Correlation of Electro Photonic Imaging parameters and Biochemical parameters in diabetes type 2

Thesis submitted by

Romesh Kumar Bhat

Towards the partial fulfillment of

DOCTOR OF PHILOSOPHY (YOGA)

FEBRUARY 2017

Swami Vivekananda Yoga Anusandhana Samsthana(S-VYASA)

(Declared as Deemed University Under Section 3 of the UGC Act, 1956)

#19 Eknath Bhavan, Gavipuram Circle,

K G Nagar, Bangalore – 560019, India

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Under the guidance of

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C E R T I F I C A T E

This is to certify that Romesh Kumar Bhat is registered for Ph.D with effect from 12 January 2012 by the Swami Vivekananda Yoga Anusandhana Samsthana, Deemed University under the Division of Yoga and Physical Sciences. He has successfully completed the required 'training' in acquiring the relevant background knowledge in philosophy, bio-energy and electro photonic analysis related to Yoga and has completed the required 'course of research' for not less than two years to submit this thesis entitled "Correlation between EPI and Biochemical Parameters in Diabetes type 2" as per the regulations of the University.

We also declare that subject matter of the thesis entitled "Correlation between EPI and Biochemical Parameters in Diabetes type2" has not previously formed the basis of the award of any degree, diploma, associate-ship, fellowship or similar titles.

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Date: 17 Feb 2017

D E C L A R A T I O N

I, hereby declare that this study was conducted by me at Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA), Bangalore, under the guidance of Dr. Ramesh Mavathur, Associate Professor Bio chemistry division and Dr. T M Srinivasan, Professor Bio energy division, Department of Yoga and Physical Sciences, Swami Vivekananda Yoga Anusandhana Samsthana, Bengaluru.(Deemed University)

I also declare that the subject matter of my thesis entitled "Correlation of Elecro Photonic Imaging parameters and Biochemical parameters in diabetes type 2"has not previously formed the basis of the award of any degree, diploma, associate-ship, fellowship or similar titles.

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Certificate

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A C K N O W L E D G E M E N T

I am blessed to be associated with S-VYASA, the spiritual hermitage of Lakshmi Amma and the place of penance (tapasya) of Dr. H R Nagendra and Dr. Nagarathna. My guide Dr. TM Srinivasan was a divine intervention, a great inspiration and guidance. But for him this study would not have been possible. Equally thankful to my Co-guide Dr Ramesh Mavathur for making himself accessible whenever I needed him and the valuable inputs he provided. Dr. Judu Ilavarasu has a role in shaping many research scholars and I am fortunate to be one of them.

My sincere thanks are to the faculty that taught me and the academic administration of S-VYASA. It was nice to have friends/coursemates in Dr Gurudeo and Dr Kuldeep Kushwaha, Ms Astha Choukse, Ms Savita Salgoankar, Dr Amravati and Ms Rajeshwari. The Journal club at Eknath Bhavan was extremely useful and bonding. My special thanks to all the student members and the faculty that made it interesting and memorable.

I am highly indebted to my wife Dr. Beena Bhat and daughter Ms Zeshta Bhat for continuous encouragement and instilling confidence

And ultimately, it was the desire of lord Shiva.

Date: 17 Feb 2017 Romesh Kumar Bhat

Place: Bengaluru

Standard International Transliteration Code Used To Transliterate Sanskrit Words

a = अ	ṅa = ङ	ba = ब
ā = आ	ca = च	bha = भ
i = इ	cha = छ	ma = म
ī = ई	ja = ज	ya = य
u = उ	jha = झ	ra = र
ū = ऊ	ña = ञ	la = ल
ṛ = ऋ	ṭa = ट	va = व
ṝ = ॠ	ṭha = ठ	śa = श
e = ए	ḍa = ड	ṣa = ष
ai = ऐ	ḍha = ढ	sa = स
o = ओ	ṇa = ण	ha = ह
au = औ	ta = त	kṣa = क्ष
aṁ = अं	tha = थ	tra = त्र
aḥ = अः	da = द	jña = ज्ञ
ka = क	dha = ध	
kha = ख	na = न	
ga = ग	pa = प	
gha = घ	pha = फ़	

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1.0 ABSTRACT

INTRODUCTION

Nature has its own manner and timing of revealing itself. Yoga is one of such divine philosophy that it has revealed through the sages and Rishis of India. The second verse of Patanjali describes most of it. Yoga is to control the distractions of the mind. Once that is done it is easier to merge individual consciousness with supreme consciousness and be in a state of bliss free from the materialistic disposition and its allied pain and misery. Controlling the mind is to control the Prana which is part of consciousness. It is Shiva making effort to be Shiva. Pranayama helps to control the Prana and hence the mind. The uncontrolled fluctuations are the cause of diseases as that disturbs the homeostasis of the body. Through Yoga we can check it and that is why Yoga has become popular worldwide, namely for disease prevention and management.

From the alternative medicine, Electro photonic imaging (EPI) technique is emerging as a novel technique of measurement of the bio-energy of the body. Yoga intervention for improvements in homeostasis and monitoring the changes through Electro photonic imaging (EPI) technique is a desired holistic approach for monitoring health and happiness across the world. It is necessary to correlate EPI norms with the established biochemical parameters to have wide and scientific acceptability in modern medicine. There is a need for such study.

The study is in two parts. In the first part, a study of classical literature is presented wherein scriptural concepts on Prana and its relation to health is discussed. In the second part, experimental aspects of bio-energy are taken up and measurements using EPI is presented.

LITERARY REVIEW

The concepts of Prana, Pranamaya kosa and Pranayama have been drawn through various Vedanta and Shaivite literature. The relationship between Prana and Bioenergy has been described and also the effect of pranayama on the homeostasis of practioners, particularly the advanced Yogis. Prana has been described from many aspects and the Shaivite ways of merging Prana into supreme consciousness is the highlight of this classical literature study. At the physical level, measurement of Prana (which is referred as bio-energy in modern medicine) through Electro Photonic Imaging is investigated in detail in Part II of the Thesis.

In the scientific literature review, following domains of scientific studies were reviewed

1) Various studies conducted to find out EPI patterns in various diseases with major focus on diabetes.

3) Studies through Integrated Yoga Module.

Findings reveal that there is a need to study the effect of diabetes specific Yoga practices of SDM (Stop diabetes movement) module of S-VYASA through Electro photonic imaging EPI and also need for correlation of EPI parameters with Biochemical parameters

AIM

To identify EPI parameters that draw correlation with established Biomarkers of Diabetes type 2 and find efficacy of Stop Diabetes Movement (SDM) Yoga module through Electro Photonic Imaging (EPI).

OBJECTIVES

The objectives of this study are

a) To correlate FBS (fasting blood sugar) with EPI parameter in normal, pre diabetes and diabetes type2 Indian population.

b) To correlate HbA1c (glycated haemoglobin) with EPI parameter in normal, pre diabetes and diabetes type 2 Indian population

c) To look at diabetes type 2 from the prism of Electro Photonic Imaging. In that investigate

i. Changes in EPI parameters between normal, pre diabetes and diabetes.

ii. Changes in EPI parameters between controlled and uncontrolled diabetes.

iii. Effect of seven day SDM Yoga program as measured through EPI.

METHODS

Study of Prana and disease

To carry out this study, Shaivite and Vedanta scriptures were referred to and Prana traced from the consciousness → Prakriti → Jeeva (Life). It was found that Prana is bio energy at the cellular level and any disturbances due to internal or external conditions results in changes in this bio energy (*pertains to first part of the study*) . This can be measured by EPI (*pertains to second part of the study).*

1. Correlation of FBS with EPI parameters

A total of 200 participants from different yoga camps and Arogyadham, a residential health centre of Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA, Bengaluru, India) were assessed once. This was spread over 6 months. Among them 102

subjects were selected. They were categorized into three groups; a. Normal; b. Pre diabetes; c. Diabetes. Normal group comprised of 29 subjects (mean age 44±11years) and Pre diabetes group comprised of 13 subjects (mean age 51.2±12.3years). Diabetes group comprised of 60 subjects mean age 54±9.6years). Out of these 35 were males (mean age 56.83±8.72years) and 25 were females (mean age 50±9.4years). EPI was taken on the inaugural day of camp before the blood sample was taken for the measurement of fasting blood sugar (FBS). Subjects in the age group of 18-75 years of age were included in the study.

2. Correlation of HbA1c with EPI parameters

A total of 150 participants were scrutinised from different yoga camps and Arogyadham, a residential health centre of SVYASA were assessed once. This was spread over 6 months. Among them 86 subjects were selected. These were divided into three groups; a. Normal; b. Pre diabetes; c. Diabetes. Normal group comprised of 50 subjects (mean age 38.6±10. 2years). Out of these 25 were males (mean age 37.2±9.74 years) and 25 were females (mean age 40±10.7 years). Pre diabetes group comprised of 17 subjects (mean age 48±14.49 years). Out of these 14 were females (mean age 48±14.49 years) and rest were males (mean age 61±18.52 years). Diabetes group comprised of 19 subjects (mean age 51.05±10.29 years). Out of these 13 were females (mean age 49.31±10.96 years) and 06 were males (mean age 54.83±8.23 years) EPI technique was used to assess the subjects once on the inaugural day of camp before blood sample was taken for measurement of glycated haemoglobin (HbA1c) .Subjects in the age group of 18-75 years of age were included in the study.

3. Diabetes type 2 from EPI perspective

a. Comparison of EPI parameters among normal, pre diabetes and diabetes

One hundred and two subjects (mean age 51±11 years) were selected. Out of these 52 were males (mean age 54±11 years) and 50 subjects were females (mean age 47±10 years).These were categorized into three groups namely normal, pre diabetes and diabetes on the basis of their FBS score. Normal comprised of 29 subjects (mean age 44±11years); Pre diabetes comprised of 13 subjects (mean age 51.2±12.3 years) and Diabetes comprised of 6o subjects (mean age 54±9.6 years). The subjects were assessed on the inaugural day of the camp utilizing the Electro Photonic Imaging (EPI) technique.

b. Comparison of parameters in controlled and uncontrolled diabetes

Sixty subjects (mean age 53.8±9.62 years) were selected for the study. Out of these 35 were males (mean age 56.83±8.72 years) and 25 were females (mean age 49.56±9.38 years). The total subjects were categorized into; a. Controlled diabetes; b. Uncontrolled diabetes .There were 27 subjects (mean age 51±11 years) in controlled category and 33 subjects (mean age 51.97± 9.65 years) in uncontrolled category. The measurements were taken once before intervention.

c. Effect of 7 day SDM Yoga program on diabetes type 2 patients.

Thirty seven subjects (mean age 54.46±7.21 years) were selected for this study. There were 24 males (mean age 57.46±7.35 years) and 13 females (mean age 54.62±6.83 years). EPI measurements were taken in the pre and post stages of SDM Yoga intervention. The EPI parameters analyzed in these studies were Total area, Average intensity, Entropy, Fractality, Form coefficient, Integral area of Pancreas, Liver, Immune organs, Coronary vessels, Cerebral vessels, Left kidney and Right kidney.

DESIGN

Study of Prana and disease - Scriptures

Study 1- Survey design

Study 2- Survey design

Study3

i. Three-group comparative design

ii. Two-group comparative design

iii. Pre-post intervention design

ASSESSMENT TOOLS

Instrument of make Kirlionics Technologies International (KTI) company Saint-Petersburg, Russia (GDV camera Pro with analog video camera, model number: FTDI.13.6001.110310) was used for the assessment purpose.

DATA EXTRACTION

EPI Diagram and EPI Screening Software Program was used for data extraction for Integral area of Pancreas, Liver, Immune organs, Coronary vessels, Cerebral vessels, Left kidney and Right kidney. EPI Scientific laboratory was used for Total area, Average intensity, Entropy, Fractality, Form coefficient.

DATA ANALYSIS

Data analysis was done with the help of Microsoft Office Excel 2007 and R studio version 3.2.0 along with 'R Cmdr' version 2.1-7

RESULTS

Study1. Correlation and regression analysis was done by using "R Statistical Package". Regression analysis was done between FBS and EPI parameters (which ever showed significant correlation individually). The results were unique as different EPI parameters showed correlation with FBS in the three categories namely normal, pre diabetes and diabetes. A very noteworthy observation was the correlation of FBS with Left kidney and pancreas in the case of pre diabetes which is in conformity with modern medical research findings.

Study2. Correlation and regression analysis was done by using "R Statistical Package". The correlation between HbA1c and EPI parameters were not significant in all the three groups namely normal, pre diabetes and diabetes. The results were similar in correlation analysis as well in the regression analysis. This was a very noteworthy observation as EPI parameters indicate *current energy status* while HbA1c is the average of three months sugar levels in the blood cells. This again was in line with the research from modern medical science that there is no correlation between FBS and HbA1c and many studies do not recommend HbA1c for certain situations.

Study3.

i. Independent sample't' test was carried out between normal–diabetes, normal-pre diabetes and diabetes-pre diabetes. Results showed progression from normal to pre diabetes to diabetes stage in most of the organ specific parameters. The results indicated that as the disease progresses EPI parameters Total area and Average intensity increase in value, Fractality and Form coefficient decrease in value.

ii. Independent sample't' test was carried out between controlled and uncontrolled diabetes. There was no change in all parameters except that Immune organs. This could

be explained from the fact that when diabetes has taken its grip, most of the organs are affected and are low on homeostasis whether or not pathologically the results show controlled or uncontrolled diabetes.

iii. Paired‘t’ test was carried out on the EPI parameters in the pre and post conditions of SDM Yoga program. Results showed changes in the selected EPI parameters. The values of the parameters were moving closer to base values. How much change can make a pathological difference was beyond the scope of this research.

CONCLUSION

In Part 1 of the study, Prana was explored in detail and its link to bio energy established. Measurement by EPI is the measurement of a form of Prana at the cellular level. *In part 2* interesting results were achieved in respect of bio energy changes at Pancreas and left kidney in the pre diabetes stage and no correlation between EPI and HbA1c parameters. The gradual change in EPI parameters was noticed from normal to pre diabetic and diabetic stage. Not much of difference was observed in the parameters in controlled and uncontrolled diabetes and is due to effect of deterioration already set in. Seven days SDM program results in changes in the EPI parameters. How much change is the desired change for medical results was beyond the scope of this research.

PART 1

2.0 LITERARY SEARCH

REVIEW OF EARLIER WORK IN THE FIELD

The concept of Prana has come to us from Rishis and sages from the ancient times. There are vast number of scriptures that speak about it in their own style and content such as Vedas, Upanisads, Tantra and Bhagwatgita to quote a few. Later many scholars have carried out studies to define and investigate the concept of Prana and Pranamaya kosa, Chakras and Nadis and their relevance to health and diseases. In the modern times the word bio energy is most often used for Prana and it is equated with Chi from Chinese scriptures. In a dissertation titled "Effect of integrated yoga lifestyle module on Acugraph measures", the author has tried to link Prana and Chi and Ida and Pingala Nadis with Yin and Yang (Niharika, 2012). More recent studies that are relevant to our literary work include a dissertation "Concept of Prana, its evolution and its regulation through Pranayama". The role of Pranayama (yogic breathing) in improving the performance of competitive swimmers has been brought out. In this study, Upanisads – Prasna Upanisad, Taittiriya Upanisad and yoga texts Patanjali's Yoga Sutras, Hatha Yoga Pradipika, Srimad Bhagavad Gita and Yoga Vasishta have been referred. The author has highlighted the concept of Prana from ancient scripture, its relevance to breathing, its regulation through Pranayama and also mentioned how to achieve mastery over Prana through Pranayama (Hakked, 2013). In another thesis titled, "Understanding type 2 diabetes at the Prāṇamaya Kosa level", authors have focused on the Pranic energy imbalances with increase in diabetes. Prana imbalances are caused by emotions and other blockages (known as Adhi). This forms important aspect of disease prevention in apparently healthy patients. This work introduced new technology Electron Photonic Imaging (EPI) and Acugraph to observe the imbalances at the inception stage and help

to reduce incidence of the disease (Sharma, 2014). There is another thesis titled "Electro-dermal study of acupuncture meridian endpoint energies in health and various conditions including type 2 diabetes mellitus". The focus was on the structure of imbalances in Prana and its five components (five vayus), their locations, and the mechanism by which this imbalances that develop in the body. In this work various scriptures were extensively reviewed and a theoretical model was proposed for Prana/chi imbalances that lead to diseases (Meenakshy, 2015). In a study titled "Effect of anapanasati meditation on stress management as measured through EPI", the authors have shown how Prana can be controlled through Pranayama and meditation and reduce stress levels. Anapanasati meditation is one of the meditation techniques in Buddhism in which the awareness is on one's own respiration (Gurudeo, 2016). Besides there is a study on the effects of music therapy on the stress levels diabetic patients has been demonstrated. (*In Table 1 below, an overview of research connected with these concepts is given)*

TABLE 1: SUMMARY TABLE OF PREVIOUS WORKS

Sl No.	Author and year	Summary	Strength	Limitations
1.	Niharika, 2012 (M.Sc. Dissertation	1. The concept of Prana was derived from ancient scriptures (Vedas, Upanisad, and Srimad Bhagvad Gita) and concept of Chi energy was driven from ancient Chinese scriptures. 2. Presence of Chi energy in the body was related to be responsible for sustaining health.	1. Correlation between Prana and Chi is brought out. 2. Ida and pingala nadis were related to Yin and Yang. 3. Five main Pranas,sub Pranas and their functioning were mentioned. 4. Prana was defined from Vedas point of view which gives indepth understanding of Prana. 5. Theoretical work was related to experimental work.	1. No theoretical model was proposed. 2. Major focus have been only on Prana and chi relevance
2.	Hakked, 2013	1. Explained the concept of	1. Prana and breath	1. No theoretical

	(M.Sc. Dissertation)	Prana, its evolution and its regulation through Pranayama. 2. The texts referred were Prasna Upanisad, Taittiriya Upanisad, Patanjali's Yoga Sutras, Hatha Yoga Pradipika, Srimad Bhagvad Gita and Yoga Vasishta. 3. Prana is force behind every Action.	were related. 2. Prana regulation was focused. 3. Experimental work has been related with literature review. 4. Prana and Pranayama have been defined.	model was proposed. 2. Main focus of the work was on Prana and Pranamaya kosa only.
3	Sharma, 2014 (Ph.D. thesis)	Main focus on the Pranic energy imbalances which is ground for manifestation of pathology. Tracking Prana imbalances at earliest in apparently healthy patients forms a potentially important aspect of disease prevention. For this, a new methodology and new techniques of assessments have been incorporated in experimental work.	1. A theoretical framework for the subtle anatomy of Pranamaya kosa have been proposed 2. An attempt has been made to incorporate the literary search in experimental work. 3. Various texts on yoga and Ayurveda have been presented to bring out the concept of disease.	Out of 108 major and minor Upanisads mainly focused on Prasna Upaniṣad with some input from Taittiriya Upanisad and Chandogya Upanisad and major focus of the work was on yoga bioenergetics and their relation to disease.
4	Meenakshy, 2015 (Ph.D. thesis)	Functioning of Prana connected to respiration and circulation. Imbalance in Ojas and Tejas cause imbalance in Prana and vice versa.	1. Detail of Prana imbalances caused by Adhi. 2. Elucidation on the structure of imbalances in Prana and 5 vayus. 3. The mechanism of how Prana imbalance develops. 4. A theoretical model for Prana/Chi imbalance that leads to diseases was pro posed. 5. Literary search work was related to experimental work.	Out of 108 major and minor Upanisads mainly focussed on Prasna Upaniṣad with some input from Taittiriya Upanisad and Chandogya Upanisad. Major focus was on Prana/chi imbalances caused by Adhi and the mechanism of how this imbalance develops and its relation with diseases.
5.	Indra Rao, 2015 (PhD thesis)	Concept of Aadhi and Vyadhi as per yoga and ayurveda. Prana and the pranic flow. Impact of blocking in the flow of prana.	Music as a therapy may be used to improve the balance of autonomic nervous system. Explanation of disease with regard to sympathetic and parasympathetic responses.	More focus was on the EPI and the music than the important literature on prana.
6.	Guru Deo, 2016 (PhD thesis)	The compiled review of literary research provides the original information about dhyana described in ancient Indian and Buddhist scriptures. If one practices meditation regularly, one may achieve a state of intuitive, self-absorptive consciousness with serenity and presence of mind, which may lead to Samadhi or	Classical texts namely Srimad Bhagavad Gita, Patanjali's Yoga Sutra YogaVasishta,Upanisad and Buddhist texts (Maha Satipatthana Sutta)have been consulted. Prana is referred as universal energy and an energy model is presented to	More of the literature is on different styles of meditation

		enlightenment.	understand the meditation from two aspects i.e., body function and energy flow. Moreover, the review throws light on the difference between dhyana and meditation in the Eastern and Western perspective.	
7.	Kushwaha, 2016 (PhD thesis)	Studies have explored measurment of Praṇa.	1. Concept of the Praṇamaya kosa. 2. Compilation of verses related to Praṇa and Pranamaya kosa from various ancient scriptures. 3. Experiment on live and dead leaves to find out the dynamic presence of Prana and lastly developed a theoretical framework.	The major focus of the study is on standardization of EPI for Indian populaion. Relating the images of dead leaves to Prana requires more research.

