***
Average pancreas	63.734	20.187	3.157	.01021*
Average right kidney	−90.257	20.572	−4.387	.00136**

Residual standard error = 24.16 ***$P < .001$, **$P < .01$, *$P < .05$

$FBS = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$
Where $\alpha = 116.856$, $\beta_1 = 63.734$, $\beta_2 = -90.257$, $\varepsilon = 24.16$; X_1 = integral area of pancreas; X_2 = integral area of right kidney

Diabetic	Estimate	Standard Error	*t* Value	Pr(>|*t*|)
Intercept	494.6	139.4	3.548	.000812***
Average immune organs	−96.11	31.78	−3.024	.003809**
Average intensity	−3.082	1.176	−2.621	.011356*
Average left kidney	51.33	28.12	1.825	.073502$^+$
Average entropy	−149.3	52.15	−2.863	.005965**
Average area	0.017	.006	2.711	.008983**

Residual standard error = 61.42 ***$P < .001$, **$P < .01$, *$P < .05$, $^+P < .1$

$FBS = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$
Where $\beta = 494.6$, $\beta_1 = -96.11$, $\beta_2 = -3.082$, $\beta_3 = 51.33$, $\beta_4 = -149.3$, $\beta_5 = 0.01698$, $\varepsilon = 61.42$; X_1 = integral area of immune organs; X_2 = intensity; X_3 = integral area of left kidney; X_4 = entropy; X_5 = area

Abbreviations: FBS, fasting blood sugar; α, constant; β_1, coefficient of variable X_1; β_2, coefficient of variable X_2; . . . ; β_n, coefficient of variable X_n. *t*, *t* test value; ε, residual standard error; $P < .001$ very highly significant; $P < .01$ highly significant; $P < .05$ significant; $P < .1$ not significant.

Table 7. Correlation Analysis Diabetic Males and Females (Separately).

	FBS/With	*t*	df	*P*	*r*
Males	Average liver	−0.046	33	.963	−.008
	Average immune organs	−1.627	33	.113	−.272
	Average pancreas	0.260	33	.795	.045
	Average coronary vessels	−1.02	33	.315	−.174
	Average cerebral vessels	−0.656	33	.514	−.085
	Average left kidney	−0.005	33	.995	−.000
	Average right kidney	−0.203	33	.840	−.035
	Average area	1.049	33	.301	.179
	Average intensity	−0.740	33	.464	−.127
	Average form coefficient	0.355	33	.724	.061
	Average entropy	−0.944	33	.351	−.162
	Average fractility	0.888	33	.380	.152
Females	Average liver	−0.555	23	.584	−.114
	Average immunity	−0.465	23	.646	−.096
	Average pancreas	−1.136	23	.267	−0.230
	Average coronary	−0.774	23	.446	−.159
	Average cerebral	−0.013	23	.989	−.002
	Average left kidney	−0.477	23	.635	−.099
	Average right kidney	−1.021	23	.317	−.208
	Average area	0.507	23	.617	−.105
	Average intensity	−1.239	23	.227	−.250
	Average form coefficient	0.718	23	.480	.148
	Average entropy	−1.325	23	.198	.279
	Average fractility	1.394	23	.176	.152

Abbreviations: FBS, fasting blood sugar; df, degrees of freedom.

due to diabetes. However, the FBS value depends on general health conditions. Total area is representative of general health, and form coefficient is a measure of irregularity in the image. Thus, normal FBS is correlated to these 2 parameters. There could be small variations in FBS within the normal limits in this group. Since no 2 human bodies function alike, there would be variation in area and form coefficient between persons as well within the same person under different conditions, which is natural. The more interesting observation is prediabetics where FBS showed a relationship with pancreas and right kidney. While both organs are prone in diabetes, the relationship in prediabetic stage was not known. It has very recently been reported that the changes in organs, particularly the kidney and pancreas, set in much earlier to diabetes being manifested.[31] Kidney damage from diabetes may thus begin much sooner than previously thought, according to the aforementioned study. A recent study has shown that above-normal sugar levels, which is found in prediabetes, could also result in kidney abnormalities that could finally cause kidney failure.[32,33] Normal blood tests in prediabetic stage may not show any damage but the subtle effects are already seen to be happening in some connected organs. Our study on EPI clearly demonstrates this and significantly substantiates and is in alignment with the latest medical research on the subject. Among diabetics, there were subjects whose diabetes was under control and also subjects whose diabetes seemed uncontrolled. This observation was based on FBS

