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

Romesh Kumar Bhat¹, Guru Deo, PhD¹, Ramesh Mavathur, PhD¹, and Thaiyar Madabusi Srinivasan, PhD¹

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 Arogyadhram at Swami Vivekananda Yoga Anusandhana Samsthana Yoga University, Bengaluru, India. The selected participants belonged to 3 groups—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

Received April 21, 2016. Received revised August 26, 2016. Accepted for publication September 1, 2016.

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

¹ S-VYASA University, Bangalore, Karnataka, India

Corresponding Author:
Romesh Kumar Bhat, Swami Vivekananda Yoga Anusandhana Samsthana, #19, “Ekath Bhavan”, Gavipuram Circle, Kempe Gowda Nagar, Bengaluru 560019, India.
Email: romesh112005@yahoo.co.in
level of basic biological processes to a dynamic system or “bio-
field” level. Molecular, cellular, organic function, and regula-
tion are thus interwoven and can be influenced by emotion, cog-
nition, and psychosocial factors, suggesting the existence of a
“subtle,” that is, low-energy system of biofield interactions con-
necting these activities. The term biofield is defined as “an orga-
nizing principle for the dynamic information flow that regulates
biological function and homeostasis.”

Another development in the field of subtle energies is electro-
photonic imaging (EPI), which is a biofield device. This equip-
ment is used widely in Russia for measuring subtle phenomena in
the body. Subtle changes in the body result in Chi energy distur-
bances 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. 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. 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 indi-
cative of the health profile. The prominent parameters are
area, entropy, form coefficient, fractility, and intensity. 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; coronary vessels; cerebral vessels; left kidney and right kidney 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. 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. 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. 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

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 cor-
relation between fasting blood sugar (FBS) and EPI parameters. Par-
ticipants 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 med-
ication 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
europathy. 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. 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 ± 11.7) in the nondiabetic group, 17 were males (mean age 48.47 ±
13.26) and 25 were females (mean age 45.2 ± 10.6). The normal group
consisted of 29 (mean age 44 ± 11), and the prediabetic group consisted
of 13 (mean age 51.2 ± 12.3). In the diabetic group of 60 (mean age 54 ±
9.6), there were 35 males (mean age 56.83 ± 8.72) and 25 females (mean age 50 ± 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 and taking any medicine in the case of normal and predia-
abetic participants; diabetic participants taking medicines apart from dia-
etes medications; participants suffering from any infectious or contagi-
ous 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 chan-

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 cor-
relation between fasting blood sugar (FBS) and EPI parameters. Par-
ticipants 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 med-
ication 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. 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 ± 11.7) in the nondiabetic group, 17 were males (mean age 48.47 ±
13.26) and 25 were females (mean age 45.2 ± 10.6). The normal group
consisted of 29 (mean age 44 ± 11), and the prediabetic group consisted
of 13 (mean age 51.2 ± 12.3). In the diabetic group of 60 (mean age 54 ±
9.6), there were 35 males (mean age 56.83 ± 8.72) and 25 females (mean age 50 ± 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 and taking any medicine in the case of normal and predia-
abetic participants; diabetic participants taking medicines apart from dia-
etes medications; participants suffering from any infectious or contagi-
ous 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 chan-
ged or as required. Informed consent was taken from all the partici-
pants 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 screen-
ing, EPI scientific laboratory, EPI diagram.

Parameters Analyzed

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

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

| Variables                  | Normal, Mean ± SD | Prediabetic, Mean ± SD | Diabetic, Mean ± SD |
|----------------------------|-------------------|------------------------|---------------------|
| Average area               | 11487.62 ± 1146.98 | 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         |

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

**Table 3. Correlation Analysis (All Parameters).**

| Variables      | Normal  | Prediabetic | Diabetic |
|----------------|---------|-------------|----------|
|                 | $t$     | $df$        | $P$      |
| FBS/With       |         |             |          |

Abbreviations: FBS, fasting blood sugar; df, degrees of freedom.
Table 4. Correlation Analysis (Noteworthy).

| Group     | FBS/With | t    | df  | P   | P^ | P^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 | .208  | |

Abbreviations: FBS, fasting blood sugar; df, degrees of freedom.
^P, level of significance, <.05 considered significant.
^bP, 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 | No | Yes |
| Average immunity | No | No | No |
| Average left kidney | No | No | No |
| Average right kidney | No | Yes | No |

Table 6. Regression Analysis.

**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 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).
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 prediabetes 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. 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. 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 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| -.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.