CONCLUSION

Earlier studies have mostly focused on compilation of the literature available from the ancient texts about Prāṇa, Pranamaya kosa, nadis and cakräs. Studies by Sharma 2014 and Meenakshy 2015 have proposed theoretical framework in the support of their experimental studies; anatomy of Pranamaya kosa and Prana/Chi imbalances leads to disease. Kushwaha 2016 attempted measurement of Prana of dead leaves. Gurudeo 2016 has given a model of Prana and energy flow in various groups of meditators. In our study, we have focussed on the concept of Prana from Shaivite and Vedanta scriptures, compilation of verses related to Praṇa and Pranamaya kosa, trace prana from consciousness to its dissolution as depicted in our scriptures and study the relationship between the prana and disease.

2.1 AIM & OBJECTIVES

AIM

To understand the concept of Prana and Pranamaya kosa through study of Shaivite and Vedanta literature.

OBJECTIVES

i. To present information about Prana with its specific functions.

ii. To trace evolution of Prana.

iii. To discuss concept of Prana merging into Consciousness.

2.2 MATERIALS

Upanisads

Prasna Upanisad, Kena Upanisad, Katha Upanisad, Mundaka Upanisad, Taittiriya Upanisad, Aitareya Upanisad, Chandogya Upanisad, Bahadarnaiyaka Upanisad

Smriti

Srimad Bhagvad Gita, Yoga Vasishta, Patanjali's Yoga Sutras

Yoga Texts

Hatha Yoga Pradipika, Hatha Ratnavale, Gheranda Samhita

Tantra

Shiv Sutras, Tantraloka, Vijnana Bhairavi

2.3 INCLUSION CRITERIA

The search lead to large number of references that include various texts; therefore in the current work we focused on those verses that link Prana and Pranamaya kosa with special reference to major Upanisad, Smritis, and Tantra only.

2.4 EXCLUSION CRITERIA

The exclusion criteria was set for those verses or references which talk about Prana and Pranamaya kosa but do not explain in detail their relevance in the context of present work. Though, those verses or references might offer rich sources of information, for our work and its need, we restricted to the texts that served our purpose**.**

2.5 METHODS

2.5.1 DESCRIPTION OF PRANA

Etymology of Prana

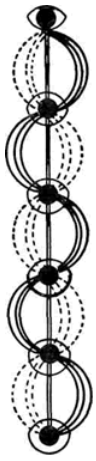
This study is regarding measurement of subtle energy in the human body. There are various names for this energy like ‘prana’or ‘prana shakti’ in the scriptures, as well bio energy or bio electricity in the modern terminology. As long as the body is functioning within the normal state of health, prana or bio-energy will have some pattern. When the normal state is disturbed either through internal factors like aging and disease external factors like infection, accidents and stress; the bio energy pattern changes. It causes changes in the electronic configuration of the cells and that results in the changes in energy status which can be captured through Electro Photonic Imaging. It is important and interesting to trace the source and destination of this energy. Indian spiritual philosophy provides an understanding of this phenomenon.

Our ego, intellect, mind and all the five constituents of living bodies, namely earth, water, fire, air and ether, in their organic form, are the creations of 'Prana-Shakti'. This is the reason why a living creature is called a Prani, which means possessing Prana, in India. It is with the energy supplied by Prana that the embodied Soul or Jivatma can will, act or know. It is with this energy, again, that he can win liberation from the cycle of life and death (Gopi Kishen, 1981). To reproduce the following passages from the work Raja Yoga, by Swami Vivekananda:

“By what power is this Akasha manufactured into this universe, it is by the power of Prana. Just as Akasha is the infinite, omnipresent material of this universe, so is this Prana the infinite, omnipresent manifesting power of this universe. At the beginning and at the end of a cycle everything becomes Akasha, and all the forces that are in the universe resolve back into the Prana: in the next cycle, out of this Prana is evolved everything that we call energy, everything that we call force. It is the Prana that is manifesting as motion, gravitation and magnetism. It is the Prana that is manifesting as the actions of the body, as the nerve currents, as the thought force. From thought down to the lowest force, everything is but the manifestation of Prana. The sum total of all forces in the universe, mental or physical, when resolved back to their original state, is called Prana” (Advaita Ashrama, 2016, Chapter III). To make clear the relations between 'chit' (cit) and 'prana', the following lines from Arthur Avalon's ‘*The Serpent Power’ (Chapter II pg 31)* are illuminating:

“Mind and body are the instruments whereby the ordinary worldly experience is had. As long as they are restricted to that role, they are impediments in the way of attainment of the state of pure Consciousness (Cit). For such attainment all screenings (Avarana) of Cit must be cleared away. Yoga, therefore, is the method whereby mental intellection

and feeling (citta-vritti) and Prana are first controlled and then stayed. Citta-vritti as per Patanjali Yog Sutras means the fluctuations of mind. When the Citta, Vritti and Prana are stilled, then Cit or Paramatma stands revealed. It supervenes without further effort on the absorption of matter and mind into the primordial Power (Shakti) whence they sprang, of whom they are manifested forms, and who is herself as Shiva, one with him who is Shiva or Consciousness. Yoga thus works towards a positive state of pure consciousness by the negation of the operation of the principle of unconsciousness, which stands in the way of the uprising. In the physical body we have two types of energies. One is known as prana and the other is known as mind or consciousness. That means, in every organ of the body there should be two channels supplying energy. Modern physiology describes two types of nervous systems - the sympathetic and the parasympathetic, and these two nervous systems are interconnected in each and every organ of the body. In the same way, every organ is supplied with the energy of prana and the energy of mind. In yoga, the concept of prana is very scientific. When we speak of prana, we do not mean the breath, air or oxygen. Precisely and scientifically speaking, prana means the original life force. Prana is a Sanskrit word constructed of the syllables *pra* and *an*. 'An' means movement and 'pra' is a prefix meaning constant. Therefore, prana means constant motion. This constant motion commences in the human being as soon as he is conceived in his mother's womb. Prana is therefore a type of energy responsible for the body's life, heat and maintenance" (Swami Satyananda Saraswati, 1981 in "Prana: the Universal Life Force" (The Bihar School of Yoga 1982)



Nadis, Chakras and the distribution of Prana

According to yoga, tantra and the science of kundalini, prana is supposed to originate in pingala nadi. Within the framework of the spinal cord, there are three channels known as nadis in yoga. One is called ida, another is pingala and the third is sushumna. Ida nadi represents mental energy, pingala represents prana or pranic energy and sushumna represents spirit or spiritual awareness. These three nadis originate in mooladhara chakra, which is situated at the perineum or cervix. Pingala nadi flows to the right from mooladhara and continues to cross ida at each chakra all the way up to ajna.

There are six chakras through which pingala nadi passes. The first one is mooladhara chakra from which it originates. The second is swadhisthana where the nadi crosses to the left. The third is manipura chakra where the nadi crosses to the right. And the fourth is anahata where the nadi crosses to the left. The fifth is vishuddhi where the nadi crosses to the right and the sixth is ajna where the nadi terminates from the right. Similarly, ida nadi also crosses at each chakra but in the reverse order. Every sincere yoga aspirant should have a clear understanding of the pathway of these three major nadis.

Pingala nadi is the distributing channel for prana in the body, and from each chakra Prana is disseminated to every organ of the body. From swadhisthana the pranic energy is distributed to the genito-urinary system. Manipura chakra supplies prana to the digestive system and anahata supplies the respiratory and cardiovascular systems. From vishuddhi, distribution takes place to the ears, eyes, nose and throat, and ajna chakra is the distributor of energy through which man's brain is nourished.

Fuel of Life

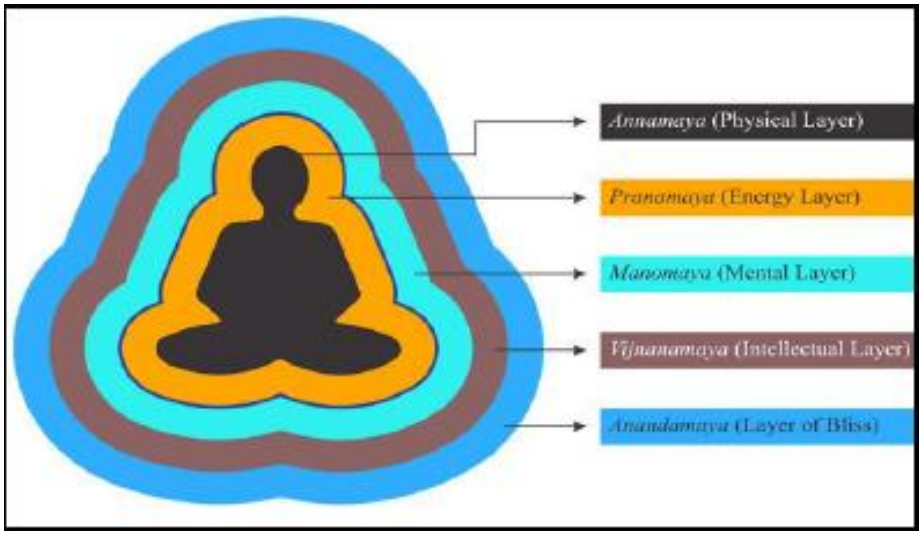
Prana is not merely a philosophical concept; it is in every sense a physical substance. Just as radioactive or electromagnetic waves exist even though we can't see them, in the same way, in this physical body, there are pranic waves and a pranic field. Now, each of us has a certain quantity of prana in our physical body and we utilize this in the course of our day to day activities throughout life. When our Prana diminishes, sickness sets in, and when we have plenty of Prana, every part of the body is in perfect health. If we have an excess of Prana, it can be transmitted to others for healing.

The inner Prana can be stimulated by the practice of Pranayama and thereby increased to a greater quantum. The brain requires maximum Prana, and for the practice of meditation, it needs an increased supply. It is for this reason that we practise Pranayama before commencing our meditation practice. If we are not able to supply plenty of pranic fuel to the brain, the mind becomes very restless and disturbed. When the brain is receiving a deficient supply of Prana, one suffers from nervous depression or nervous breakdown. Then the whole body perspires, there is trembling in every organ, mind is unsteady and one is constantly thinking negative thoughts. This state indicates that the brain is only receiving a very small quantity of Prana.

The Yoga Vasishta (one of the great Advaita scriptures) depicts Prana as a live form of expanded cosmic existence, without limit or boundaries. However, the ancient sage also postulated that there is some kind of personal Prana, which encompasses about twelve inches around the body in all directions (Swami Venkatesananda - Hatha Yoga 1975. pg 39). He calls this personal Prana “vadasanta”. This can roughly correspond to what is usually known today as the aura). According to yogic science, a human being is capable of experiencing five dimensions of existence, which are called Panchakosa or five

sheaths. These are the five spheres in which a human being lives at any given moment and they range from gross to subtle. The five sheaths are Annamaya koça, the koça of matter, the physical vehicle, the Pranamaya kosa, the kosa of Prana, the "vital" vehicle, the Manomaya kosa, the kosa of Manas, the mental vehicle, the Vijnanamaya kosa, the kosa of Vijïnana, the vehicle of Higher Reason and the Änandamaya kosa, the kosa of Ananda (joy or bliss). And when that vehicle is well developed there is self-realization which involves ultimate experience of Unity with All.

Figure 1: Graphical presentation of Panchakosa



The physical body (Annamaya kosa) is also called SthUla Sarira, "gross body." The soul body (Änandamaya kosa) is also called Karana SarIra, "causal body." The Pranamaya, Manomaya and Vijnanamaya kosas together comprise the Sukshama Sarira, "subtle body," with the Pranamaya shell disintegrating at death.

When covered by a blue cloth, a pure colour less crystal takes the colour of cloth itself. Similarly because of the union with the five kosas, the pure Atma (soul) appears to be like them. (***Atmabodha, Verse14***). The Panchakosa (five sheaths) concept is mentioned with in-depth understanding in the Taittiriya Upanisad.

Table 2: Explanation of Pancha kosa from gross to fine

Panchakosa			
Annamaya kosa	Matter	Physical	Physical body and senses
Pranamaya kosa	Vital Air	Energy	Driving force behind the physical aspect of the senses and the operation of the physical body.
Manomaya kosa	Mind	Mental	Processing, reason, logic and emotion.
Vijnanamaya kosa	Intellect	Wisdom	Faculty which discriminates.
Anandmaya kosa	Bliss	Centre of consciousness	Independent of any reason or stimulus.

Uniting with Universal Prana

Prana is not only the life force, it is also a very powerful healing force in the body that can eradicate the most difficult physical problems. Moreover, the Prana within us is a part of the universal Prana. If one can unite with the universal Prana, he/she can draw the required amount of Prana whenever there is a need.The characteristics of Prana are described in many scriptures like Upanisads, Tantra, Bhagwad Gita, Yoga texts viz., Patanjali's Yoga Sutra, Hath Yoga Pradipika, Yoga Vasishtha, Gerhanda Samhita, Shiv Sutra.

Our scriptures describe beautifully the journey from absolute subtle also called the supreme consciousness to a gross, interspersed with the individual consciousness. Mind is an interface between the gross and the individual self (consciousness). Diseases are due to fluctuations of the mind and if this mind gets subjugated to individual self, there will be no disease and death. Let us try to understand this consciousness through our scriptures.

Pranayama and Disease Cure

It is often claimed in Hatha yoga that Pranayama is capable of curing many diseases (though improper practice may cause disease) viz., viral diseases, auto immune diseases, and genetic diseases. This claim is actually quite sound and entirely within the realms of scientific explanation.

यावद्वायुः स्थितो देहे तावज्जीवनमुच्यते ।
मरणं तस्य निष्क्रांतिस्ततो वायुं निरोधयेत् ॥

yāvadvāyuḥ sthito dehe tāvajjīvanamucyate ।
maraṇaṁ tasya niṣkrāantistato vāyuṁ nirodhayet ॥

So long as the (breathing) air stays in the body, it is called life. Death consists in the passing out of the (breathing) air. It is, therefore, necessary to restrain the breath. ***Hatha Yoga Pradipika Ch II Verse 3***

Then let the intelligent student close with his right thumb the pingala (the right nostril), inspire air through the Ida (the left nostril), and keep the air confined—suspend his breathing—as long as he can; and afterwards let him breathe out slowly, and not forcibly, through the right nostril. ***Shiva Samhita Ch III Verse 22***

Many of the Pranayamas used in hatha yoga share a common factor: they work in some way to slow and reduce standard unconscious breathing, for example nadi shodanna,

alternates the breathing between each nostril and whilst this may produce additional subtle effects it acts to reduce airway size so slowing the rate at which air can be inhaled and exhaled, the gentle contraction of the base of the throat used in Ujayi also serves to restrict airway size, breath retention in general will obviously reduce breathing rate.

2.5.2 VERSES ON SELF AND PRANA FROM SCRIPTURES

Attributes of Self

ऊधर्वं प्रणमुन्नयत्यपानं प्रत्यगस्यति ।

मध्ये वामनमासीनं विश्वे देवा उपासते ॥

ūdharvaṁ praṇamunnayatyapānaṁ pratyagasyati।

madhye vāmanamāsīnaṁ viśve devā upāsate।।

That which moves Prana up and pushes apana down. One who stays in the middle of heart, all devas worship that praiseworthy lord. ***Katha Upanisad 2.2.3***

ईन्द्रं मित्रं वरुणं अग्निम हु

अथो दिव्या स सुपर्णो गरुत्म्नः

एकम् सद् विप्रह् बहुधा वदन्ति

अग्निम यमं म्तरिव्नम हु ।

īndraṁ mitraṁ varuṇam agnima hu

atho divyā sa suparṇo garutmnaā

ekam sad viprha bahudhā vadanti

agnima yamaṁ mtarivnama hu।

They hail Him as Indra, as Mitra, as VaruNa, as Agni, also as that divine and noble-winged Garutman. It is of One Existence that the wise ones speak in diverse ways, whether as Agni, or as Yama, or as Matarishva. ***Rigveda 1.164.64***

देवानामसि वह्नितमः पितृणां प्रथमा स्वधा ।

ऋषीणां चरितं सत्यमथर्वाङ्गिरसामसि ॥

devānāmasi vahnitamaḥ pitṛṇāṁ prathamā svadhā।

ṛṣīṇāṁ caritaṁ satyamatharvāṅgarasāmasi।।

You are the best transmitter to the celestials. You are the food-offering to the manes that precedes other offerings. You are the right conduct of the organs that constitute the essence of the body and which are known as the atharvas. ***Prasna Upanisad 2.8***

तपसा चीयते ब्रह्म ततोऽन्नमभिजायते ।

अन्नात्प्राणो मनः सत्यं लोकाः कर्मसु चामृतम् ।

tapasā cīyate brahma tato'nnmabhijāyate।

annātprāṇo manaḥ satyaṁ lokāḥ karmasu cāmṛtam।

*Through knowledge Brahman increases in size. From that is born food (the Unmanifested**).** From food evolves Prana (Hiranyagarbha);(thence the cosmic) mind;(thence) the five elements;(thence)the worlds, (thence) the immortlity that is in karmas.* ***Mundaka Upanisad 1.1.8***

स यो ह वै तत्परम ब्रह्म वेद

ब्रह्मैव भवति नास्याब्रह्मवित्कुले भवति ।

तरति ओक तरति पाप्मानं

गुहाग्रन्थिभ्यो विमुक्तोऽमृतो भवति ॥

sa yo ha vai tatparama brahma veda
brahmaiva bhavati nāsyābrahmavitkule bhavati।
tarati oka tarati pāpmānaṁ

guhāgranthibhyo vimukto'mrto bhavati।।

Anyone who knows that supreme Brahman becomes Brahman indeed. In his line is not born anyone who does not know Brahman, He overcomes grief, and rises above aberrations; and becoming freed from the knots of the heart, he attains immortality. ***Mundaka Upanisad 3.2.9***

हꣳसः शुचिषद्वसुरन्तिरिक्षसद्धोता वेदिषदतिथिर्दुरोणसत्।

नृष्द्वरसदृतसद्वयोमसदब्जा गोजा ऋतजा अद्रिजा ऋतं बृहत्।

haṁsaḥ śuciṣadvasurantirikṣasaddhotā vediṣadatithirduroṇasat।

nṛṣdvarasadṛtasadvayomasadabjā gojā ṛtajā adrijā ṛtaṁ bṛhat।

One who is in the act of doing like the migratory bird, he is the Sun in the sky and hence a planet, in the form of air moves in outer space, he is fire in the earth, wine in the container. Likewise he is the action in men, he is in the Devtas , he is in truth, one who moves in sky, appears from water, earth, fire and mountains. He is the ultimate truth and the great. ***Katha Upanisad 2.2.2***

एष उ एव भामनीरेष हि सर्वेषु लोकेषु भति

सर्वेषु लोकेषु भति य एवं वेद

eṣa u eva bhāmanīreṣa hi sarveṣu lokeṣu bhati

sarveṣu lokeṣu bhati ya evaṁ veda

This once again is called the bestower of lustre because this one shines in all the worlds. He who knows thus shines in all the worlds. ***Chandogya Upanisad 4.15.4***

यत्प्राणेन न प्राणिति येन प्राणः प्रणीयते ।
तदेव ब्रह्म त्वं विद्धि नेदं येदिदमुपासते ॥

yatprāṇena na prāṇiti yena prāṇaḥ praṇīyate।
tadeva brahma tvaṁ vidghi nedaṁ yedidamupāsate।।

That which man does not smell with the organs of smell, that by which the organ of smell is impelled, know that to be Brahman and not what people worship as an object.

Kena Upanasid 1.9

<u>Introduction to Prana</u>

आत्मन एष प्राणो जायते ।
यथेषा पुरुषे छायेतस्मिन्न्नेतदाततं मनोकृतेनायात्यस्मिञ्शरीरे ॥

ātmana eṣa prāṇo jāyate।
yatheṣā puruṣe chāyeetasminnnetadātataṁ manokṛtenāyātyasmiñśarīre।।

From the self is born this Prana. Just as there can be this shadow when a man is there , so this Prana is fixed on the self. He comes to this body owing to the actions of the mind.