Table 8. Regression Analysis, Diabetics Males and Females (Separately).

Males	Estimate	Standard Error	*t* Value	Pr(>|*t*|)
Intercept	707.686	309.572	2.286	.03*
Average immune organs	−90.095	40.229	−2.240	.03*
Average intensity	−4.156	2.022	−2.055	.04*
Average left kidney	64.576	39.664	1.628	.11
Average right kidney	−18.652	33.699	−0.553	.58
Average entropy	−252.386	122.559	−2.059	.04*
Average area	0.023	0.011	2.067	.04*

Residual standard error = 64.05 *$P < .05$

$FBS = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \varepsilon$

Where $\alpha = 707.6$; $\beta_1 = -90.09$, $\beta_2 = -4.15$, $\beta_3 = 64.57$, $\beta_4 = -18.65$, $\beta_5 = -252.38$, $\beta_6 = 0.02$; $\varepsilon = 64.05$; X_1 = integral area of immune organs; X_2 = intensity; X_3 = integral area of left kidney; X_4 = integral area of right kidney; X_5 = entropy; X_6 =area

Females	Estimate	Standard Error	*t* Value	Pr(>|*t*|)
Intercept	−1123.12	605.61	−1.855	.07$^+$
Average immune organs	−117.46	67.09	−1.751	.09$^+$
Average left kidney	80.00	58.34	1.371	.185
Average entropy	−168.03	68.86	−2.440	.024*
Average fractility	864.54	349.14	2.476	.022*

Residual standard error = 61.04 *$P < .05$, $^+P < .1$

$FBS = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$

Where $\alpha = -1123.12$; $\beta_1 = -117.46$, $\beta_2 = 80.00$, $\beta_3 = -168.03$, $\beta_4 = 864.54$; $\varepsilon = 61.04$; X_1 = integral area of immune organs; X_2 = integral area of left kidney; X_3 = entropy; X_4 = fractility

Abbreviations: FBS, fasting blood sugar; α, constant; β_1, coefficient of variable X_1; β_1, coefficient of variable X_2; . . . ; β_n, coefficient of variable X_n. *t*, *t* test value; ε, residual standard error; $P < .001$ very highly significant; $P < .01$ highly significant; $P < .05$ significant; $P < .1$ not significant.

Table 9. Summary of Independent Samples *t* Test Between the 3 Groups.

Parameter	Groups	Level of Significance of Difference[a]
Average intensity	Diabetes–Normal	Significant
	Diabetes–Prediabetes	Significant
	Normal–Prediabetes	Not significant
Average form coefficient	Diabetes–Normal	Highly significant
	Diabetes–Prediabetes	Significant
	Normal-Prediabetes	Not significant
Average entropy	Diabetes–Normal	Highly significant
	Diabetes–Prediabetes	Highly significant
	Normal–Prediabetes	Not significant
Average fractility	Diabetes–Normal	Significant
	Diabetes–Prediabetes	Highly significant
	Normal-Pre diabetes	Not significant
Average liver	Diabetes–Normal	Highly significant
	Diabetes–Prediabetes	Not significant
	Normal–Prediabetes	Not significant
Average immune organs	Diabetes–Normal	Very highly significant
	Diabetes–Prediabetes	Very highly significant
	Normal–Prediabetes	Very highly significant
Average pancreas	Diabetes–Normal	Highly significant
	Diabetes-Prediabetes	Not significant
	Normal–Prediabetes	Significant
Average coronary	Diabetes–Normal	Very highly significant
	Diabetes–Prediabetes	Highly significant
	Normal–Prediabetes	Not significant
Average cerebral	Diabetes–Normal	Very highly significant
	Diabetes–Prediabetes	Significant
	Normal–Prediabetes	Not significant
Average left kidney	Diabetes–Normal	Highly significant
	Diabetes–Prediabetes	Not significant
	Normal–Prediabetes	Not significant
Average right kidney	Diabetes–Normal	Highly significant
	Diabetes–Prediabetes	Significant
	Normal–Prediabetes	Not significant