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

|                         | Estimate | Standard Error | t Value | Pr(>|t|) |
|-------------------------|----------|----------------|---------|---------|
| **Males**               |          |                |         |         |
| 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 = a + β1X1 + β2X2 + β3X3 + β4X4 + β5X5 + β6X6 + ε

Where a = 707.6; β1 = -90.09, β2 = -4.15, β3 = 64.57, β4 = -18.65, β5 = -252.38, β6 = 0.02; ε = 64.05; X1 = integral area of immune organs; X2 = intensity; X3 = integral area of left kidney; X4 = integral area of right kidney; X5 = entropy; X6 = area

|                         | Estimate | Standard Error | t Value | Pr(>|t|) |
|-------------------------|----------|----------------|---------|---------|
| **Females**             |          |                |         |         |
| 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 = a + β1X1 + β2X2 + β3X3 + β4X4 + ε

Where a = -1123.12; β1 = -117.46, β2 = 80.00, β3 = -168.03, β4 = 864.54; ε = 61.04; X1 = integral area of immune organs; X2 = integral area of left kidney; X3 = entropy; X4 = fractility

Abbreviations: FBS, fasting blood sugar; a, constant; β1, coefficient of variable X1; β2, coefficient of variable X2; ...; β6, coefficient of variable X6; t, t test value; ε, residual standard error; P < .001 very highly significant; P < .01 highly significant; P < .05 significant; P < .1 not 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

#### 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 | Not significant |
| | Diabetes–Prediabetes | Highly significant |
| | Normal–Prediabetes | Significant |
| Average entropy | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Highly significant |
| | Normal–Prediabetes | Significant |
| Average fractility | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Highly significant |
| | Normal–Prediabetes | Significant |
| Average liver | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Highly significant |
| | Normal–Prediabetes | Not significant |
| Average immune organs | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Very highly significant |
| | Normal–Prediabetes | Very highly significant |
| Average pancreas | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Highly significant |
| | Normal–Prediabetes | Not significant |
| Average coronary | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Very highly significant |
| | Normal–Prediabetes | Highly significant |
| Average cerebral | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Very highly significant |
| | Normal–Prediabetes | Significant |
| Average left kidney | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Highly significant |
| | Normal–Prediabetes | Not significant |
| Average right kidney | Diabetes–Normal | Not significant |
| | Diabetes–Prediabetes | Highly significant |
| | Normal–Prediabetes | Significant |

$^a P < .001$ very highly significant; $P < .01$ highly significant; $P < .05$ significant.
medical system. 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, 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 as alternative medicine therapists and healers to assess the effectiveness of their treatment.

Acknowledgments

The authors would like to thank Dr Judo Ilavarasu for the review and guidance. Dr Kuldeep K. Kushwaha was extremely helpful during collection of data. The support from the SDM (Stop Diabetes Movement) team and Aroghyadham of S-VYASA was highly valuable.

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.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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).