Prasna Upanisad 3.3

स प्राणमसृजत प्राणाच्छ्रद्धां खं वायुर्ज्योतिरापः पृथिवीनिद्रयं मनः ।
अन्नमन्नाद्वीर्यं तपो मन्त्राः कर्म लोका लोकेषु च नाम च ॥

sa Pranamasṛjata Pranacchraddhāṁ khaṁ vāyurjyotirāpaḥ pṛthivīnidrayaṁ manaḥ।
annamannādvīryaṁ tapo mantrāḥ karma lokā lokeṣu ca nāma ca।।

He created Prana; from Prana faith, space, air, fire, water, earth, organs, mind, food; from food vigour, self control, mantras, rites, worlds, and the name in the worlds. ***Prasna Upanisad 6.4***

प्रणे तृप्यति चक्षुस्तृप्यति चक्षुषि
तृप्यत्यादित्य स तृप्यत्यादित्ये तृप्यति द्यौस्तृप्यति
दिवि तृप्यन्तयां यत्किञ्च द्यौश्चादित्यश्चधैतिष्ठहतस्तृप्यति
तस्यानुतृपितं त्प्यति प्रजया पशुभिरन्नाघेन तेजसा ब्रह्मवर्चसेनेति।

praṇe tṛpyati cachustṛpyati cachuṣi
tṛipyatyāditya sa tṛpyatyāditye tṛpyati dyaustṛpyati
divi tṛpyantayāṁ yatkiñca dyauścadityaścadhaitiṣṭhahatastṛpyati
tasyānutṛpitaṁ tpyati prajayā paśubhirannāghena tejasā brahmavarcaseneti।

When Prana becomes satisfied, the eye becomes contented; when the eye becomes satisfied, the sun becomes contented; when heaven becomes satisfied, then, whatever is presided over by heaven and the sun becomes contented. After that is satisfied, the eater himself becomes contented with progeny, ailments, edible food, physical lustre of vedic knowledge. ***Chandogya Upanisad 5.19.2***

एषोऽग्निस्तपत्येष सुर्य एष पर्जन्यो मघवानेष वायुः।

एष पृथिवी रयिर्देवः सदसच्चामृतं च यत्।

eṣo'gnistapatyeṣa surya eṣa parjanyo maghavāneṣa vāyuḥ।

eṣa pṛthivī rayirdevaḥ sadasaccāmṛtaṁ ca yat।

This one (Prana) burns as fire, this one is the sun,this one is the cloud, this one is Indra and air, this one is the earth and food. This god is the gross and subtle, as well as that which is nectar. ***Prasna Upanisad 2.5***

प्राणस्येदं वशे सर्वं त्रिदिवे यत् प्रतिष्ठतम्।

मातेव पुत्रान् रक्षस्व श्रीश्च प्रज्ञां च विधेहि न इति ॥

Pranasyedaṁ vaśe sarvaṁ tridive yat pratiṣṭhatam।

māteva putrān rakṣasva śrīśca prajñāṁ ca vidhehi na iti।।

All this in the world ,as also all that in the heaven is under the control of Prana. Protect us just as amotherdoes her sons, and obtain for us splendour and intelligence. ***Prasna Upanisad 2.13***

अरा इव रथनाभौ प्राणे सर्वं प्रतिषिठतम्।

ऋचो यजुꣳषि सामानि यज्ञः क्षत्रं ब्रह्म च।

arā iva rathanābhau prāṇe sarvaṁ pratiṣiṭhatam।

ṛco yajuṁ̃ṣi sāmāni yajñaḥ kṣatraṁ brahma ca।

Like spokes are fixed on the hub of a chariot wheel, so everything starting from faith and ending with name is fixed on Prana during the time of existence of the world. The things fixedon Prana are three kinds of mantras (rks,yajus,samas), sacrifice, kshatriya and Brahmana. ***Prasna Upanisad 2.6***

प्रजापतिश्चरसि गर्भे त्वमेव प्रतिजायसे।

तुभ्यं प्रण प्रजास्तिवमा बलिंः हरन्ति यः प्राणैः प्रतितिष्ठसि ॥

prajāpatiścarasi garbhe tvameva pratijāyase।

tubhyaṁ praṇa prajāstivamā baliṁḥ haranti yaḥ Pranaiḥ pratitiṣṭhasi।।

It is veily you who move about in the womb as the lord of creation, and it is you who take birth after the image of the parents. O Prana,it is for you, who reside with the organs, that all these creatures carry presents. ***Prasna Upanisad 2. 7***

इन्द्रस्त्वं प्राण तेजसा रुद्रोऽसि परिरक्षिता ।

त्वमन्तरिक्ष चरसि सूर्यस्त्वं ज्योतिषां पतिः ॥

indrastvaṁ Prana tejasā rudro'si parirakṣitā।

tvamantarikṣae carsi sryastvaṁ jyotiṣaṁ patiḥ।।

O Prana, you are Indra. Through your valour you are Rudra; and you are the preserver on all sides. You move in the sky-you are the Sun, the lord of all luminaries. ***Prasna Upanisad 2.9***

चले वाते चले चिअं निश्चले निश्चलं भवते ।

योगी स्थानु त्वं आप्नोतित तोवायुं निरोघयेत् ॥

cale vāte cale cittaṁ niścale niścalaṁ bhavate।

yogī sthānu tvam āpnotita tovāyuṁ niroghayet।।

When Prana moves, chitta (the mental force) moves.When Prana is without movement, chitta is without movement. By this (steadiness of Prana) the Yogi attains steadness and should thus restrain the Vayu (air). ***Hathyoga Pradipika 2.2***

यावद्वायुः सिथतोदेहेतावज्जीवन मुच्यते

मरणंतस्यनिष्क्रान्तिस्ततो वायुं निरोघयेत

yāvadvāyuḥ sithatodehetāvajjīvana mucyate

maraṇantasyaniṣkrāntistato vāyuṁ niroghayeta

As long as the vayu (air and Prana) remains in the body, that is called life. Death is when it leaves the body. Therefore retain vayu. ***Hathyoga Pradipika 2.3***

प्राणो ह्योष यः सर्वभुतेर्विभाति विजानन्विद्वान्भवते नातिवादी।

आत्मक्रीड आत्मरतिः क्रियावानेष ब्रह्मविदां वरिष्ठः॥

prāṇo hyoṣa yaḥ sarvabhutaervibhāti vijānanvidvānbhvate nativādī|

ātmakrīḍa ātmaratiḥ kriyāvāneṣa brahmavidāṁ variṣṭhaḥ||

This one is verilly the vital force which shines divergently through all beings. Knowing this , the illuminated man has no (further) occasion to go beyond anything in his talk, He sports in the self, delights in the self, and is engrossed in (spiritual) effort. This one is the chief among the knowers of Brahman. ***Mundaka Upanisad 3.1.4***

प्राणं देवा अनु प्राणन्ति। मनुष्याः पशवश्च ये। प्राणो भूतानाभायुः। तस्मात् सर्वायुष्मुच्त्ये।

सर्वमेव त आयुर्यन्ति । ये प्राणंब्रह्मनोपासते। प्राणो हि भूतानभायुः । तस्मात् सर्वायुष्मुच्त्ये इति।

Pranaṁ devā anu Prananti. manuṣyāḥ paśavaśca ye prāṇo bhtānābhāyuḥ

tasmāt sarvāyuṣmuctye

sarvameva ta āyuryanti ye Pranaṁ brahmanopāsate prāṇo hi bhtānabhāyuḥ

tasmāt sarvāyuṣmuctyeiti

The senses act by folllowing the vital force in the mouth; all human beings and animals that are there act similarly; since on the vital force depends the life of all creatures, therefore, it is called the life of all. Those who worship the vital force as Brahman attain full span of life. Since on this vital force depends the life of all, it is called the life of all. Those who worship the vital force as Brahman attain the full span of life. ***Taittiriya Upanisad 2.3.1***

प्राणो अह्मेति व्यजानात्। प्राणाद्धयेव् खल्विमानि भूतानि जायन्ते।

प्राणेन जातानि जीवन्ति। प्राणं प्रयन्त्यभिसंविशन्तीति।तद्विज्ञाय।

पुनरेव वरुणं पितरमुपससार। अदीहि भगवो ब्रह्मेति। तꣳ होवाच।

तपसा ब्रह्म विजिज्ञासस्व। तपो अह्मेति। तपसा ब्रह्म विजिज्ञासस्व।

तपो ब्रह्मेति। स तपोऽतप्यत।स तपस्तप्त्वा।

prāṇo brahmeti vyajānāt| Pranaddhayev khalvimāni bhtāni jāyante|

prāṇena jātāni jīvanti| Pranaṁ prayantyabhisaṁviśantīti|tadvijñāya|

punareva varuṇaṁ pitaramupasasāra | adīehi bhagavo brahmeti| taṁ hovāca|

tapasā brahma vijijñāsasva| tapo brahmeti| tapasā brahma vijijñāsasva|

tapo brahmeti| sa tapo'tapyata|sa tapastaptvā|

(He) knew the vital force as Brahman, for it is from the vital force indeed all beings spring. Having come into being, they live through vital force, they move towards and enter the vital force. Having known this, he again approached his father Varuna with the formal request 'O revered sir, teach me Brahman'. To him Varuna said, 'crave to know Brahman well through concentration; concentration is Brahman. He practiced concentration, he having practiced concentration. ***Taittiriya Upanisad 3.3.1***

प्राण ऐव ब्रह्मणचतुर्थः पादः स वायुना ज्योतिषा

भ्राति च तपति च भतिच तपति च कीर्त्या यशसा

ब्रह्मवर्चसेन य ऐवं वेद।

Prana aiva brahmaṇacaturthaḥ pādaḥ sa vāyunājyotiṣā

bhrāti ca tapati ca bhatica tapati ca kīrtyā yaśasā

brahmavarcasena ya aivaṁ veda|

Prana alone is the organ of smell indeed is the fourth foot of Brahman. That shines and emits heat through the air. He who knows this shines and emits heat through fame and lustre of the knowledge of Brahman. ***Chandogya Upanisad 3.18.4***

Characteristics of Prana

उक्तो य एष उच्चारस्तत्र योऽसौस्फुरन् स्थितः

अव्यक्तानुकृतिप्रायो ध्वनिर्वर्णः स कथ्यते

ukto ya eṣa uccārastatra yo'sausfuran sthitaḥ

avyaktānukṛtiprāyo dhvanirvarṇaḥ sa kathyate

From the Uccara of this general Prana there vibrates an imperceptible, inarticulate sound which is known as varna. This goes on naturally and continuously in every living creature. ***Tantraloka 131***

Uccara is connected with Prana which means life is energy or bioplasma. Main charecteristic of Prana is Uccara-which means rising upwards and appearing as sound. Prana is used in two senses 1. General or subtle –known as Pranana; 2. Specific acquires names Prana, apAna, samAna, udAna, vyAna according to various functions of Prana sakti. Characteristic of specific Prana is Uccara, characteristic of subtle Prana is Varna. Various kinds of ananda are obtained by fixing on various Pranas

- Paramata (subject of experience) – Nijananda
- Absence of all objects- Nirananda
- Prana and apana jointly-Parananda
- Samana-Brahamananda
- Udana-Mahananda

- Vyana- Cidananda

After realizing experience of these six kinds of anAnda, aspirant has the experience of JagadAnanda-consciousness alone expresses as knower, known and means of knowledge

नास्योच्चारयिता कश्चित्प्रतिहन्ता न विध्ते

स्वयमुच्चरते देवः प्राणिनामुरसि सिथतः

nāsyoccārayitā kaścitpratihantā na vidhte

svayamuccarate devaḥ prāṇināmurasi sithataḥ

No one sound is voluntarily, nor can any one prevent its being sounded. The deity abiding in the heart of living creatures sounds it himself. ***Svacchananda tantra Ch VII Verse50***

Abhinavgupta says about it in the following

एको नादात्मको वर्णः सर्व वर्णविभागवन्।

सोऽनस्तमितरूपत्वादनाहत् इं होदितः

eko nādātmako varṇaḥ sarva varṇavibhāgavan।

so'nastamitarūpatvādanāhat iṁ hoditaḥ

*There is one varna in the form of nada in which lie all the various letters, latently in an undivided form. As it is ceaseless, it is called anahata i.e., unstruck, natural, uncaused.****Tantraloka 61216***

Jayaratha's commentary on this runs as follows

सर्व वर्णा विभाग स्वभावत्वादव्यक्त प्रायो

योऽसावनाहतरूपो नादः स वर्णेआत्पअिनिमिअत्वाद् वर्ण उच्यते वर्णशब्दाभिधेयो भवेदित्यर्थः

sarva varṇā vibhāga svabhāvatvādavyakta prāyo

yo'sāvanāhatarūpo nādaḥ sa varṇeātpattinimittatvād

varṇa ucyate varṇaśabdābhidheyo bhavedityarthaḥ

In this imperceptible, inarticulate anahata nada, all the varnas (letters) lie latently in an undivided way. As all the varnas (letters) originate from the nada, therefore it is called varna proleptically. The anusandhana or intensive awareness of this nada is called varna yoga or dhuvni yoga . It is very ancient form of yoga . Sankaracarya calls it nada anusandhana.

सृष्टिसंहारबीजं च तस्य मुख्यं वपुर्विदिः

sṛṣṭisaṁhārabījaṁ ca tasya mukhyaṁ vapurvidiḥ

The srsti bija and the samhara bija are its main forms. ***Tantraloka 132***

Jayaratha explains the main forms in the following words.

प्रधानमभिव्यक्ति स्थानमित्यर्थः

pradhānamabhivyakti sthānamityarthaḥ

Sristibija and Samharabija are the main spots of its revelation

Sa –sristibija –denoting expiration

Ha- Samharabija –denoting inspiration

विद्याशरीरसआ मन्त्ररहस्यम्।

vidyāśarīrasattā mantrarahasyam।

The luminous being of the perfect consciousness which is non different from the entire cosmos and which is inherent in the multitude of words whose essence consists in the knowledge of the highest non dualism is the secret of mantra. In the text tantra sadhbhava the following matter has been elucidated in detail. "All mantras consist of letters,the letters are a form of Sakti; the Sakti should be known as Matraka which should be known as the very form of Shiva".

Matraka is paravak Sakti that generates the world. The little unknown mother, the letter and word power, are the basis of all knowledge. Sakti enclosing within herself the central vindu sleeps coiled up in the form of snake. Sleeping there she is thoroughly incognizant. Having cast within her womb the moon,fire,the sun, the stars and the fourteen worlds she appears as if senseless owing to the poison. The para Shakti which is only one appears in three ways; 1.anuttara or the letter अ (a) 2. iccha or letter इ (i) 3. Unmesa(jnana) or the letter उ (u). Through these saktis by various sorts of conjunctionsand disjunctions, all the nine classes of letters are produced. Parasakti characterized by nine classes of letters is known in nine ways . She pervades five mantras , she is described in five ways. She appears in twelve vowels, therefore she is said to be existing in twelve. From 'a' to 'ksa', she exists in fifty varieties in the Sanskrit letters.

In the heart she is said to be of one atom. In throat, she is of two atoms; always situated in the root of the tongue,she is to be known as having three atoms. In the rront of the

tongue , there si successful production of the letters . There is no doubt about this . In this way is the production of words. All existents moving and unmoving, are pervaded by words. ***Shiv Sutra 2.3***

Nine classes of letters are the following

१॥ अ वरग २॥ क वरग ३॥ च वरग ४॥ ट वरग ५॥ त वरग ६॥ प वरग ७॥ य वरग ८॥ श वरग ९॥ क्ष वरग

The five mantras are

१॥ सद्योजात २॥ तात्पुरुस ३॥ ईसान ४ ॥ वामदेव ५॥ अगौर

The twelve vowels are all the vowels of Sanskrit alphabet with the exception of ऋ ॠ ऌ ॡ

Sanskrit alphabet from अ to क्ष consists of fifty letters

Parasakti or Paravak is kundalini Sakti. She is the central creative power of the entire Matrka of all the subjective and objective phenomena. Broadly, she expresses herself in three ways, Pasyanti, Madhyama and Vaikhari. Pasyanti is that where the word and object are identical. The division between word and object has not arisen. In this, there is only the light of consciousness. Therefore this is the stage of vision,and that is why this Sakti is known as pasyanti. She consists of one atom. She is said to be existing in the heart.

In the Madhyama stage , through the division between the word and object has started, it is not fully pronounced yet. Madhyama occupies an intermediate stagebetween Pasyanti and Vaikhari.That is why she is called Madhyama. She is of two atoms and resides in the throat. In the Vaikhari stage, the object is completely separated from the word. The word vaikhara means body. The body is the seat of gross speech. Therefore gross

speech is known as Vaikhari. She is said to exist in the root of the tongue and consists of three atoms. ***Shiv Sutra 3.1***

अन्योऽन्तर आत्मा प्राणमयः। तेनैष पूर्णः।

anyo'antara ātmā Pranamayaḥ। tenaiṣa pūrṇaḥ।

There is another self which is inside, imagined through ignorance to be a self just like the physical body. This later inner self is Prana, the air (vital force). By this airy self has filled the self constituted by the essence of food, just as the bellow is filled with air. ***Taittiriya 2.2.1***

Methods to merge with consciousness

न चक्षुषा गृह्यते नापि वाचा नान्यैर्देवैस्तपसा कर्मणा वा।

ज्ञानप्रसादेन विशुद्धसतत्वस्ततस्तु तं पश्यते निष्कलं ध्यायमानः॥

na cakṣuṣā gṛahyate nāpi vācā nānyairdevestapasā karmaṇā vā।

jñānaprasādena viśuddhasatatvastatastu taṁ paśyate niṣkalaṁ dhyāyamānaḥ।।

It is not comprehended through the eye, nor through speech, nor through the other senses; nor is it attained through austerity or karma. Since one becomes purified in mind through the favourableness of the intellect, therefore can one see that indivisible self through meditation. ***Mundaka Upanisad 3.1.8***

य एषोऽक्षिनि पुरुषो द्रश्यत एष आत्मेति

होवाचैत्दमृतमभयमेत ब्रह्मेति

तद्यद्यप्यस्मिन्सर्पिर्वोदकं वा सिञ्चति वर्त्मनी एव गच्छति।

ya eṣo'kṣini puruṣo draśyata eṣa ātmeti

hovācaitdamṛtamabhayametabrahmeti

tadyadyapyasminsarpirvodakaṁ vā siñcati vartmanī eva gacchati|

He said thus. 'The person that is seen in the eye, this is the self. This is deathless, fearless; this is the Brahman. If anybody pours clarified butter or water on it, that flows surely to the eyelashes'. This person the withholder of vision is seen by those who have withdrawn their organs from the objects, who are endowed with such discipline as celibacy etc., the calm ones and discriminating ones in accordance with other Vedic texts. ***Chandogya Upanisad 4.15.1***

आनन्दो अह्मेति व्यजानात्। आनन्दाद्धयेव खल्विमानि भूतानि जायन्ते। आनन्देन जातानि जीवन्ति।

आनन्दं प्रयन्त्याभिसंविशन्तीति। सेष भार्गवी वारूणि विधा। परमे व्योमन्प्रतिषिठता। स य एवं एद प्रतितिष्ठति।

अन्नवानन्नादो भवति। महान्भ्वति प्रज्या पशुभिर्अह्मवर्चसेन। महान् कीर्त्या॥

ānando brahmeti vyajānAt| ānandādghayeva khalvimāni bhtāni jāyante| ānandena jātāni jīvanti| ānandaṁ prayantyābhisaṁviśantīti| seṣa bhārgavī vārūṇi vidhā| parame vyomanpratiṣiṭhatā| sa ya evaṁ eda pratitiṣṭhati| annavānannādo bhavati |

mahānbhvati prajyā paśubhirbrahmavarcasena| mahān kīrtyā||

(He) knew Bliss as Brahaman; for from bliss, indeed, all these beings originate; having been born, they are sustained by bliss; they move towards and merge in bliss. This knowledge realized by Bhrgu and imparted to varuna(starts from the food-self and) terminates in the supreme (bliss), established in the cavity of the heart. He who knows thus becomes firmly established; he becomes the possessor of food and the eater of food;

and he becomes great in progeny,cattle and the lustre of holiness, and great in glory. ***Taittiriya Upanisad 3.6.1***

नित्योऽनित्यानां चेतनश्चेतनानामेको बहूनां यो विदधाति कामान्।

तमात्मस्थं येऽनुपश्यन्ति धीरास्तेषां शान्तिः शाश्वती नेतरेषाम्॥

nityo'nityānāṁ cetanaścetanānāmeko bahūnāṁ yo vidadhāti kāmān|

tamātmasthaṁ ye'nupaśyanti dhīrāsteṣāṁ śāntiḥ śāśvatī netareṣām||

Eternal peace is for those---and not for others---who are discriminating and who realize in their hearts him who---being the eternal among the ephemeral, the consciousness among the conscious-alone dispenses the desired objects to many. ***Katha Upanisad 2.2.13***

तद्ध तद्धनं नाम तद्धनमित्युपासितव्यं स य एतदेवं वेदाभि हैनꣳ सर्वाणि भूतानि संवाञ्छन्ति।

taddha taddhanaṁ nāma taddhanamityupāsitavyaṁ sa ya etadevaṁ vedābhi hainaꣳ sarvāṇi bhūtāni saṁvāñchanti|

The Brahman is well known as the one adorable to all creatures (hence) it is to be meditated on with the help of the name tadavana. All creatures surely pray to anyone who meditates on it in this way. ***Kena Upanisad 4.6***

यद्वाचाऽनभ्युदितं येन वागभ्युद्यते।

तदेव ब्रह्म त्वं विद्धि नेदं यदिदमुपासते॥

yadbācā'nabhyuditaṁ yena vāgabhyudyate|

tadeva brahma tvaṁ viddhi nedaṁ yadidamupāsate||

That which is not uttered by speech, that by which speech is revealed, know that alone to be Brahman, and not what people worship as an object. ***Kena Upanisad 1.5***

यम्मनसा न मनुते येनाहुर्मनो मतम्।

तदेव ब्रह्म त्वं विद्धि नेदं यदिदमुपासते॥

yammanasā na manute yenāhurmano matam।

tadeva brahma tvaṁ viddhi nedaṁ yadidamupāsate।।

That which man does not comprehend with the mind, that by which, they say, the mind is encompassed, know that to be Brahman and not what people worship as an object. ***Kena Upanisad 1.6***

यच्चक्षुषा न पश्यति येन च्क्षूंषि पश्यति।

तदेव ब्रह्म त्वं विद्धि नेदं यदिदमुपासते॥

yaccakṣuṣā na paśyati yena ckṣṁṣi paśyati।

tadeva brahma tvaṁ viddhi nedaṁ yadidamupāsate।।

That which man does not see with the eye, that by which man perceives the activities of the eye, know that alone to be Brahman and not what people worship as an object. ***Kena Upanisad 1.7***

यच्छोत्रेण न शृणोति येन श्रोत्रमिदं श्रुतम्।

तदेव ब्रह्म त्वं विद्धि नेदं यदिदमुपासते॥

yacchotreṇa na śṛṇoti yena śrotramidaṁ śrutam।

tadeva brahma tvaṁ viddhi nedaṁ yadidamupāsate।।

That which man does not hear with ear, that by which man knows this ear, know that to be Brahman and not this that people worship as an object. ***Kena Upanisad 1.8***

न प्राणेन नापानेन मर्त्यो जीवति कश्चवन।

इतरेण तु जीवन्ति यस्मिन्नेतावुपाश्रितौ॥

na prāṇena nāpānena martyo jīvati kaścavana|

itareṇa tu jīvanti yasminnetāvupāśritau||

No mortal lives by Prana or apana; but all live by something else due to which these two find asylum. ***Katha Upanisad 2.2.1***

शरीरे संहारः कलानाम्।

śarīre saṁhāraḥ kalānām|

Dissolution of the various parts of the tattvas in the body (gross, subtle, and casual) should be practised by bhavana.