[a]$P < .001$ very highly significant; $P < .01$ highly significant; $P < .05$ significant.

readings. For our study, we considered these 1 groups as one. In this group, we observe that FBS is related both to general EPI parameters as well the organ values. Among organs are immune organs and left kidney. Since immune functions and kidneys are showing lesser energy, they can have overall impact on the general health parameters. Thus, we find correlation with area (measure of general health), entropy (measure of disturbances in the body, it increases with diabetes), and intensity. The results are in consonance with current medical literature and hence EPI may be a research tool to understand the energy status of various organs/systems before the full-fledged manifestation of disease. Earlier studies on EPI were mostly focused on comparison of parameters in the 2 states, viz., pre- and postintervention, where the reference for comparison was the EPI parameter itself.[34] In this study, we have compared the results with known and established biochemical parameters. A workable relationship has been established between the EPI and biochemical parameters and this can help a healer in diagnosis and to assess the effectiveness of treatment.[17] Separate analysis of males and females yields interesting outcomes. Noteworthy among them is the negative correlation with immunity, which is significant in males than in females. This perhaps is due to the fact that immunity in the case of women is more than that of men.[35-37] Very high significant to significant difference in the selected parameters were observed when average values of EPI parameters in the 3 groups were compared by independent samples *t* test. The difference was more pronounced between normal and diabetics; prediabetics and diabetics. The difference between normal and prediabetics was not significant in most of the EPI parameters except pancreas and immune organs. This is an important observation showing that these 2 organs get affected the most at the prediabetic stage.

Strength of the Study

EPI can be used by practitioners of conventional, alternative, and holistic medicine to have a preliminary idea of glucose levels in blood. This study has indicated changes at the organ level in the prediabetic stage itself. Statistical tools were of great help in arriving at the results. Correlation between FBS and right kidney at the prediabetic stage is the greatest strength of this study. It conforms to the latest research in the modern

medical system.[31] It establishes that the EPI technique can be a reliable tool for observing changes at the premanifestation stage of the disease.

Limitations of the Study

Work needs to be taken up on much larger sample sizes especially for people with prediabetes. The distinction between controlled diabetes and uncontrolled diabetes needs to be studied in detail along with the mechanism. The linear regression equation needs to be more refined and residual error reduced.

Future of EPI

Future studies need to focus on integration of EPI with genetics and molecular biology,[38,39] and of course, further developments on EPI itself and software for interpretation may be required for systematic evaluation of many disorders.

Conclusion

EPI can measure subtle energies that would be highly helpful to modern medicine in initiating preemptive action against diseases. The protocol of medicine might change and lead to formulating an energy-based paradigm. More research in the field of EPI will make this change happen sooner than later. Similar research can be undertaken on other serious diseases as well. EPI can be used by both modern medicine practitioners as well alternative medicine therapists and healers to assess the effectiveness of their treatment.

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Author Contributions

RKB: Principal investigator of the project, data analysis and interpretation, preparation of the first draft of the article. GD: Data collection and review of the final version of the article. RM: Comentor and design of the study. TMS: Mentor and reviewed the final version of this article.

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Ethical Approval

This study was cleared by the Institutional Ethics Committee at S-VYASA Yoga University, Bengaluru, India. Informed consent was obtained from the participants (RES/1EC-SVYASA/66/2015).

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