References

1. Chen CL, Tsai HW. Modeling the physiological glucose-insulin system on normal and diabetic subjects. Comput Methods Programs Biomed. 2010;97:130-140.
2. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care, 2010;33(suppl 1):S62-S69.
3. Tuomi T, Groop LC, Zimmet PZ, Rowley MJ, Knowles W, Mackay IR. Antibodies to glutamic acid decarboxylase reveal latent anti immune diabetes mellitus in adults with non-insulin-dependent onset of disease. Diabetes. 1993;42:359-362.
4. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes. Estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27:1047-1053.
5. Jonas WB, Chez RA, Duffy B, Strand D. Investigating the impact of optimal healing environments. Altern Ther Health Med. 2003; 9:36-40.
6. Tindle HA, Davis RB, Phillips RS, Eisenberg DM. Trends in use of complementary and alternative medicine by US adults: 1997-2002. Altern Ther Health Med. 2005;11:42-49.
7. Gupta N, Khera S, Vempati RP, Sharma R, Bijlani RL. Effect of yoga based lifestyle intervention on state and trait anxiety. Indian J Physiol Pharmacol. 2006;21:108-113.
8. Jakubczak M. The philosophical foundations of yoga therapy. In: Tymieniecka AT, Zalewski Z, eds. Life the Human Being Between Life and Death: A Dialogue Between Medicine and Philosophy: Recurrent Issues and New Approaches. Dordrecht, Netherlands: Springer; 2000:145-151. doi:10.1007/978-94-017-2081-6_14
9. Rao RM, Nagendra HR, Raghuram N, et al. Influence of yoga on mood states, distress, quality of life and immune outcomes in early stage of breast cancer patients undergoing surgery. Int J Yoga. 2008;1:11-20.
10. Nagarathna R, Nagendra HR. Integrated Approach Yoga Therapy for Positive Health. Bengaluru, India: Swami Vivekananda Yoga Prakashana; 2009.
11. Kafatos MC, Chevalier G, Chopra D, Hubacher J, Kak S, Theise ND. Biofield science: current physics perspectives. Glob Adv Health Med. 2015;4(suppl):25-34.
12. Muehsam D, Chevalier G, Barsotti T, Gurfein BT. An overview of biofield devices. Glob Adv Health Med. 2015;4(suppl):42-51.
13. Lee HC, Khong PW, Ghista DN. Bioenergy based medical diagnostic application based on gas discharge visualization. Paper presented at: Proceedings of the 2005 IEEE Engineering in Medicine and Biology 27th Annual Conference; Shanghai, China; September 1-4, 2005.
14. Yang JM, Choi C, Hyun-hee J, et al. Left-right and Yin-Yang balance of biophoton emission from hands. Acupunct Electrother Res. 2004;29:197-211.
15. Ciesielska IL. Images of corona discharge as a source of information about the effects of textiles on humans. AUTEX Res J. 2009;9:36-41.
16. Kostyuk N, Cole P, Meganathan N, Isokpehi RD, Cohly HH. Gas discharge visualization: an imaging and modeling tool for medical biometrics. Int J Biomed Imaging. 2011;2011:196460.
17. Korotkov KG, Matravers P, Orlov DV, Williams BO. Application of electrophoton capture (EPC) analysis based on gas discharge.
visualization (GDV) technique in medicine: a systematic review. *J Altern Complement Med.* 2010;16:13-25.
18. Alexandrova RA, Fedoseev BG, Korotkov KG, et al. Analysis of the bioelectrograms of bronchial asthma patients. Paper presented at: Proceedings of the conference “Measuring the Human Energy Field: State of the Science.” Baltimore, MD: National Institute of Health; 2003:70-81.
19. Kreier F, Kap YS, Mettenleiter TC, et al. Tracing from fat tissue, liver, and pancreas: a neuroanatomical framework for the role of the brain in type 2 diabetes. *J Endocrinol.* 2006;147:1140-1147.
20. Shimabukuro M, Saito T, Higa T, et al. Risk stratification of coronary artery disease in asymptomatic diabetic subjects using multi detector computed tomography. *Circ J.* 2015;79:2422-2429.
21. Shan Y, Lin J, Xu P, Zeng M, Lin H, Yan H. Association of aortic compliance and bronchial endothelial function with cerebral small vessels disease in type 2 diabetes mellitus patients: assessment with high resolution MRI. *Biomed Res Int.* 2016;2016:1609317.
22. Pecoits-Filho R, Abensur H, Betónico CC, et al. Interactions between kidney disease and diabetes: dangerous liaisons. *Diabetol Metab Syndr.* 2016;8:50.
23. Gagua PO, Gedevanishvili EG, Kapanidge A, et al. Experimental study of the EPI technique application in oncology. *J Izvestia Vuzor Priborostroenie.* 2006;49(2):47-51.
24. Akhmetelli GG, Boldyrevas US, Komissarov NV, et al. *Diagnostics of Allergy Etiology Using Gas Discharge Visualization (EPI) Technique.* Workbook: St Petersburg, Russia; 2004:54-58.
25. Yakovleva EG, Struchkov KG, Zarubina TV, et al. Evaluation of EPI technique diagnostic possibilities in examination of the patients afflicted with arterial hypertension. In: *Proceedings of X International Scientific Congress on Bioelectrography.* St Petersburg, Russia; 2006:216-218.
26. Srinivasan TM, Indira Rao T, Kushwah KK. Effect of Indian devotional music on students and performers measured with electron photonic imaging. 2014; 4:284-291.
27. Deo G, Itagi RK, Thaiyar MS, Kuldeep KK. Effect of anapanasati meditation technique through electrophotonic imaging parameters: a pilot study. *Int J Yoga.* 2015;8:117-121.
28. Kushwah KK, Srinivasan TM, Nagendra HR, Ilavarasu JV. Development of normative data of electro photonic imaging technique for healthy Indian population: a normative study. *Int J Yoga.* 2016;9:49-56.
29. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care.* 2011;34(suppl 1):S62-S69.
30. Pantalone KM, Hobbs TM, Wells BJ, et al. Clinical characteristics, complications, comorbidities and treatment patterns among patients with type 2 diabetes mellitus in a large integrated health system. *BMJ Open Diabetes Res Care.* 2015;3:e000993.
31. Dallas ME. Prediabetes: a precursor to kidney disease. https://www.kidney.org/news/prediabetes-precursor-kidney-disease. Published December 29, 2015. Accessed October 6, 2016.
32. Navarro A. Prediabetes linked to early kidney damage risks: ways to improve blood sugar control. *Tech Times.* http://www.techtimes.com/articles/120424/20151231/prediabetes-linked-to-early-kidney-damage-risks-ways-to-improve-blood-sugar-control.htm. Published December 31, 2015. Accessed October 6, 2016.
33. Charnow JA. Kidney damage linked to prediabetes. *Renal and Urology News.* http://www.renalandurologynews.com/acute-kidney-injury/kidney-damage-linked-to-prediabetes/article/461853/. Published December 29, 2015. Accessed October 6, 2016.
34. Sharma B, Hankey A, Nagendra HR. Gas discharge visualization characteristics of an Indian diabetes population. *Voice of Research.* 2014;2(4):28-33.
35. Hirokawa K, Utsuyama M, Hayashi Y, Kitagawa M, Makinodan T, Fulop T. Slower immune system aging in women versus men in the Japanese population. *Immune Aging.* 2013;10(1):19.
36. Caruso C, Accardi G, Virruso C, Candore G. Sex, gender and immunosenescence: a key to understand the different lifespan between men and women. *Immune Aging.* 2013;10(1):20.
37. Klein SL, Flanagan KL. Sex difference in immune responses. *Nat Rev Immunol.* 2016;16:626-638.
38. Srinivasan TM. Bridging the mind-body divide. *Int J Yoga.* 2013; 6:85-86.
39. Srinivasan TM. Prana and electrons in health and beyond. *Int J Yoga.* 2014;7:1-3.