By sarira is meant the gross body consisting of the five gross elements, subtle body (five tanmatras,manas,budhi and ahamkara) and the causal(highest) body consisting of Prana and subtle manas upto samana to universal mind. In this body (physical , subtle and causal) dissolution has to be contemplated upon of all the constitutive parts from earth upto Siva into the precceding causes by bhavana. ***Shiv Sutra 3.4***

न चक्षुषा गृह्यते नापि वाचा नान्यैर्देवैस्तपसा कर्मणा वा।

ज्ञानप्रसादेन विशुद्धसतत्वस्ततस्तु तं पश्यते निष्कलं ध्यायमानः॥

na cakñuñā gåahyate nāpi vācā nānyairdevestapasā karmaëā vā|

jïānaprasādena viçuddhasatatvastatastu taà paçyate niñkalaà dhyāyamānaù||

It is not comprehended through the eye, nor through speech, nor through the other senses; nor is it attained through austerity or karma. Since one becomes purified in mind through the favourableness of the intellect, therefore can one see that indivisible self through meditation. ***Mundaka Upnasid 3.1.8***

स्वदेहे जगतो वाऽपि सूक्ष्मसूक्ष्मतराणि च ।

तत्त्वानि यानि निलयं ध्यात्वान्ते व्यज्यते परा ॥

svadehe jagato vā'pi sūkṣmasūkṣmatarāṇi ca।

tattvāni yāni nilayaṁ dhyātvānte vyajyate parā||

If one meditates on the subtlest elements in one's own body or of the world as if they are merging one after another, then in the end the supreme is revealed

In Tantraloka III 283-285 Abhinavgupta explains the nature of Shiva as Bhairava." I am manifesting the universe in the space of my own consciousness, I am the creator, being of the nature of everything"---by this act of awareness, one attains the nature of Bhairava.

In your own body or in this whole universe, just make all these elements enter in their subtle formation in a successive way. Successively make your body enter in its subtle formation of dreaming state, and take that dreaming stste of your own body in its subtler formation of dreamless state, susupti, and carry that dreamless state of susupti of your body in that supreme consciousness of turiya and take that state of turiya in turiyatita and so on. Or take this gross universe: just imagine that this gross universe is existing in your consciousness, your individual consciousness: carry that individual consciousness in your I- consciousness and carry that I –consciousness to universal I- consciousness.

This is melting one after another, in the end supreme God consciousness appears. ***Vijnana Bhairava 54***

व्योमाकारं स्वमात्मानं ध्यायेद्दिग्भिरनावृतम्।

निराश्रया चितिः शक्तिः स्वरूपं दर्शयेअदा॥

vyomākāraṁ svamātmānaṁ dhyāyeddigbhiranāvṛtam।

nirāśrayā citiḥ śaktiḥ svarūpaṁ darśayettadā।।

One should meditate on one's own body in the form of the vast sky, unlimited in all directions, then the power of consciousness is free from any support and reveals her own nature. ***Vijnana Bhairava 92***

चिद्धर्मा सर्वदेहेषु विशेषो नास्ति कुत्रचित्।

अतश्च तन्मयं सर्वं भावयन्भवजिज्जनः॥

ciddharmā sarvadeheṣu viśeṣo nāsti kutracit।

ataśca tanmayaṁ sarvaṁ bhāvayanbhavajijjanaḥ।।

The one which is characterized as consciousness is residing in all the bodies; there is no differentiation in anything. Therefore, if a person realizes that everything is full of that (very consciousness), he conquers the world of becoming. ***Vijnana Bhairava 100***

कामक्रोधलोभमोहमधमात्सर्यघोचरे।

बुद्धिं निस्तिमितां क्रत्वा तअत्त्वमवशिष्यते॥

kāmakrodhalobhamohamadhamātsaryaghocare।

buddhiṁ nistimitāṁ kratvā tattattvamavaśiṣyate।।

If one makes one's mind stable in the various states of desire, anger, greed, delusion, intoxication or envy, then the reality alone will remain (which is underlying them). ***Vijnana Bhairava 101***

न चिअं निक्षिपेद् दुःखे न सुखे वा परिक्षिपेत्।

भैरवि ज्ञायतां मध्ये किं तत्त्वमवशिष्यते॥

na cittaṁ nikṣiped duḥkhe na sukhe vā parikṣipet।

bhairavi jñāyatāṁ madhye kiṁ tattvamavaśiṣyate।।

One's mind should neither be engrossed in suffering nor in pleasure. O Bhairavi ! you should know the middle state (between both)- then the reality alone remains. ***Vijnana Bhairava 103***

ग्राह्यग्राहकसंविअिः सामान्या सर्वदेहिनाम्।

योगिनां तु विशेषोऽयं संबन्दे सावधानता॥

grāhyagrāhakasaṁvittiḥ sāmānyā sarvadehinām।

yogināṁ tu viśeṣo'yaṁ sambande sāvadhānatā।।

The perception of object and subject is common to all embodied beings. But characteristic of yogis is that they are constantly aware of this relationship. ***Vijnana Bhairava 106***

यत्र यत्राक्षमार्गेण चैतन्य व्यज्यते विभोः।

तस्य तन्मात्रधर्मित्वाच्चिल्लयाद्भरितात्मता॥

yatra yatrākṣamārgeṇa caitanya vyajyate vibhoḥ।

tasya tanmātradharmitvāccillayādbharitātmatā।।

Whenever the universal consciousness of the all pervading lord is revealed through any of the sense organs, since their nature is the same (universal consciouness), then by absorption into pure consciousness the fullness of the self will be attained. ***Vijnana Bhairava 117***

स्कारेण बहिर्याति हकारेण विशेत्पुनः ।हंस हंसेत्यतो मंत्रं जीवो जपतिनित्यशः ॥

षटशतनि दिवारात्रो सहस्त्राण्येकाविंशतिः ।जपो देव्या विनिर्दिष्टः सुलभो दुर्लभो जडेः ॥

skāreṇa bahiryāti hakāreṇa viśetpunaḥ।haṁsa haṁsetyato mantraṁ jīvo japatinityaśaḥ।।

ṣaṭaśatani divārātro sahastrāṇyekāviṁśatiḥ।japo devyā vinirdiṣṭaḥ sulabho durlabho jaḍeḥ।।

The breath is exhaled with sound Sa and inhaled with sound Ha. Therefore emperical individual always repeats mantra hamsah. Throughout day and night he repeats this mantra 21600 times . It is known as ajapa –japa, also known as ajapa gayatri. Exhalation –Prana, inhalation- Apana. By mental awareness this automatic process inhalation(apana) and exhalation(Prana) become equilibrated and then dormant kundalini that lies three and ahalf folds at the base of spine rises upwards. At that time number of pleasant sounds are heard. Aspirant should not dwell on these sounds and dwell on anahata nadi only. ***Shiv Sutras Ch III Verse27***

सर्वं खल्विदं अह्म तज्जलानिति शान्त उपासीत ।

अथ खलु क्रतुमयः पुरूषो यथाक्रतुरस्मिँअल्लोके पुरूषो भवति तथेतः प्रेत्य भवति स क्रतुं कुर्वीत ॥

sarvaṁ khalvidaṁ brahma tajjalāniti śānta upāsīta।

atha khalu kratumayaḥ purūṣo yathākraturasmiṁalloke purūṣo

bhavati tathetaḥ pretya bhavati sa kratuṁ kurvīta।।

All this is Brahman. This is born from , dissolves in, and exists in that. Therefore, one should meditate by becoming calm. Because a person is identified with his conviction, just as the conviction a man has in this world, so does he become after departing from here. Therefore he should shape his conviction. ***Chandogya Upanisad 3.14.1***

स वा अयमात्मा ब्रह्म विज्ञानमयो मनोमयः प्राणमयश्चक्षुर्मयः श्रोत्रमयः पृथिवीमय आपोमयो वायुमय आकशमयस्तेजोमयोऽतेजोमयः काममयोऽकाममयः क्रोधमयोऽक्रोधमयो धर्ममयोऽधर्ममयः सर्वमयस्तद्यदेतदिदमयोऽदोमय इति यथाकारी यथाचारी तथा भवति –साधुकारी साधुर्भवति पापकारी पापो भवति पुण्यः पुण्येन कर्मणा भवति पापः पापेन। अथो खल्वाहुः काममय एवायं पुरूष इति स यथाकामो भवति तत्क्रतुर्भवति यत्क्रतुर्भवति तत्कर्म कुरूते यत्कर्म कुरूते तदभिसंपद्यते॥

sa vā ayamātmā brahma vijñānamayo manomayaḥ Pranamayaścakṣurmayaḥ śrotramayaḥ pṛthivīmaya āpomayo vāyumaya ākaśamayastejomayo'tejomayaḥ kāmamayo'kāmamayaḥ krodhamayo'krodhamayo dharmamayo'dharmamayaḥ sarvamayastadyadetadidamayo'domaya iti yathākārī yathācārī tathā bhavati -sādhukārī sādhurbhavati pāpakārī pāpo bhavati puṇyaḥ puṇyena karmaṇā bhavati pāpaḥ pāpena। atho khalvāhuḥ kāmamaya evāyaṁ purūṣa iti sa yathākāmo bhavati tatkraturbhavati yatkraturbhavati tatkarma kurūte yatkarma kurūte tadabhisampadyate।।

That self is indeed Brahman, as also identified with the intellect, the manas and the vital force, with the eyes and ears, with earth, water, air and the ether, with fire, and what is other than fire, with desire and the absence of desire, with anger and the absence of anger, with righteousness and unrighteousness, with everything identified, in fact, with this (what is perceived) and with that (what is inferred). As it does and acts, so it becomes; by doing good it becomes good, and by doing evil it becomes evil- it becomes virtuous through good acts and vicious through evil acts. Others , however, say,"The

self is identified with desire alone. What it desires, it resolves; what it resolves, it works out; and what it works out;it attains". ***Brhadaranyaka Upanisad 4.4.5***

2.6 CONCLUSION

The present study has compiled the authentic description and explanations of Prana and Pranayama kosa from various traditional Yoga texts. These texts are eight of major Upanisad, Smritis such as Srimad Bhagavad Gita, Yoga Vasishta and Patanjali's Yoga Sutras, Tantras, Hatha Yoga Pradipika, Gherand Samhita and Hatha Ratnavali have been referred and presented with descriptions of Prana and Pranayama kosa. *This concludes Part 1 of the study.*

REVIEW OF PART I

From the study of ancient scriptures it is revealed that Prana is an intrinsic part of consciousness like the shadow to a man. When it gets involved in the creation, it becomes individualised Prana for the created. As long as it is there, the matter exists and the life exists. Prana is responsible for creation and sustenance and that is why it is called life force. Once it retracts , that is the disolution. In the humans as in other matter and life, the prana nourishes it and enjoys its being and movement in different forms viz., prana, apana, samana, udana and vyana. As long as there is perfect freedom for its movement, there is good health. That means the bioenergy of body is in perfect harmony. Every matter has to disolve and the the begining of this process is called aging process. In energy terms it results in changes in bio energy, the other reasons for the same could be disease and infection. Prana does not have an absolute hold over matter and life. It is there as a life force to permit the body to grow and function in the desired manner. But sometimes the body creates conditions that Prana feels obstructions to its movement. If the constriction is severe, Prana has no option but to leave and that is the death. So bioenergy is directly related to prana and the state of health. Any changes in it can be a cause of altered state of health. This bioenergy can be captured through Electrophotonic imaging and with the help of software; state of different organs / systems can be known. In the Part II we shall see how this can be correlated with known bio chemical markers to integrate it in the modern medicine.

PART II

3.0 REVIEW OF THE SCIENTIFIC LITERATURE

3.1 A BRIEF HISTORY OF BIO-ELECTROGRAPHY

In the year 1977, Professor Lichtenberg observed a glow or fluorescence during investigation of electrical charges on an insulator surface that was covered with powder. A century later, Nicola Tesla in (1880), demonstrated the same phenomenon from a human body. This florescence effect became known as 'Lichtenburg figures'. In the year 1892 Nardkevitch-Yodko of Russia developed a method to study human energy state. A Catholic Priest, Father Landel de Morua of Brazil, developed an electrography camera. However, this method was restricted in its uses as it had some complexities and danger in using (Korotkov, 2002c).

3.2 KIRLIAN EFFECT

The discovery of electrography became known to the world by 1939, when Russian investigators Semyon and Valentina Kirlian discovered the same phenomenon. This method of high frequency photography came to be known as Kirlian Effect. Then onwards, this method drew attention of many scientist and researchers worldwide. The Kirlian Effect is known as the resultant of an image of a gas discharge from an object when placed in high intensity electrical field and this outcome as an image is registered on some photo materials. When this technique is used to study biological subjects then it is referred as 'bio-electrography' and Kirlianography. There onwards, the Kirlianography has been explored worldwide to conduct several experiments and investigations of various cases in the field of medicine. There are many references and

published work using Kirlianography on biological subject's mainly human energy field (Korotkov, 2002b).

3.3 ELECTRO PHOTONIC IMAGING TECHNIQUE (EPI)

About two decades ago in 1995, a Russian Scientist, Professor Konstantin Korotkov designed an instrument based on electro photonic imaging (EPI) technique. This was the time when analysis of electrophotonic imaging gained scientific status worldwide. As a typical biometric system, the EPI biometric device is comprised of five components: a sensor, signal processing unit, data storage, a matching algorithm, and a decision process (Kostyuk, et al., 2011).The present equipment based on EPI technique incorporates digital video methods, modern electronics and computer system to process the data for analysis (Korotkov, 2002b, 2011b). Using EPI technique, when any object (animate or inanimate), is exposed to a high electric field (frequency of 1024Hz and voltage of 10 kV for less than a millisecond), there is excitation of electrons at the surface of the object. These excited electrons get converted to photons in the high electrical field and hence results a glow. This phenomenon is known as electro photonic emission, which is captured by Charged Coupled Device (CCD) camera (Hacker et al., 2005; Korotkov et al., 2004). In humans, this measurement is performed from all 10 finger tips. The amount of electron emission from the body fluctuates from homeostatic level under different psychophysiological conditions, (Korotkov et al., 2004).

3.4 ENERGY POINTS IN THE HUMAN BODY

The lead for using electro photonic imaging for human energy measurements comes from the ancient Chinese system of acupressure and acupuncture. More than 5,000 years ago they observed that by pressing certain points on the body, pain was relieved and also benefited other parts of the body remote from the pain and the pressure point. Gradually,

they found more locations that not only alleviated pain but also influenced the functioning of certain internal organs. The art and science of acupressure and acupuncture developed to an extent that experienced practitioners could feel where the bodies of people in pain were constricted and sense which trigger points would alleviate the problem. Of all the parts of the human organism it is the hands and feet that resembles the most structure and shape of the body. Stimulation of the points on hands and feet that correspond to disease areas leads to the recovery. This fact awakens our realization and makes us deeply understand the basis of the curative effect that spring up when the correspondence points are stimulated.

Prof. Park Jae Woo an eminent Korean philosopher and scientist invented Su Jok Therapy. This is a system of treatment comprising of a variety of techniques to prevent and cure illness and restore health without any drugs. The theoretical basis of this system of Healing is the discovery of self regulation Energy System of Human Body. In Korean language **SU** means hand, and **JOK** means foot. The theoretical basis of this system of healing is the discovery in each hand and foot, shape and points corresponding to each part (organ) of human body. These corresponding micro points (systems) in hands and feet can therefore be used conveniently and effectively as remote controls to treat any diseased organ/part in human body. SU JOK Acupuncture is a multi-dimensional healing system. The first dimension is a physical healing system, whereby giving simple stimulation to the specific corresponding points in hands and feet, cure is achieved. It is possible as hand as a miniature correspondence treatment system is the most symmetric part of the human body in structural shapes among entire corresponding systems. The second dimension treatment is adapted from classical acupuncture. The classical 12 main meridians, the 8 extra meridians, and their attendant points are represented on the hands and feet.

The principle behind Su Jok is that there is a continuous flow of energy in all of us. This energy flows in a very systematic and uniformed manner. “Su Jok’s aim is to balance the imbalanced energy in the body—the tissues, the cells and the organs”. Advanced Su Jok uses needles to balance the energy and it is called Six Ki treatment which harmonise energy on the physical, emotional and even the Chakra plane.

Modern scientists wanted to measure this human energy. All living organisms have a cellular, and therefore, a molecular organized structure. The living processes inside them run on a cellular and a molecular level. Bioelectrical activity is one of the very important physical parameters of living organisms (Ignatov et al., 1998). Bioelectric potentials generated by various cells are widely used in medical diagnostics and are recorded as electrocardiogram, electromyogram, electroencephalogram, etc. Between the outer surface of the cell membrane and the inner contents of the cell there is always the electric potential difference, which is created because of different concentrations of K+ , Na+ and Cl inside and outside of the cell and their different permeability through the cell membrane (Kiang et al., 2005).

Taking the lead from system of acupressure and acupunctre (or SU Jok Therapy) and the scientific explanation of working of human body, electro photonic imaging was developed for the measurement of energy levels through the finger points.

Figure 2: Demonstration of the Electro Photonic Imaging Process

Figure 3: Demonstration of excitation of electrons and photonic emission using EPI technique

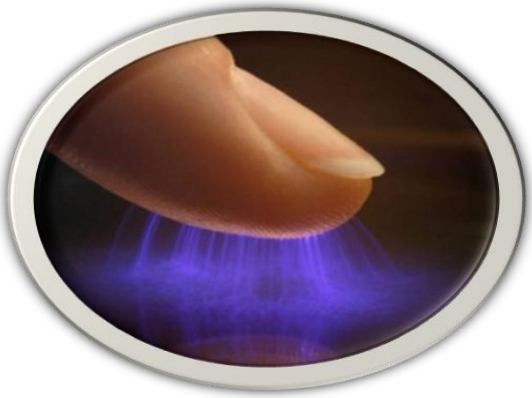
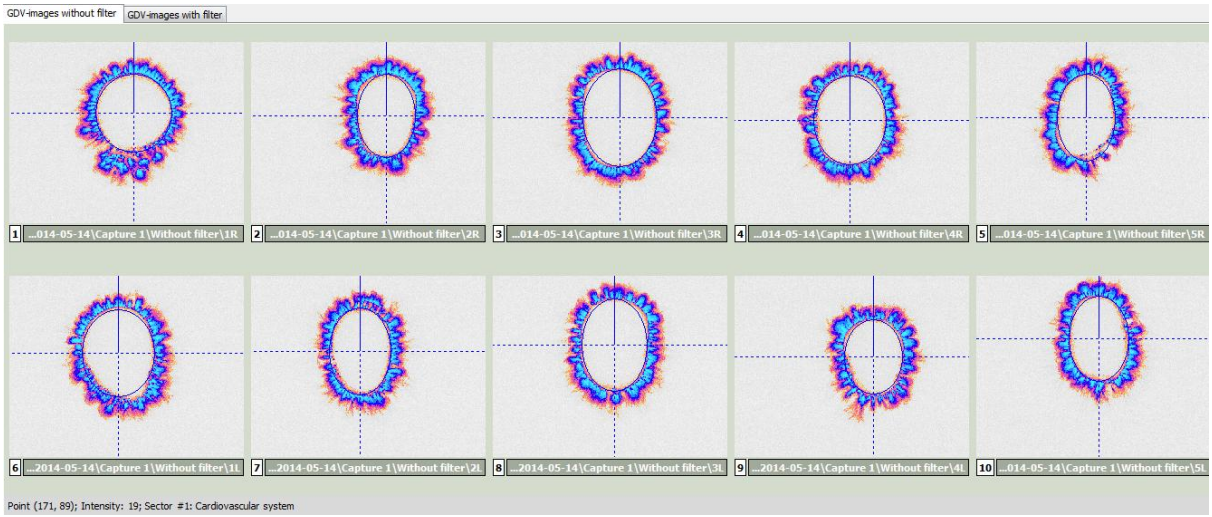


Figure 4: Demonstration of obtained electron photonic images from all 10 fingers using EPI technique



3.5 RECOMMENDED EPI MEASUREMENT PROCEDURE

To obtain reliable and reproducible data, it is necessary to follow the recommended guidelines (Yakovleva & Korotkov, 2015a).

I. Collect data after 3 hours of food intake, without alcohol (approximately 24 hours post alcohol consumption) or strong medicines. Specific medicines like hormones or anti-depressants will have an effect on the energy levels. Subjects should be advised to empty the bladder and bowels before starting EPI readings.

II. Subjects must not wash or wipe their fingers using alcohol before measurements. If hands are dirty then wash but wait for another 15 minutes and then take measurements.

III. If hands are too sweaty, wipe each finger individually and then take the measurements.

IV. Before taking measurements ensure subjects are in a comfortable and pleasant surroundings for about 15 minutes.

V. No other diagnostic procedure should be held at the same time.

VI. In case of periodical measurement of subjects, it is necessary EPI readings be taken by the same expert, at the same place in a constant optimum temperature.

VII. Calibration of EPI device should be performed routinely at least four times a year, or if conditions change, e.g. moving the camera to other site, change of computer, severe changes in atmospheric conditions. The calibration should also be done if results obtained are unusual.

VIII.Subjects should place finger pads, one at a time, on the glass at 45° angles with a gentle but firm touch.

IX. All metallic ornaments that the subjects do not wear for the entire 24 hours must be removed.

X. Subjects must stand on electrically insulated surface during measurements.

XI. Before each measurement the optic lens of the EPI device must be wiped clean.

XII. If EPI grams are unusual, recapture the respective fingers for precise results.

XIII. There should be ideal distance of three feet between EPI device and a dedicated laptop computer while collecting data.

XVI. Women menstruating will affect the EPI results, therefore this factor should be kept in mind during assessments of females.

3.6 RELIABILITY AND VALIDITY OF EPI

Russo et al in (2001) worked on reproducibility of EPI data. They could demonstrate that most people who were assessed showed repeatability of more than 90%. To broaden the study it was necessary to consider physiological factors, influence of emotions, alcohol, medications, and quality of sleep (Yakovleva & Korotkov, 2015a). The reproducibility of EPI parameters was investigated for healthy people and bronchial asthma (BA) patients. This study demonstrated that EPI parameters in healthy individuals have an average variation of 4.1% when measured in a single day and 6.6% when measured within 10 min interval. This variability in BA patients was respectively – 8.6% and 7.7%. This shows the high level of reliability of this technique (Korotkov, 2011c).

3.7 ADVANTAGES OF EPI

I. EPI system is easy to use and all the analysis is computer based.

II. EPI is non-invasive and safe to use .

III. Quick evaluation of health abnormalities from the human energy system,

IV. Simplicity and convenience of the method as measurement is performed from fingers only,

V. It provides quantitative information on the energy homeostasis level both for the organism as a whole and for individual functional systems,

VI. EPI system is relatively economic and the procedure itself does not involves any extra costs.

3.8 EPI ANALYSIS IN THE INTEGRATIVE MEDICINE

A. EPI in clinical areas

Medical biometrics based on the EPI technique has been used in medicine (Olalde Rangel & del Castillo, 2005) to monitor patients and compare their natural electro-photonic emission before and after surgeries (Korotkov, et al.,2011). EPI technique has been utilized to screen and study various population worldwide for medical conditions such as bronchial asthma, hypertension, CVDs, cancer, pregnancy, autism and diabetes etc. Comparisons of three different populations; 1. healthy; 2. patients with stomach and duodenum ulcer; and 3.bronchial asthma patients showed that Area parameter of EPI for unhealthy people are always greater, as compared to that of healthy people.

1. Bronchial Asthma (BA)

EPI area is in proportion to severity. Higher degrees of pulmonary obstruction and more pronounced dysfunctions of the microcirculation in the lungs indicate higher area. Form coefficients (FC) and Fractality demonstrate less significant difference. On the other

hand, Entropy parameter showed statistically significant difference between the groups. The EPI-gram area in BA patients in the restorative phase after acute exacerbation is characterized by lower values of area indices and the integral area (IA) coefficient as compared to practically healthy people. IA values for healthy people were 0.56□ 0.35 on the left and 0.54□ 0.33 on the right side, whereas for BA patients 0.42□ 0.64 on the left and 0.51□ 069 on the right side (P=0.01) (Alexandrova et al., 2002).

2. Hypertension

Another study, investigating patients with arterial hypertension (AH) of different degree of severity, in the course of population screening, found reliable differences between healthy patients and groups with various degrees and stages of AH. This was calculated with sufficiently high accuracy and showed that Electrophotonic technique could be included in population screening (Aleksandrova, Zarubina, Kovelkova, Strychkov, & Yakovleva, 2011).

3. Cardiovascular Diseases (CVDs)

The study was designed to assess changes in images of corona discharges (ICD) in patients with cardiovascular diseases (n=96) comparing with healthy people group (n=30). It showed that age, gender, temperature in examination rooms as well as frame of mind of the study population exerted a similar effect on ICD in both groups. Heart rate, blood pressure and the pattern of coronary heart disease exerted varied effects on the ICD parameters of patients in the study group. It was concluded that the analysis of changes in ICD may be a source of information about the effect of physiological and pathophysiological changes in the human health state, both physical and mental (Ciesielska et al., 2010).

4. Cancer

Looking at the EPI patterns between cancer patients (both breast and lung cancers) and healthy people had demonstrated significant statistical differences.The study also showed that after treatment, EPI parameters shifted toward the “healthy” range of EPI. (Yakovleva & Korotkov, 2015b).

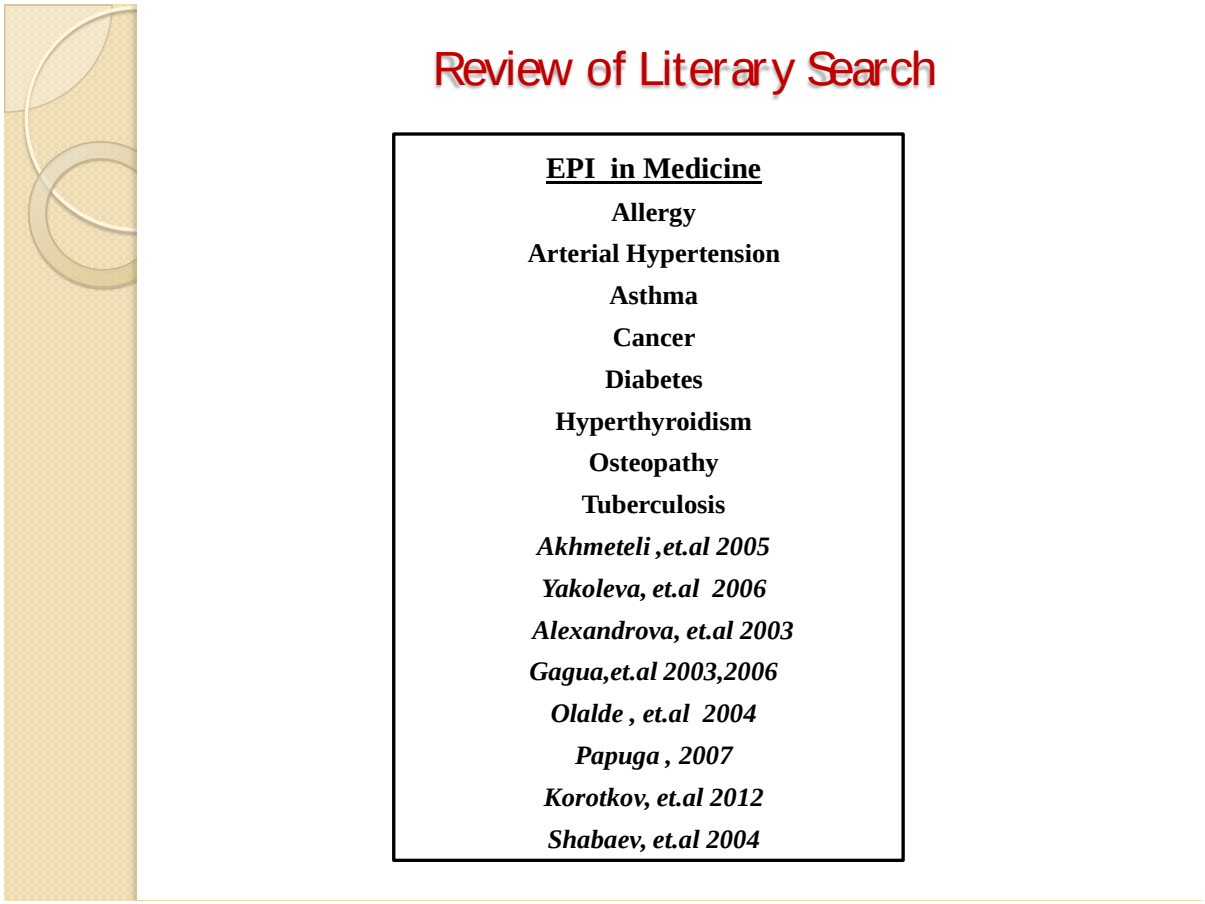
5. Autism

A pilot study was conducted to assess the psycho-emotional and physiological functional state based on the activity of the autonomic nervous system in autistic children, siblings and their parents through a biometric device based on EPI technique. The results showed statistically significant differences on psycho emotional and physiological levels between all compared groups. These differences between autistic children and controls on psycho-emotional level were found the most significant as compared to other groups. Therefore, it was interpreted that the activity of the sympathetic nervous system could have been significantly altered in children with autism (Kostyuk et al., 2010).

6. Diabetes

The recent study in India conducted by Sharma et al. in 2014 demonstrated that the two groups, namely T2DM (Type 2 Diabetes Mellitus) and healthy subjects, have significantly different EPI pattern for cardiovascular, endocrine, immune and urogenital systems. Differences between diabetic and healthy groups showed increasing trend of EPI pattern with increase in duration of the disease. When dividing the diabetes group according to their pathological duration revealed systematic increases in values in all organs and organ systems. However, the study indicated that the existing EPI norms

might be different for the Bangalore based population norms, and, hence, suggested that EPI norms for Indian population should be developed (Sharma, Hankey, & Nagendra, 2014 and was subsequently done (Kushwaha, Srinivasan & Nagendra 2015).



3.9 INTERVENTIONAL STUDIES USING EPI

1. Stress reduction through osteopathy

EPI technique has been explored in various interventional studies, specifically looking at stress reduction and general health index. Such a study to explore how osteopathy treatments influence certain measurable aspects of the human biofield (various calculated parameters of finger corona discharge patterns) in healthy adults was conducted. Results demonstrated that most of the participants of these osteopathic treatments experienced increase in fingertip florescence area and average intensity,

reduction in stress levels, and improved blood pressure measurements (Korotkov et al., 2012).

2. Music and EPI

Influence of Indian devotional music on the human energy in the performers (singers and accompanists) and the audience of a music program was measured by EPI . Parameters area and intensity increased significantly and no significant decrease in the entropy of student audience. Similar trends were observed in the singers and accompanists, though not significant (Rao, Kushwah, & Srinivasan, 2014). Another study, exploring the effect of music and focused meditation on the human energy field using EPI showed that both interventions had a significant palliative effect as thrown through EPI physiological measures. Data indicated a strengthening of the human energy field in area and brightness parameters of EPI (Gibson, 2004). A study investigating the effect of anapanasati meditation on EPI parameters at physiological and psycho-physiological levels found significant changes in integral area with filter (physiological) in both right and left side and similar trends from without filter (psycho-physiological). There was reduction in activation coefficient (stress levels). Integral entropy (disorderliness) found decreased at psycho-physiological level on the left side, but not significant. (Deo, Ravi, Srinivasan, & Kuldeep, 2015).

Review of Literary Search

EPI in Community Set up

Music

Meditation

Profiling

Standardization

Indira „et.al. 2014

Gurudeo, et.al .2016

Sharma ,2013

Kuswaha ,2016

4.0 SCIENTIFIC STUDY

4.1 DIABETES

4.1.1 EPIDEMIOLOGY OF DIABETES

Diabetes is a major health issue across continents and social spectrum. This disease is characterized by insufficient production of insulin by the body or inability of the body cells to use insulin properly, even if produced sufficiently. The medical term for this condition is hyperglycemia. It is has two types.Type1 IDDM (insulin dependent diabetes mellitus) and Type 2 NIDDM (non insulin dependent diabetes mellitus). Type 2 diabetes is more common (Rother K.L, 2007). Though this disease is part of human civilization for long time and mentioned in ancient scriptures under different names, the scenario is worsening in recent years. Because of demographic changes there is increase in the number of people above 65 years of age and this group is more susceptible to diabetes. According to International Diabetes Federation the most vulnerable age group is 45-65 yrs in developing countries and above 64 yrs in developed countries. It is necessary to quantify the prevalence of diabetes for planning and allocation of resources. Earlier the diabetic population of the world was estimated to be 2.8% (177 million) in 2000 and 4.4% (366 million) in 2030 (Shaw E.E, 2004). Revised estimates suggest 7.7% (439 million) in 2030(Wild S, 2004). Diabetes is far overshooting the estimates made on trends in 2000. As the disease is spreading to younger generation, susceptible age bracket now is 20-79 yrs.

4.1.2 ECONOMIC BURDEN OF DIABETES

The global expenditure on diabetes is expected to be US $ 490 billion in 2030. Twelve percent of health expenditure would be spend on diabetes related diagnosis and management. It was estimated to be US $ 1330 per person for year 2010. The expenditure would vary as per region, age group, gender and the income level of

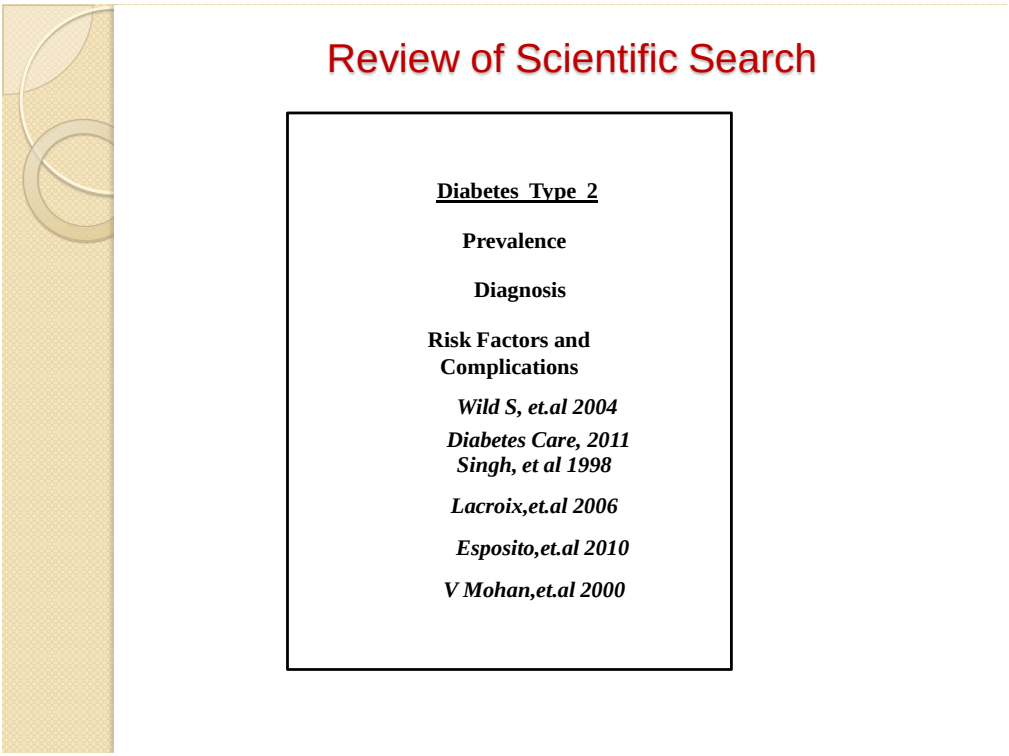
country. Diabetes is a serious problem on the financial health of the country. Expenditure on diabetes varies from 2 - 41% of a country's total health expenditure (Boeffetta P, 2011). Nations have to spend more on health care system which otherwise could be spent on economic and social development. In US, people with diabetes spend 2.5 times more on medication than those without diabetes and that is scenario in India as well. Poor countries need to allot more resources to provide basic diabetes care. Urban poor spend 34% and rural poor 27% of their income on diabetes care in India. The average expenditure per patient per year would be a minimum of Rupees 4,500. Therefore, the estimated annual cost of diabetes care would be approximately Rupees 180,000 million. Of all health care costs, 85 to 95% are borne by individuals and their families from their personnel income. The poor are greatly affected as large amounts of their income go into this disease. Not only that, they are more prone to the co-morbid risks. The cost on diabetes is due to ambulatory care (65%) and hospitalization (35%). Ambulatory care comprises of doctor visit (12%), laboratory (22%), drugs (17%), disposables (3%) and other drugs (11%). As per estimates of Indian Diabetes Prevention Program the cost effectiveness to prevent one case of diabetes is a) Rs 47,341 with life style modification b) Rs 49,280 with medicine c) Rs 61,133 with lifestyle modification and medicine. Besides there are indirect cost which comprises of man days lost and loss of personnel and family income. This has been worked out to be Rs 12,756. Hospital costs are worked out by number of hospitalizations multiplied by the average cost per event divided by the duration of each event. Higher cost of treatment is a great burden on the state resources as well the patients among all socio economic groups. The financial strain is alarming among the poor for treating diabetes and they must be provided with the insurance cover (Misra P, 2011).

4.1.3 DIABETES IN INDIA

WHO estimates suggests that mortality rate from diabetes, stroke and heart disease cost India $210 billion in 2005 which will go up to $ 333.6 billion in 2015. Indians develop diabetes at a very young age which is earlier by at least 10-15 years in comparison to western population. Earlier occurrence gives ample time for chronic complications of diabetes. The factors responsible are familial history, abdomen obesity, sedentary lifestyle, insulin resistance, urbanization stress (Mohan V, 2007).

4.1.4 CONVENTIONAL DIAGNOSIS AND MEDICAL TREATMENT OF DIABETES

Conventional medicine to treat diabetes comprises of lifestyle modification and medication, the first stage of treatment is meal planning, weight loss and exercising. Drugs used are Sulfonylureas, Meglilinides, Biguanides, Thiazolidinediones, Alpha-glucosidasl inhibitors. Pills work only in those patients whose pancreas still makes some insulin. The diagnostic tests are IGT (impaired glucose tolerance), IFT (impaired fasting glucose), HbA1c (glycated haemoglobin), H-FABP (Heart type-fatty acid binding protein), BMI (Body mass index), Lipid profile and new type of tests are under scientific development and validation. Complications that arise due to diabetes are related to heart, kidneys, liver and eyes. As the disease progresses, almost all the systems and organs are affected directly or indirectly. Some of the preliminary tests for diagnosis of complications are Serum Creatinine and Urea (renal problems), Total Cholesterol and Triglycerides (cardiac problems), Alkaline Phosphate, ALT(alanine aminotransferase) and AST(aspartate aminotransferase) for liver disorders; among host of other tests.



4.1.5 CAM AND DIABETES

There are complementary and alternative therapies being practiced mostly to supplement the conventional medicine and rarely as standalone treatment. Most common are biologically based practices and Mind Body medicine. Biologically based practices consist of herbs, minerals and food supplements (Wild S, 2004). Indian system of medicine Ayurveda and Unani are based on herbs, plants and minerals. Ayurveda is an ancient system of medicine practiced for thousands of years. Diabetes is mentioned in the texts of Ayurveda and there are certain preparations (herbs and plants) used for the control and management of diabetes. Sources of study in Ayurveda are 1. Caraka Samhita 2. Susruta Samhita 3. Astanga Sangraha 4. Astanga Hridaya. Food supplements based on natural resources referred to as nutraceuticals, are commonly used especially by the upper economic status society. These are generally called as life style supplements which are validated through science but not classified as drug by FDA. There are lot of herbs and plants which have proven anti diabetic activity viz., garlic,

aloe vera, ivy gourd, gymnema, momordica charantia and fenugreek. Mind body medicine works on the concept that physical body and mind influence each other. Mind body techniques have arisen in various cultures and contexts from time to time. Most of these therapies are derived from eastern traditions such as yoga, tai chi and meditation. Yoga has become very popular in western countries and lot of research has been done there in this field. Yoga includes physical techniques of movements, breathing, meditation, chanting and life style changes. Tai chi is a mind body practice from China with roots in martial arts and ancient healing tradition. It includes coordinates gentle movements with mental focus, breathing and relaxation. Yoga and tai chi come under the category of low to moderate aerobic activity as per the classification of ADA (American Diabetes Association). According to their guidelines patients with diabetes should perform at least 150 min/week of moderate to intense physical activity/aerobics (Rubin R.J, 1994).

4.1.6 YOGA AND DIABETES

Yoga is a mental, physical and spiritual activity originated in ancient India 5000 years ago. The benefits of yoga are many and proved through research. To mention some of the benefits viz., sense of inner peace through breath awareness, better sleep, reduced anxiety and depression, feeling of well being, flexibility and physical strength (National Centre publication). Diabetes occurs because of non functioning of pancreas. β- cells become deactivated and when 80% of the cells are dead, the disease surfaces. Yoga can effectively support by messaging internal organs like liver/ pancreas and activating glandular system responsible for diabetes (Centre for disease control publication). Yoga is a scientific system given to us by ancient sages. Originally a spiritual practice its benefits extend to achieve health and happiness (Gresham GE). Yoga is a technique for balancing the mind. Stress is generated in mind and gets reflected in the body (physical

and mental) in the form of diseases. In diabetes, mastery of mind contributes to stability of blood glucose level around normal values (*Rockville M.D, 1995*). 'Patanjali Yoga Sutra' is the main text of yoga, it has eight main components. These eight components are yama, niyama, asana, pranayama, pratyahara, dharana, dhyana and samadhi. The application of yoga for specific disorders is recent. The medical benefits can be viewed as positive side effects of the primary goal of yoga viz. control over the mind and spiritual development. Practitioners and therapists of yoga view it as a holistic intervention. Modern medicine has shown acceptance for yoga as a supplementary therapy. Well designed short term and long term studies have shown the effect of yoga in Diabetes mellitus type 2 with good glycaemic status for long periods of time with lesser requirement of oral hypoglycemic drugs. Yoga asana and pranayama result in stable autonomic functions in Type 2 DM (diabetes mellitus) cases. Slow pace pranayama activates the parasympathetic system resulting in better glycaemic control (Matcher D.B, 1994). There are studies where yoga practice for 40 days has shown reduced BMI, improved well-being, and reduced anxiety in T2DM (type2 diabetes mellitus) subjects. The program resulted in improvement of the subjective well being scores of the subjects. Therefore yoga can help in primary prevention as well as management of T2DM (Schoenberg BS). Yoga reduces risk factors for T2DM by promoting weight loss, improving glucose levels and reducing blood pressure and lipid levels (Davis PH et.al.,). Yoga is helpful in controlling both symptoms as well as complications associated with type 2 diabetes mellitus. Another benefit associated with yoga is improvement in quality of life. The sources of study in Yoga are 1.Patanjali Yoga Sutras 2.Yoga Vasistha 3.Bhagavad Gita. The sources of study in spiritual lore are 1.Bhadranayaka Upanisad 2.Chandogya Upanisad 3.Prasna Upanisad 4. Mandukya Upanisad 5. Aksh Upanisad 6. Adhyatma Upanisad 7. Vijnana Bhairavi.

4.1.7 PRE DIABETES

Plasma glucose levels above normal range but below the clinical diabetes represent pre-diabetes Pre- diabetes can be identified as either impaired fasting glucose (IFG) or impaired Glucose tolerance (IGT). Both are risk factors for type2 diabetes, risk is greater when both IFG and IGT occur together. Pre diabetes commonly associates with the metabolic syndrome. For both Pre- diabetes and metabolic syndrome, the desirable approach is life style intervention, especially weight reduction and physical activity. Persons who have both IFG & IGT plus metabolic syndrome are at a greater risk for conversion to diabetes than are those with only IFG or IGT. Such persons may be better candidates for aggressive therapy to delay onset of diabetes. Major detrimental outcomes with pre diabetes are macrovascular disease and type2 diabetes, the leading contributors to microvascular disease. Macrovascular disease occurs both before and after the onset of diabetes but microvascular disease occurs several years after conversion to diabetes.

4.2 AIMS AND OBJECTIVES OF THE STUDY

4.2.1 AIMS

To Identify EPI Parameters that draw Correlation with established Biomarkers of Diabetes Type 2 and find

Efficacy of Stop Diabetes Movement (SDM) Yoga module (developed at Yoga University, Bengaluru) through Electro Photonic Imaging (EPI)

4.2.2 OBJECTIVES

1**.** To study the correlation and establish relationship between Fasting Blood Sugar (FBS) and EPI parameters in type 2diabetic population. (**constitutes study 1**)

2.To study the correlation and establish relationship between glycated hemoglobin (HbA1c) and EPI parameters in type 2diabetic population. (**constitutes study 2**)

3. To study Diabetes type 2 through the prism of EPI in that

i. study the trend in normal, pre diabetic and diabetic type 2 subjects as measured by EPI technique. (**constitutes study 3**)

ii. to study the difference between controlled and uncontrolled diabetes through EPI parameters. (**constitutes study 4**)

iii. To see the effect of seven day Yoga Pragram (SDM) Module in diabetic type 2 patients using EPI technique. (**constitutes study 5**)

4.3 RESEARCH QUESTION

1. Can we have a mathematical model which establishes an equation between FBS and EPI parameters.

2**.** Can HbA1c be used as a marker for correlation with EPI parameters.

3. Do EPI parameters show a progressive change from normal to pre diabetes and diabetes.

4. Is there any difference in EPI parameters in controlled and uncontrolled diabetes type2.

5. Can 07 day SDM Yoga program improve EPI parameters in diabetic type 2 subjects.

4.4 HYPOTHESES

Ha1: There will be a correlation between FBS and EPI parameters in normal, pre diabetics and diabetics.

Ha2: There will be a correlation between HbA1c and some EPI parameters in normal, pre diabetics and diabetics.

Ha3: There will be significant change in EPI parameters among normal, pre diabetics and diabetics.

Ha4: There will not be significant difference in EPI parameters between controlled and uncontrolled diabetic type 2 subjects.

Ha5: There will be significant improvement in EPI parameters after seven days of diabetes specific yoga Program (SDM).

4.5 NULL HYPOTHESES

Ha1: There will be no correlation between FBS and EPI parameters in normal, pre diabetics and diabetics.

Ha2: There will be no correlation between HbA1c and some EPI parameters in normal, pre diabetics and diabetics.

Ha3: There will not be significant change in EPI parameters among normal, pre diabetics and diabetics.

Ha4: There will be significant difference in EPI parameters between controlled and uncontrolled diabetic type 2 subjects.

Ha5: There will be no significant improvement in EPI parameters after seven days of diabetes specific yog program (SDM).

4.6 NEED AND SCOPE OF THE STUDIES

4.6.1 CORRELATIONAL STUDY

All the research work and practices through EPI are confined to comparing EPI parameters in various conditions. It could be a population survey, interventional study (pre-post) or observational study. The reference is EPI itself which is not yet an internationally accepted marker. If we take the case of diabetes type 2, there are accepted biomarkers for testing of diabetes e.g., FBS and HbA1c. It is very important to establish correlation between acknowledged biochemical parameters and EPI parameters to have interusability in hollistic medicine. Therefore, present study focuses on the establishment of this correlation between EPI parameters and biochemical parameters viz., FBS and HbA1c. This will enable EPI to integrate into modern medicine in case of diabetes which can be extended to other diseases as well.

4.6.2 YOGA BASED TECHNIQUE

Prevalence of stress is one of reasons for diabetes type 2. Yog is an established way of life for stress reduction. The underlying principle of Yoga practice through asanas is stimulations followed by relaxation. This reduces sympathetic activity (Vempati & Telles, 2000) and increases parasympathetic activity (Sarang & Telles, 2006). In medical connotation it is indicative of stress reduction. There are many methods to measure stress level both subjective and objective. EPI method has also been used to measure stress levels (Korotkov et al., 2012). Because of its multiple advantages, as non-invasive, objective, cost effective, time saving and easy method for quick health assessment, its clinical use could be profound**.**

4.6.3 DIABETES SPECIFIC YOGA MODULE (SDM)

Yoga is recognized by World Health Organization (WHO) as a practice for prevention and management of diseases. Looking at the challenges that diabetes throws at global medical community, SVYASA University has launched a Stop Diabetes Movement(SDM) compaign to educate the masses about diabetes and restrict its spread through Yogic way of life . SDM module developed has the components for aligning energies at all Pancakosa (five layer of human) levels. According to yoga philosophy, stress is a primary cause of diseases. Stress in Manomaya (mind related) Kosa level leads to imbalances in Pranamaya (energy related) Kosa level and over a period of time, it percolates to physical level manifesting in the form of diseases in energy imbalanced organs (Nagarathna & Nagendra, 2009). EPI can assess these physiological conditions of a person.This information is available through energy diagrams and parameters (Korotkov et al., 2012). EPI technique is non-invasive and a quick assessment of all physiologicalsystems can be done in a couple of minutes and no laboratory costs. Thus the EPI technique could play an important role in monitoring and prevention of diseases.

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5.0 METHODS

5.1 FBS, EPI CORRELATIONAL STUDY

SUBJECTS

Two hundred participants from various Yoga camps in the rural areas of Bengaluru and Arogyadham (a residential health centre) at Swami Vivekananda University, Bengaluru, India were scrutinized. Out of these 102 subjects were selected for the study. The drop outs were on account of defects in the image and/or the biochemical (FBS) reports were not available. Out of the selected, 42 participants were in the category of no health problem (NHP). It comprised of 29 normal and 13 pre diabetes subjects. Further 60 participants were in the category of diabetes irrespective whether the diabetes was under control or uncontrolled (Table1). The three groups were designated as; normal, pre diabetes and diabetes. Out of 42 (mean age 46.5±11.7 years) in the non diabetes group, 17 were males (mean age 48.47±13.26 years) and 25 females (mean age 45.2±10.6 years). Normal consisted of 29 (mean age 44±11years), pre diabetes consisted of 13 (mean age 51.2±12.3years). In the diabetes group of 60 (mean age 54±9.6years), there were 35 males (mean age 56.83±8.72years) and 25 females (mean age 50±9.4years). Participants in the age range of 18 to75 years, male or female and willing were included in the study.

EXCLUSION CRITERIA

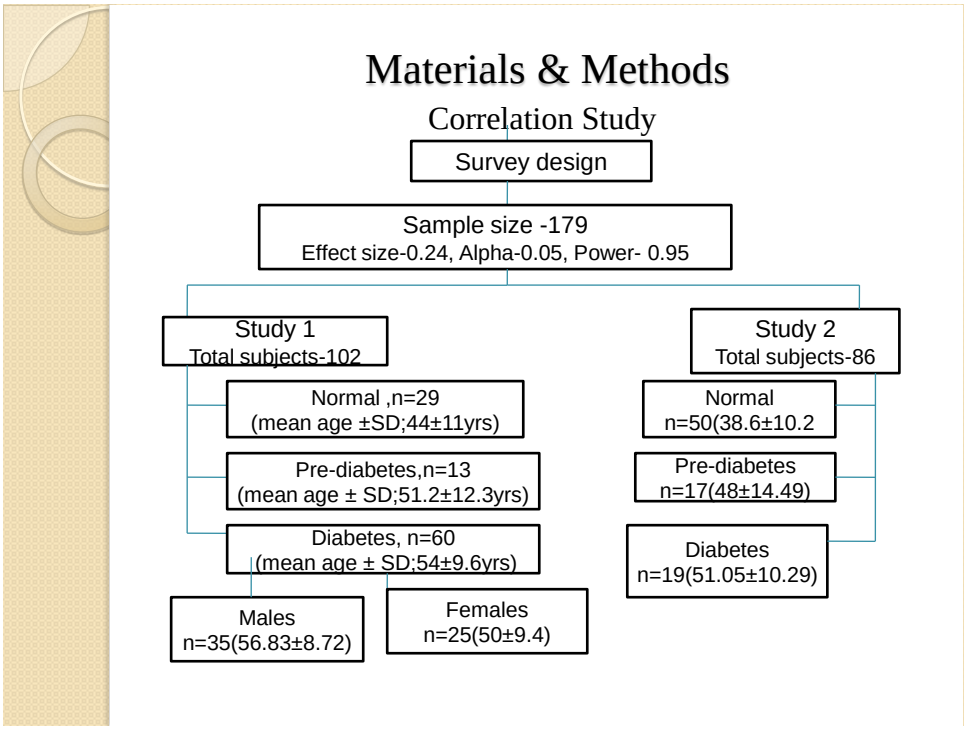
The following subjects were excluded from the study: Participants with co-morbidity and taking any medicine in the case of normal and pre diabetes participants; diabetes participants taking medicines apart from diabetes medications; participants suffering from any infectious or contagious diseases; physically handicapped persons with

missing fingers and females having menstruation or pregnancy on the day of measurement.

5.2 HbA1c, EPI CORRELATIONAL STUDY

SUBJECTS

Eighty six subjects were selected after scrutiny of 150 participants from various Stop Diabetes Movement camps and Arogyadam. The rejections were due to improper finger prints or/and non availability of biochemical test HbA1c. The selected subjects were categorized into three groups: a) normal, b) pre diabetes and c) diabetes (Table 1). Normal comprised of 50 subjects (mean age 38.6 ± 10.2years). Out of these 25 were males (mean age 37.2 ± 9.74years) and 25 were females (mean age 40 ± 10.7years). Pre diabetes comprised of 17 subjects (mean age 48 ± 14.49years). Out of these 14 were females (mean age 48 ± 14.49years) and rest were males (mean age 61 ± 18.52years). The diabetes group of 19 subjects (mean age 51.05 ± 10.29years) comprised of 13 females (mean age 49.31 ± 10.96years) and 06 males (mean age 54.83 ± 8.23years). Participants in the age range of 18 to75 years, male or female, willing for the study and trials were included. HbA1c reports of all the volunteers were available.



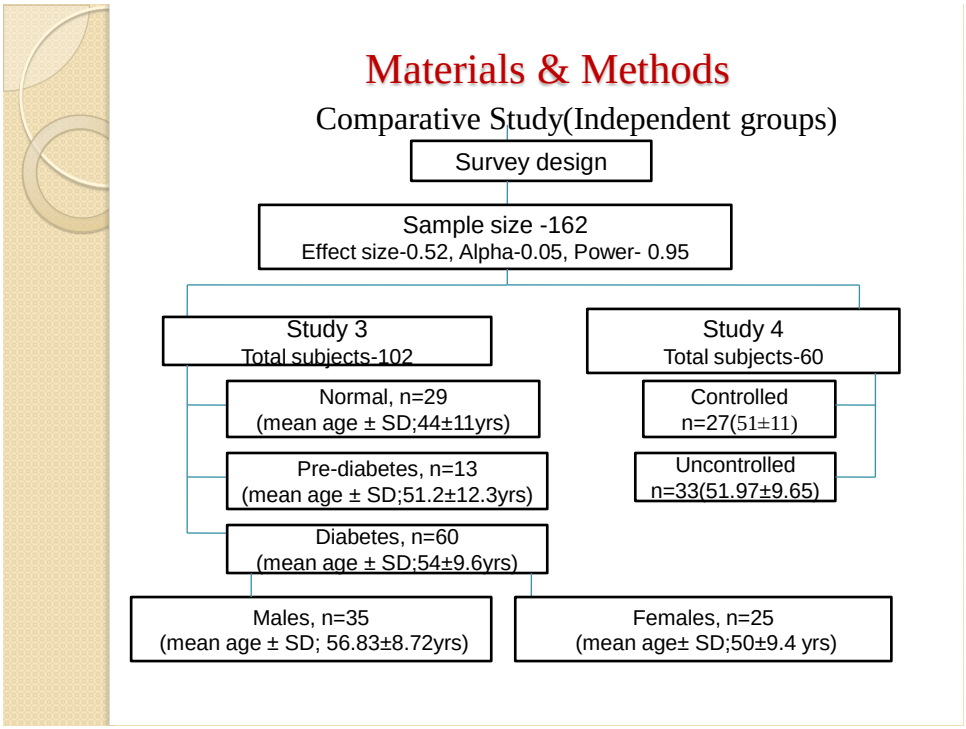
EXCLUSION

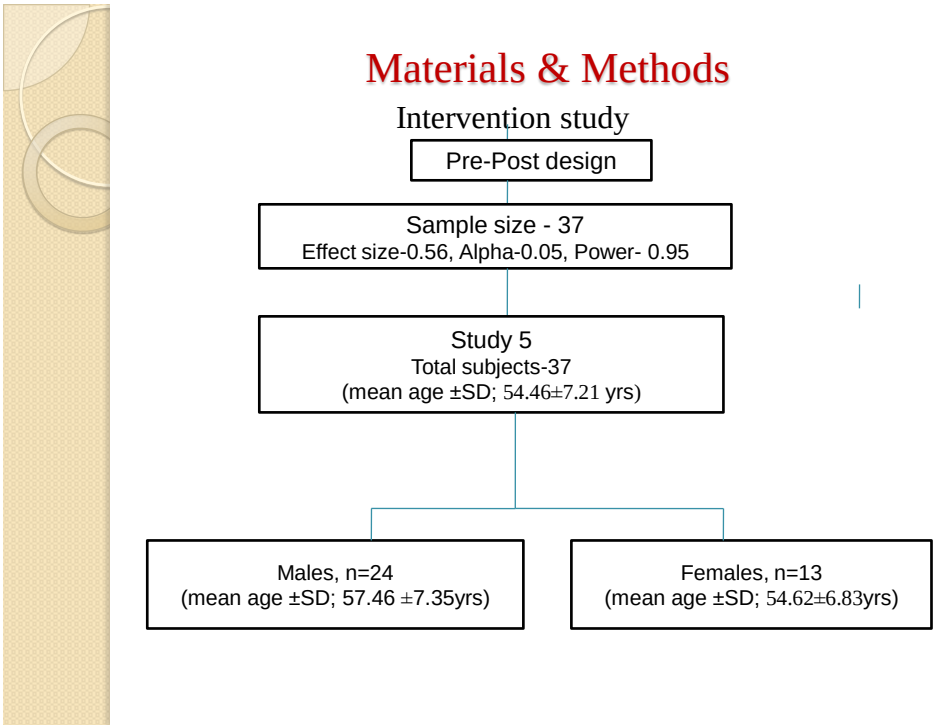
The following subjects were excluded from the study: Participants with co-morbidity (e.g., hypertension, dyslipidemia, fatty liver disease) and taking any medicine in the case of normal and pre diabetes participants; diabetes participants taking medicines apart from diabetes medications; participants suffering from any infectious or contagious diseases; physically handicapped persons with missing fingers and females having menstruation or pregnancy on the day of measurement.

5.3 COMPARATIVE STUDY OF DIABETES THROUGH EPI

The study was conducted on the participants of the yoga camps held in connection with Stop diabetes movement (SDM) campaign and Arogyadham (a residential health centre) of S-VYASA Yoga University. After the scrutiny of 250 participants following number of subjects were selected for the different study. **a.** One hundred and two subjects (mean age 51±11years) for the first objective. Out of these 52 were males (mean age 54±11years) and rest females (mean age 47±10 years).The total subjects comprised of

29 normal (mean age 44±11years), 13 pre diabetes (mean age 51.2±12.3years) and 60 diabetes (mean age 54±9.6years). **b.** 60 subjects (mean age 53.8±9.62years) for the second objective. Out of these 35 were males (mean age 56.83±8.72years) and 25 females (mean age 49.56±9.38years). The total subjects were divided into controlled diabetes n=27 (mean age 56.04±9.28years) and uncontrolled diabetes n=33 (mean age 51.97±9.65years). **c.** 37 subjects (mean age 54.46±7.21years) comprising 24 males (mean age 57.46±7.35years) and 13 females (mean age 54.62±6.83years). Participants in the age range of 18 to75 years, male or female and those willing to volunteer for study were selected. All participants had to give blood for FBS test on the inaugural day of camp or have a recent blood report.





EXCLUSION CRITERIA

Subjects with co-morbidity like hypertension, dyslipidemia , fatty liver disease and those taking any medicine in the case of normal and pre diabetic participants. Diabetic subjects taking medicines apart from diabetes.Subjects suffering from any infectious or contagious disease, physically handicapped and those having missing fingers. Females having menstruation or pregnancy on the day of measurement were excluded.

5.4 ETHICAL CONSIDERATION

This study was cleared by Institutional Ethics Committee (IEC) at S-VYASA Yoga University, Bengaluru India .The study was cleared vide RES/1EC-SVYASA/66/2015. All the participants were informed about the study and the assessments before conducting the study and Informed consent was obtained from the participants. They were thus conversant with the aims and objectives of the study as well as the intervention modules and their confidentiality was maintained.

5.5 DESIGN

1. Survey design

It is a correlational study following a survey design in which data collection was done only once from all participants.

2. Survey design

This is a exploratory study based on correlational analysis. EPI readings were carried out before the blood samples were taken for HbA1c.

3. Survey design and interventional study

This is comparative and interventional study. All subjects were diabetic for the interventional study.

5.6 INTERVENTIONS

STOP DIABETES MOVEMENT (SDM) YOGA MODULE

This module includes Bhajan , Prayers, Breathing exercises, Loosening exercises, Sun Salutations, Asanas, Pranayama, Lectures on diabetes and Cyclic meditation. The principle of CM is stimulation followed by relaxation, one gets rest in periodic cycles. Asana is an integral component of CM. It has been compared with the other Yogic methods and tested for various physiological, neurophysiological and psychophysiological advantages (Subramanya & Telles, 2009b). The total program was for 02 hours daily for seven days.The program was held daily from 0600hrs to 0800hrs (Appendix C).

5.7 ASSESSMENT TOOL

Instrument of make Kirlionics Technologies International (KTI) company Saint-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 provides various features such as EPI screening, EPI scientific laboratory, EPI diagram. These are different software programs for analysis and data extraction. EPI screening allows to observe particular sectors of different fingers related to body systems as well different organs. EPI scientific laboratory gives the data for each finger and the average related to general health parameters and EPI diagram brings forth detailed insight into the left and right brain hemisphere communication and distribution of energy through every organ.

Figure 5: EPI/GDV-COMPACT

Figure 6: EPI/GDV-PRO

5.8 EPI PARAMETERS

EPI gives large no of parameters through different image evaluation softwares. For our study we have considered only the images taken without filter which represents the psychiphysiological state (Korotkov et al., 2012). Some softwares provide parameters related to general health like software EPI scientific laboratory. Main such parameters that indicate the state of health which we have considered for our study are Total area, Average intensity, Entropy, Fractility and Form coefficient. Another two softwares EPI diagram and EPI screening provide parameters specific to organs and systems and we have considered the Integral area of organs Pancreas, Liver, Immune organs, Coronary vessels, Cerebral vessels, Left kidney and Right kidney. ***Integral area*** *(IA) is relative value and shows the extent to which the EPI gram deviates from an ideal model. It is a is a measure of general health index of the person being investigated (Korotkov, 2002b) The normal range for IA is −0.6 to + 1.* This corresponds to a good health state. The second constituent is ***Entropy***. *It is the level of non uniformity of image, in other words, the level of stability of the energy field. It is a measure of chaos/disorder in the energy pattern of human energy systems (Kostyuk et al., 2011). Entropy in the EPI system ranges (1 to 2)* and is considered normal. ***Total area*** *is the number of pixels in the image having brightness above the threshold (Rubik, 2005).* ***Intensity*** *is the light intensity averaged on the area of image.* ***Fractality*** is defined as the ratio of lengths of perimeters of the image glow obtained in different scales of EPI gram. ***Form Coefficient*** FC = aL2/S where L is length of EPI gram external contour and S is EPI gram area. ***Fractality*** *and* ***Form coefficient*** *are measure of irregularity in the image external contour(Alexandrova,et.al.2004)*

5.9 DATA TAKING PROCEDURE

The prescribed guidelines were followed (Alexandrova et al., 2002). It is recommended to collect data after 3 hours of food intake and after 5 hours of any prescribed medications. No other diagnostic procedure was to be held at the same time. They were assessed before and after the respective interventions, and the EPI readings were taken by the same expert, at the same place. There were identical conditions of psychological and physical comfort for all subjects in a quiet and calm environment. Calibration of EPI device was performed routinely as per the guidelines. Subjects were instructed about finger placement on the glass at 45° angles with a gentle but firm touch. They were asked to remove all metallic ornaments that they do not wear for the entire 24 hours a day. Further, a few more things were followed for acquiring consistent readings: (1) The subjects stand on an electrically isolated surface while making a measurement; (2) the measurements were taken without filter; (3) an alcoholic solution was used to clean the glass plate after every subject; and (4) a distance of three feet was maintained between EPI and a dedicated laptop computer while collecting data (Yakovleva & Korotkov, 2015b).

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6.0 DATA EXTRACTION AND ANALYSIS

6.1 DATA EXTRACTION

The EPI Diagram/Screening and EPI Scientific laboratory Software were used to extract the raw data into Excel sheet. These provided all parameters which were considered for analysis.

6.2 DATA ANALYSIS

Data analysis was done with the help of Microsoft Office Excel 2007 and R studio version 3.2.0 along with 'R Cmdr' version 2.1-7.

6.2.1 CORRELATION ANALYSIS

The correlation analysis was done between the two variables i.e., FBS and the selected EPI parameter, one by one. Whichever EPI parameter was showing highly significant correlation with FBS, all those were put in the regression analysis. Similarl analysis was done between HbA1c and EPI parameters.

6.2.2 DIABETES TYPE 2 AND YOGA

Independent sample t-test was carried out for cross sectional comparisons among normal, pre diabetes and diabetes as well as between controlled and uncontrolled diabetes. Paired 't' test was done in the interventional study to find the difference between pre and post conditions.

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7.0 RESULTS

7.1 CORRELATION STUDY FBS AND EPI PARAMETERS

There were total of 7 organs considered for the study. The data for these came from the module 'EPI screening'. The 7 organs/ systems are liver, pancreas, immune organs, coronary vessels, cerebral vessels, left kidney and right kidney. The average value of parameters associated with these organs in the three groups is given in (Table 3). These organs / systems were selected based on literature on diabetes from the modern medical system. These organs are prone to changes from inception to the advanced stages of diabetes. The average of integral area of the left and right fingers was taken for the study. There were total of 5 general parameters which are related to the image of the fingers. These are area, entropy, fractality, form coefficient and intensity. The data for these came from the module 'EPI scientific laboratory' (Table 4). The participants were divided into three groups; a) Normal, b) pre diabetes and c) diabetes. First, correlation analysis (Table 5) was applied followed by linear regression analysis. In Normal, a high correlation (but not significant) between FBS and form coefficient ($p=0.06$ $r=0.35$) was observed (Table 6). Significant correlation was found between FBS and right kidney ($p=.03$ $r=-0.60$) in pre diabetic group (Table 7). In the case of diabetics, a high correlation (but not significant) was observed of FBS with immune organs ($p=0.06$ $r=-0.25$), with coronary vessels ($p=0.09$ $r=0.22$) and with entropy ($p=0.08$ $r=0.23$) (Table 8). Negative sign indicates that predictor variable and responding variable increase in opposite directions.

Table 3: EPI Diagram / Screening Analysis. Independent sample‘t’ test

Variables	Normal Mean ±SD	Pre diabetic Mean ±SD	Diabetic Mean ±SD
Av. Liver	-0.05±0.47	0.10±0.33	0.27±0.53
Av. Immune organs	-0.20±0.31	-0.17±0.29	0.08±0.38
Av. Pancreas	-0.26±0.59	0.10±0.39	0.22±0.53
Av. Coronary vessels	-0.13±0.37	-0.05±0.24	0.21±0.32
Av. Cerebral vessels	-0.02±0.29	0.01±0.31	0.26±0.35
Av. Left Kidney	-0.05±0.44	0.05±0.39	0.26±0.43
Av. Right Kidney	-0.09±0.36	-0.06±0.38	0.24±0.46

Table 4: EPI Scientific Laboratory Analysis. Independent sample‘t’ test

Variables	Normal Mean ±SD	Pre diabetic Mean ±SD	Diabetic Mean ±SD
Av. Area	11487.62±1416.98	11597.54±1425.695	12003.11±1451.19
Av. Intensity	78.0867±5.863	77.3890±8.345	84.06±7.62
Av. Form Coefficient	14.9347±4.792	15.5009±6.065	11.34±3.24
Av. Entropy	1.8603±0.161	1.7691±0.180	1.96±0.16
Av. Fractility	1.9229±0.174	1.9860±0.120	1.85±0.05

Table 5: Correlation Analysis (all parameters)

	FBS/with	t	df	p	r
Normal	Av. Liver	0.966	27	0.342	0.182
	Av. Immune organs	1.392	27	0.175	0.258
	Av. Pancreas	0.047	27	0.962	0.009
	Av. Coronary vessels	0.995	27	0.328	0.188
	Av. Cerebral vessels	-0.157	27	0.875	-0.030
	Av. Lt Kidney	0.832	27	0.412	0.158
	Av. Rt Kidney	0.553	27	0.584	0.105
	Av.Total Area	1.454	27	0.157	0.269
	Av. Intensity	-0.718	27	0.478	- 0.136
	Av.Form Coeff	1.943	27	0.062	0.350
	Av.Entropy	0.066	27	0.947	0.012
	Av.Fractility	-0.179	27	0.858	-0.034

Pre diabetic	Av. Liver	-1.203	11	0.254	-0.341
	Av. Immune organs	-0.555	11	0.589	-0.165
	Av. Pancreas	0.800	11	0.440	0.234
	Av. Coronary vessels	0.921	11	0.376	0.267
	Av. Cerebral vessels	0.006	11	0.994	0.002
	Av. Lt Kidney	0.299	11	0.770	0.089
	Av. Rt Kidney	-2.459	11	0.031	-0.595
	Av.Total Area	0.182	11	0.858	0.055
	Av. Intensity	1.035	11	0.322	0.298
	Av.Form Coeff	-0.251	11	0.805	-0.075
	Av.Entropy	1.193	11	0.257	0.338
	Av.Fractility	-0.773	11	0.453	-0.227
Diabetic	Av. Liver	-0.742	58	0.461	-0.096
	Av. Immune	-1.956	58	0.055	-0.248

	organs				
	Av. Pancreas	-0.578	58	0.565	-0.075
	Av. Coronary vessels	-1.752	58	0.085	-0.224
	Av. Cerebral vessels	-0.656	58	0.514	-0.085
	Av. Lt Kidney	- 0.749	58	0.456	-0.097
	Av. Rt Kidney	-0.979	58	0.331	-0.127
	Av.Total Area	0.935	58	0.353	0.121
	Av. Intensity	-1.647	58	0.104	-0.211
	Av.Form Coeff	0.960	58	0.340	0.125
	Av.Entropy	-1.771	58	0.081	0.208
	Av.Fractility	1.621	58	0.110	-0.226

df- degrees of freedom are the number of values in a study that have the freedom to vary. r-the main result of a correlation is called the correlation coefficient. It ranges from -1.0 to +1.0. The closer **r** is to +1 or -1, the more closely the two variables are related. If **r** is close to 0, it **means** there is no relationship between the variables.

Table 6: Noteworthy Correlation matrix for normal

FBS/with	t	df	P	r
Form Coefficient	1.9434	27	0.0624	0.3503

t –'t' test, df –degrees of freedom, p –level of significance <0.05 considered significant

r –correlation coefficient varies between -1 to +1

Table 7: Noteworthy Correlation matrix for pre-diabetic

FBS/with	t	df	P	r
Right Kidney	-2.4598	11	0.0316	-0.5957

t –'t' test, df –degrees of freedom, p –level of significance <0.05 considered significant

r –correlation coefficient varies between -1 to +1

Table 8: Noteworthy Correlation matrix for diabetic

FBS/with	t	df	P	r
Immunity	-1.9563	58	0.0552	-0.2487
Coronary	-1.752	58	0.0850	-0.2241
Entropy	-1.7717	58	0.0817	0.2082

t –'t' test, df –degrees of freedom, p –level of significance <0.05 considered significant

r –correlation coefficient varies between -1 to +1

The results of regression analysis for the three different groups are as follows. Normal (Table 9), Fig 7 represents the graphical scatter plot of FBS vs Area and Form Coefficient. Pre diabetic (Table 10), Fig 8 represents the graphical scatter plot of FBS vs Pancreas and Right Kidney. Diabetic (Table 11), Fig 9 represents the graphical scatter plot of FBS vs Immune organs, Intensity, Left Kidney, Entropy and Area.

Table 9: Regression analysis, Normal

	Estimate	Standard Error	t value	Pr(>|t|)
Intercept	49.475	10.964	4.512	0.000122***
Area	0.0024	0.0008	3.085	0.004780**
Form Coefficient	0.7796	0.2294	3.398	0.002196**
Residual standard error 5.167		Significant codes '***' p<0.001 '**' <0.01		
FBS= $\alpha+ \beta1X1+ \beta2X2+ \epsilon$ Where α=49.475, $\beta1$=0.0024, $\beta2$=0.7796, ϵ=5.167 X1= Total area ; X2= Form coefficient				

α –constant, $\beta1$-coefficient of variable X1, $\beta2$- coefficient of variable X2,

ϵ-residual standard error, p<.001 very highly significant, p<.01highly significant

Figure 7: Scatter plots of Area and Form coefficient w.r.t FBS in normal subjects showing slope of linear regression equation

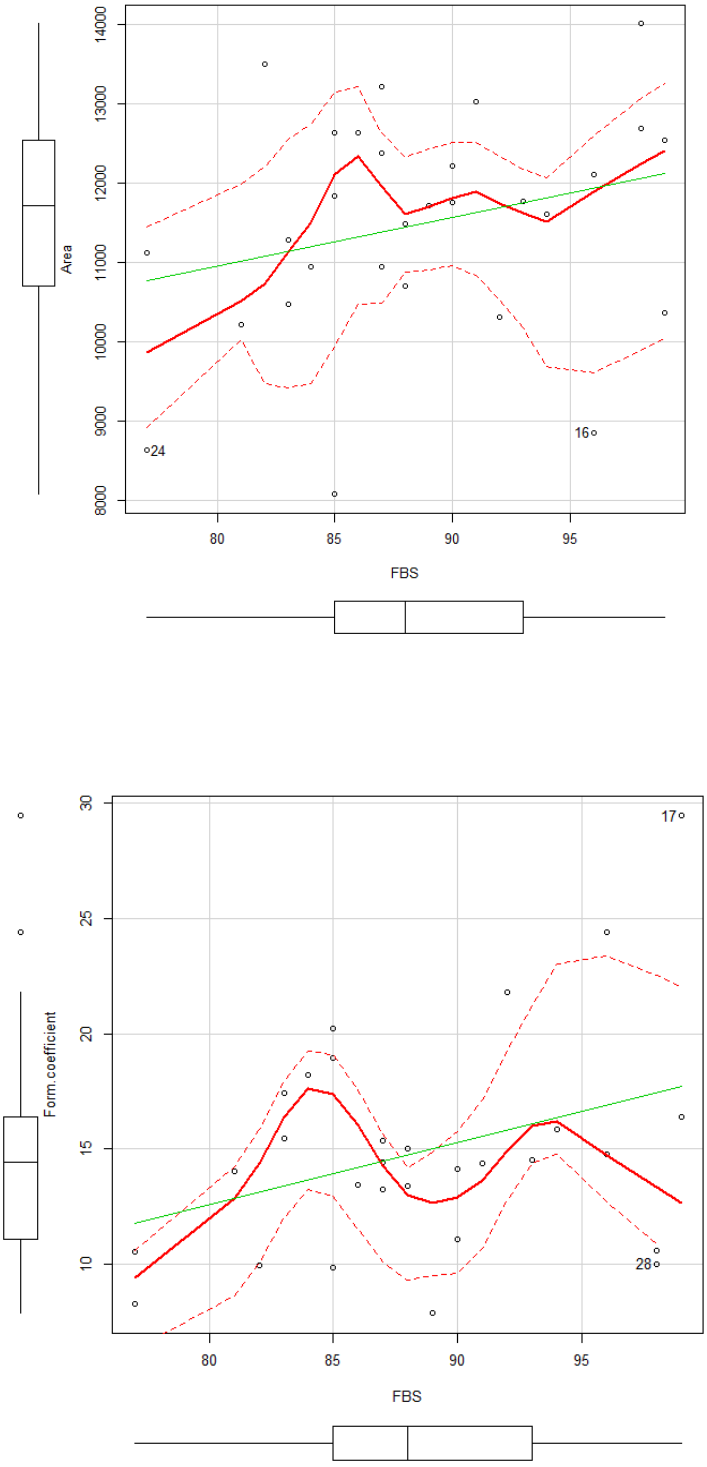


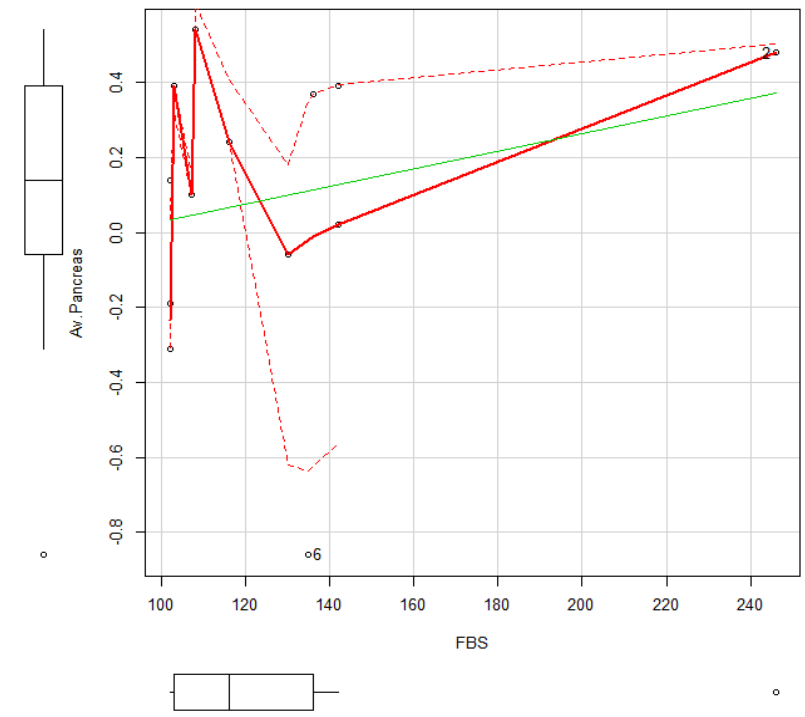
Table 10: regression analysis, Pre diabetic

	Estimate	Standard Error	t value	Pr(>|t|)
Intercept	116.856	7.246	16.126	1.74e-08***
Pancreas	63.734	20.187	3.157	0.01021*
Right Kidney	-90.257	20.572	-4.387	0.00136**
Residual standard error 24.16		Significant codes '***'p< 0.001 '**' p<0.01 '*' p<0.05		
FBS= α+ β1X1+ β2X2+ ϵ Where α=116.856, β1=63.734, β2=-90.257, ϵ=24.16 X1= Integral area of pancreas ; X2= Integral area of right kidney				

α –constant, β1-coefficient of variable X1, β2- coefficient of variable X2, ϵ-residual standard error,

p<.001 very highly significant, p<.01highly significant, p<0.05 significant

Figure 8: Scatter plots (slope) of Pancreas and Right Kidney w.r.t FBS in pre diabetes



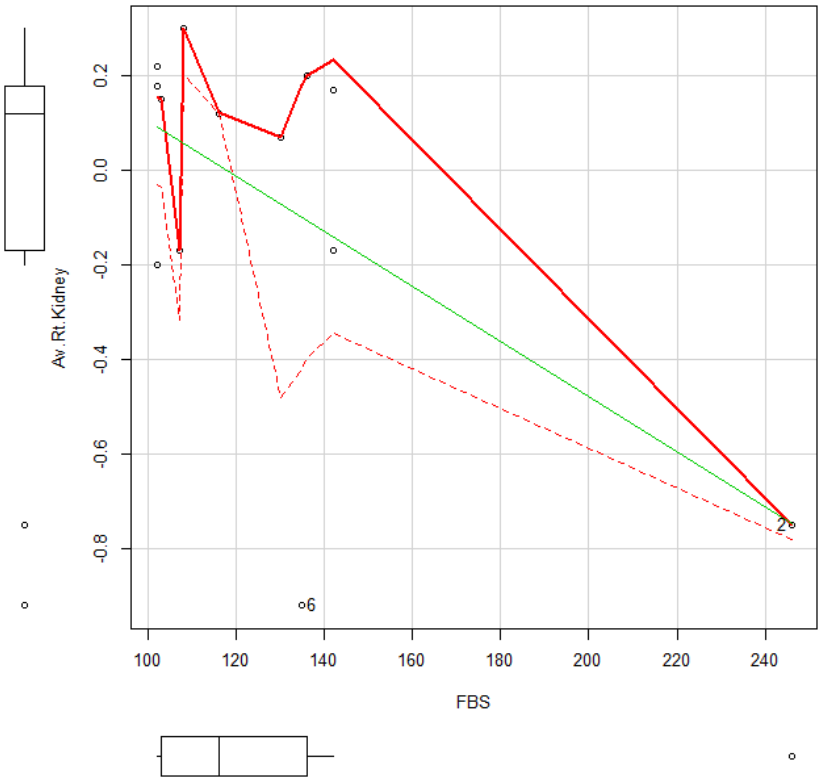


Table 11: regression analysis, Diabetic

	Estimate	Standard Error	t value	Pr(>|t|)
Intercept	494.6	139.4	3.548	0.000812***
Immune organs	-96.11	31.78	-3.024	0.003809**
Intensity	-3.082	1.176	-2.621	0.011356*
Left Kidney	51.33	28.12	1.825	0.073502 '.'
Entropy	-149.3	52.15	-2.863	0.005965**
Area	.017	.006	2.711	0.008983**
Residual standard error 61.42		Significant codes '***' p<0.001 '**' p<0.01 '*' p<0.05 '.' P<.1		

FBS= α+ β1X1+ β2X2+ β3X3+ β4X4 +β5X5+ ϵ

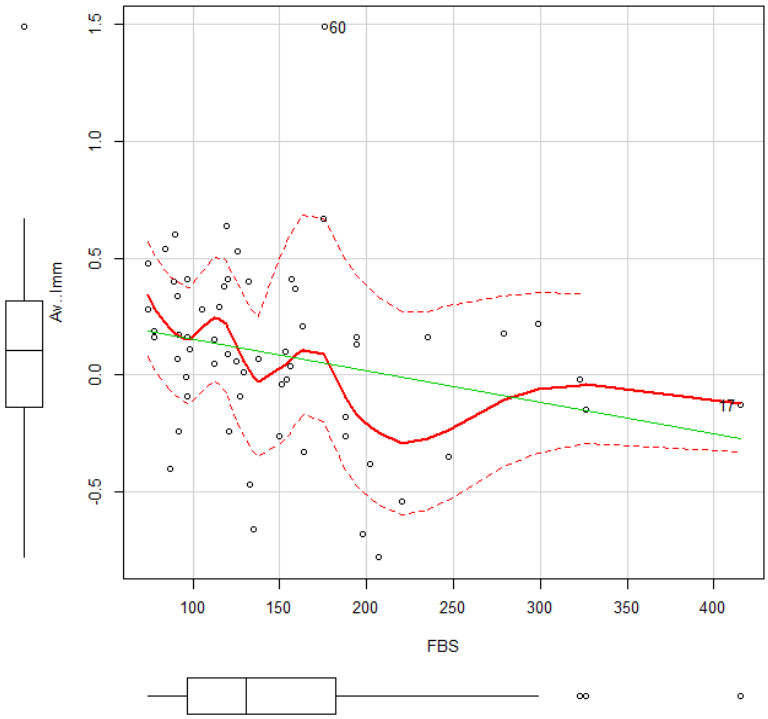
Where α=494.6, β1=-96.11, β2=-3.082, β3=51.33, β4=-149.3, β5=.01698, ϵ=61.42

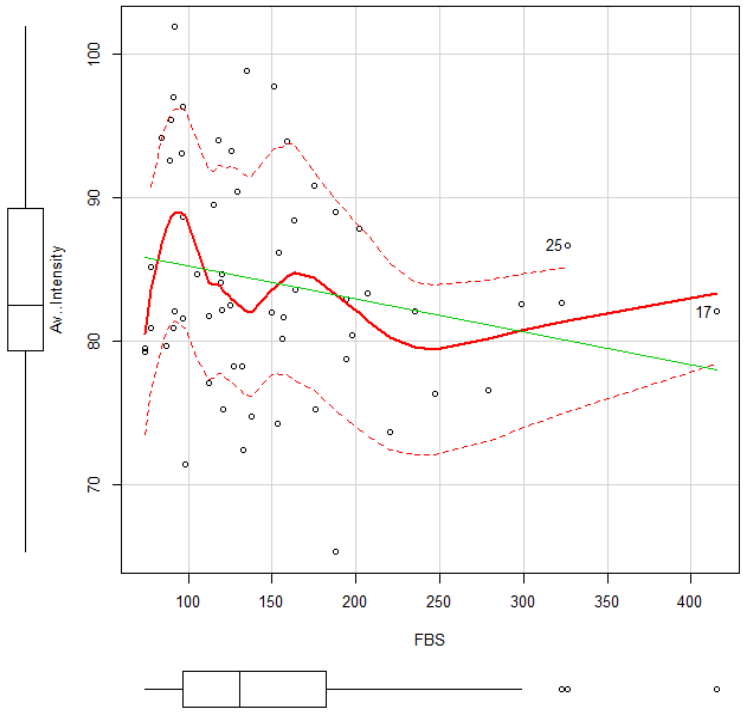
X1= Integral area of immune organs **;** X2= intensity ; X3= Integral area of left kidney ; X4=Entropy; X5=Area

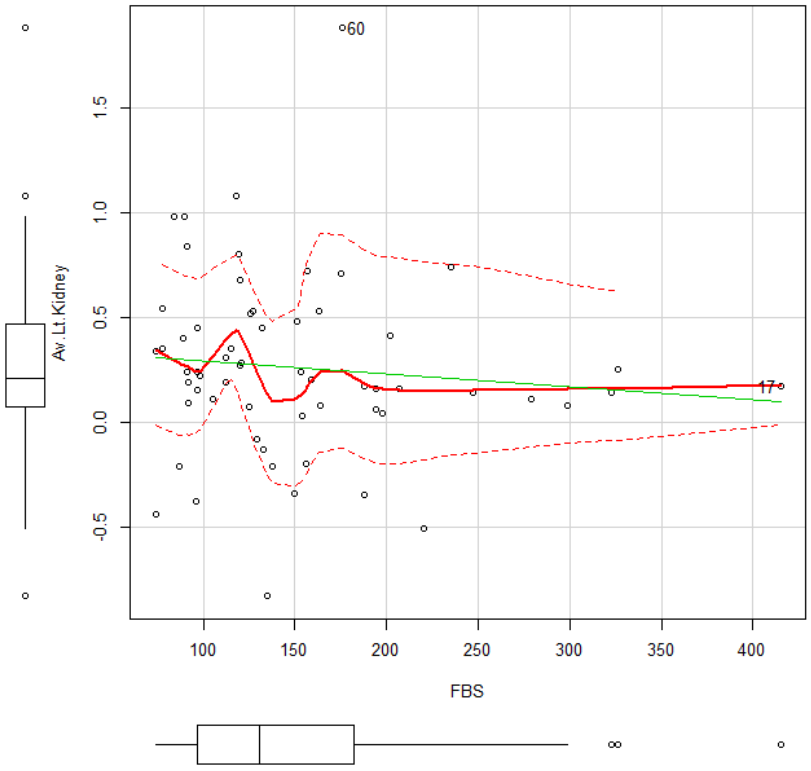
α –constant, β1-coefficient of variable X1, β2- coefficient of variable X2, t- 't' test value

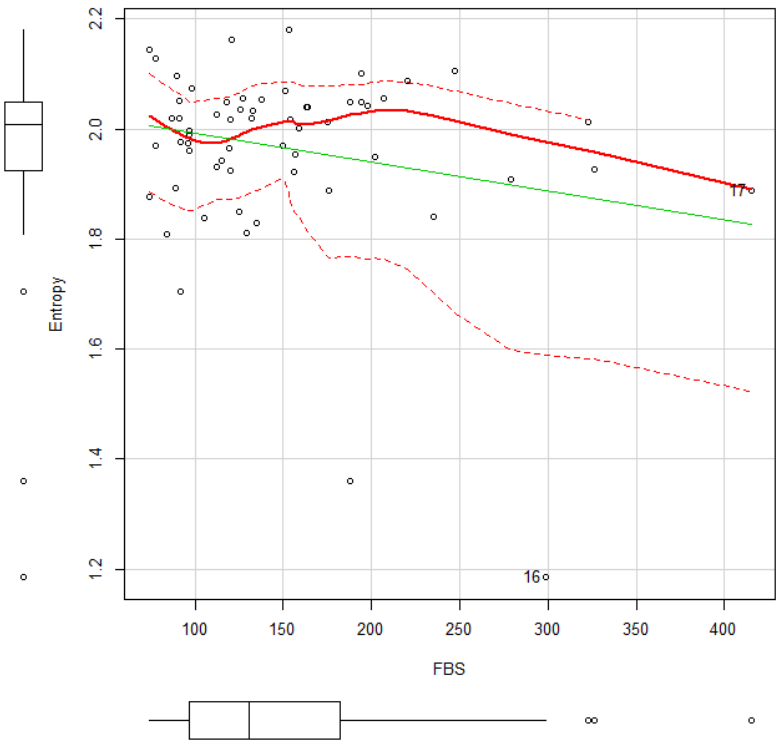
ϵ-residual standard error, p<.001 very highly significant, p<.01highly significant, p<.1 not significant

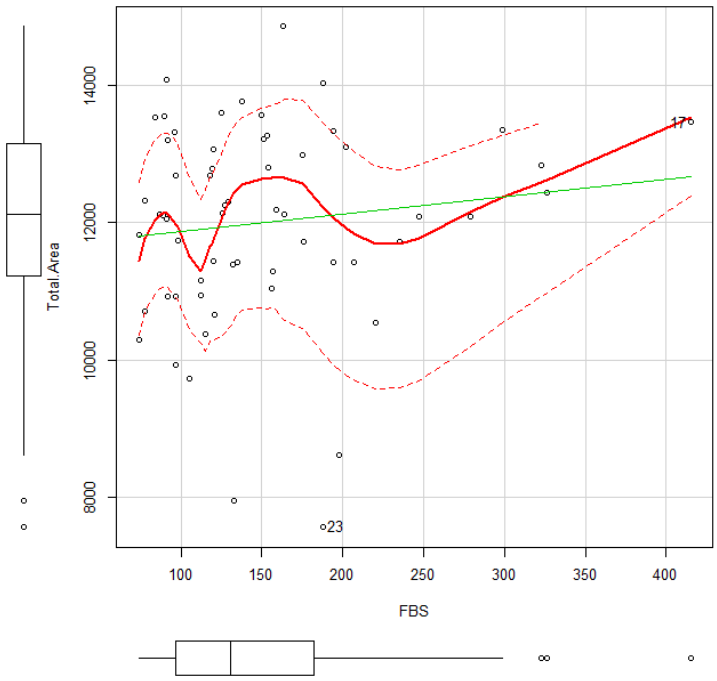
Figure 9: Slope of Immunity, Intensity, Left Kidney, Entropy and Total area.






60
17
Av.Lt.Kidney
1.5
1.0
0.5
0.0
-0.5
100
150
200
250
300
350
400
FBS
∞


17
16
Entropy
2.2
2.0
1.8
1.6
1.4
1.2
100
150
200
250
300
350
400
FBS
∞



In the diabetic group separate analysis was done for males and females. Correlation and regression analysis are reflected in Tables (12 and 13).

Table 12: Correlation Analysis Diabetic males and females (separately)

Males	FBS/with	t	df	p	r
	Av. Liver	-0.046	33	0.963	-0.008
	Av. Immune organs	-1.627	33	0.113	-0.272
	Av. Pancreas	0.260	33	0.795	0.045
	Av. Coronary vessels	-1.02	33	0.315	-0.174
	Av. Cerebral vessels	-0.656	33	0.514	-0.085
	Av. Lt Kidney	- 0.005	33	0.995	-0.000

	Av. Rt Kidney	-0.203	33	0.840	-0.035
	Av. Area	1.049	33	0.301	0.179
	Av. Intensity	-0.740	33	0.464	-0.127
	Av.Form Coeff	0.355	33	0.724	0.061
	Av.Entropy	-0.944	33	0.351	-0.162
	Av.Fractility	0.888	33	0.380	0.152
Females	Av. Liver	-0.555	23	0.584	-0.114
	Av. Immunity	-0.465	23	0.646	-0.096
	Av. Pancreas	-1.136	23	0.267	-0.230
	Av. Coronary	-0.774	23	0.446	-0.159
	Av. Cerebral	-0.013	23	0.989	-0.002
	Av. Lt Kidney	- 0.477	23	0.635	-0.099
	Av. Rt Kidney	-1.021	23	0.317	-0.208
	Av. Area	0.507	23	0.617	0.105
	Av. Intensity	-1.239	23	0.227	-0.250
	Av.Form Coeff	0.718	23	0.480	0.148
	Av.Entropy	-1.325	23	0.198	0.279
	Av. Fractility	1.394	23	0.176	0.152

Table 13 Regression analysis, Diabetics males and females (separately)

Males	Estimate	Standard Error	t value	p
Intercept	707.686	309.572	2.286	0.03*
Av.Immune organs	-90.095	40.229	-2.240	0.03*
Av.Intensity	-4.156	2.022	-2.055	0.04*
Av.Left Kidney	64.576	39.664	1.628	0.11
Av.Right Kidney	-18.652	33.699	-0.553	0.58
Av.Entropy	-252.386	122.559	-2.059	0.04*
Av.Area	0.023	0.011	2.067	0.04*
Residual standard error 64.05		Significant codes '***' p<0.001 '**' p<0.01 '*' p<0.05 '.' P<.1		
FBS= α+ β1X1+ β2X2+ β3X3+ β4X4 +β5X5+ β6X6+ ϵ Where α=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				
Females	Estimate	Standard Error	t value	p
Intercept	-1123.12	605.61	-1.855	0.07.
Av. Immune organs	-117.46	67.09	-1.751	0.09.
Av. Left Kidney	80.00	58.34	1.371	0.185
Av. Entropy	-168.03	68.86	-2.440	0.024*

Av. Fractility	864.54	349.14	2.476	0.022*
Residual standard error 61.04		Significant codes '***' p<0.001 '**' p<0.01 '*' p<0.05 '.' P<.1		
FBS= α+ β1X1+ β2X2+ β3X3+ β4X4 + ϵ Where α=-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				

7.2 CORRELATIONAL STUDY HbA1c AND EPI PARAMETRS

Biochemical parameter HbA1c was compared with EPI parameters namely 1. General parameters: area, entropy, intensity, form coefficient, fractality.2. Organ specific: integral area of liver, pancreas, immune organs, coronary vessels, cerebral vessels, left kidney, right kidney. The organ specific parameters were selected from a large number of parameters which are closely related to diabetes. The subjects were divided into three groups; a) normal, b) pre diabetes and c) diabetes. The demographic details are given in (Table 14). First the correlation of HbA1c was done with the selected EPI parameters. From the correlation analysis parameters were identified to be considered in the regression analysis. In all the three cases, no significant correlation was established between HbA1c and the EPI parameters. However, a correlation was seen between HbA1c and right kidney (p=0.17 r= 0.19) in case of normal subjects (Table 15); between HbA1c Vs liver (p=0.15 r=0.36), Vs pancreas (p=0.16 r= 0.35), Vs intensity (p=0.16 r= 0.35), Vs form coefficient (p=0.11 r= -0.39) in the case of pre diabetics (Table 16); between HbA1c Vs right kidney (p=0.16 r= .38), Vs entropy (p=0.18 r=-0.3178) in the case of diabetics (Table 17). These were the parameters chosen for regression analysis in

each of the three groups. No significant results were observed (Tables 18, 19, & 20) which means that there is no correlation between HbA1c and EPI parameters.

Table 14: Demographic details

Groups(N)	Mean age±SD	Male no. Mean Age±SD	Female no. Mean Age±SD
Normal (50)	38.6 ± 10.2 years	n=25 37.2±9.74years	n=25 40±10.7years
Pre diabetic (17)	48±14.49 years	n=03 61±18.52years	n=14 48±14.49years
Diabetic (19)	51.05 ± 10.29 years	n=06 54.83 ±8.23 years	n=13 49.31 ± 10.96 years

SD –Standard deviation

Table 15: Correlation Analysis Normal

HbA1c/with	**t**	**df**	**p**	**r**
Area	0.7669	48	0.4469	0.1100
Cerebral	-0.1947	48	0.8464	-0.0281
Coronary	0.7934	48	0.4314	0.1137
Immunity	0.3811	48	0.7047	0.0549
Liver	- 0.7606	48	0.4506	- 0.1091
Lt Kidney	-0.3254	48	0.7462	-0.0469
Pancreas	0.8797	48	0.3834	0.1259
Rt Kidney	1.3614	48	0.1797	0.1928
Intensity	0.1026	48	0.9187	0.0148
Entropy	-0.1124	48	0.9110	-0.0162
Form Coeff	0.0391	48	0.9689	0.0056
Fractility	-0.6083	48	0.5458	-0.0874

t-'t' test; df- degree of freedom; p-level of significance, $p<0.05$ considered significant; r-level of correlation varies between +1and -1. Both values considered high correlation

Table 16: Correlation Analysis Pre-diabetic

HbA1c/with	t	df	p	r
Area	1.1499	15	0.2682	0.2846
Cerebral	-0.0817	15	0.9360	-0.0210
Coronary	0.1959	15	0.8473	0.0505
Immunity	0.9717	15	0.3466	0.2433
Liver	1.5190	15	0.1496	0.3651
Lt Kidney	0.1109	15	0.9131	0.0286
Pancreas	1.4842	15	0.1585	0.3578
Rt Kidney	0.1921	15	0.8502	0.0495
Intensity	1.4752	15	0.1608	0.3559
Entropy	0.4355	15	0.6694	0.1117
Form Coeff	-1.6764	15	0.1144	-0.3972
Fractility	-0.3434	15	0.7360	-0.0833

t-'t' test; df- degree of freedom; p-level of significance, $p<0.05$ considered significant; r-level of correlation varies between +1and -1. Both values considered high correlation

Table 17: Correlation Analysis Diabetic

HbA1c/with	t	df	p	r
Area	1.242	17	0.2311	0.2884
Cerebral	1.2457	17	0.2298	0.2892
Coronary	0.2885	17	0.7764	0.0698
Immunity	1.2537	17	0.2269	0.2909
Liver	0.9002	17	0.3806	0.2133
Lt Kidney	0.9234	17	0.3687	0.2185
Pancreas	0.6674	17	0.5135	0.1597
Rt Kidney	1.4761	17	0.1582	0.3370
Intensity	0.0972	17	0.9237	0.0235
Entropy	-1.3824	17	0.1848	- 0.3178
Form Coeff	-0.2800	17	0.7828	-0.0677
Fractility	0.1786	17	0.8604	0.0432

t-'t' test; df- degree of freedom; p-level of significance,$p<0.05$ considered significant; r-level of correlation varies between +1and -1. Both values considered high correlation

Table 18: Regression analysis Normal

	Estimate	Standard Error	t value	p
Intercept	5.20	0.03	135.357	<2e-16***
Right Kidney	0.10	0.07	1.361	0.18 Not significant

t- 't'test; p- level of significance, p<0.05 considered significant

Table 19: Regression analysis Pre diabetic

	Estimate	**Standard Error**	**t value**	**p**
Intercept	6.22	2.04	3.051	0.0101*
Liver	0.10	0.25	0.434	0.6721 Not significant
Pancreas	0.05	0.22	0.229	0.8226 Not significant
Intensity	0.00	0.02	0.005	0.9962 Not significant
Form Coefficient	-0.01	0.02	-0.481	0.6394 Not significant

t- 't'test; p- level of significance, p<0.05 considered significant

Table 20: Regression analysis Diabetic

	Estimate	**Standard Error**	**t value**	**p**
Intercept	23.73	14.25	1.665	0.115 Not significant
Entropy	-7.29	7.21	-1.011	0.327 Not significant
Right Kidney	1.03	0.91	1.124	0.277Not significant

t- 't'test; p- level of significance, p<0.05 considered significant

7.3 DIABETES TYPE 2 AND YOGA

In the first study we observed significant difference in means for Average intensity [diabetes & normal=5.978 (p= 0.000), diabetes & pre diabetes = 6.676 (p= 0.017)]; Form coefficient [diabetes & normal = - 3.590 (p=.001), diabetes & pre diabetes = -4.158 (p= 0.032)]; Immune organs [diabetes & normal = 0.281 (p=0.000), diabetes & pre diabetes =-5.890 (p=0.000) and normal & pre diabetes = -6.171 (p=000)] (Table 21, 22, 23). Apart there were very small differences (but very significant) observed in many other parameters as in Table 24. In the second study significant observations were pertaining to Immune organs (difference in means 0.201 p= 0.031; Table 25). In the third i.e., pre –post study the noticeable observation was as follows. Area (mean difference 630.37 p= 0.00), Form coefficient (mean difference -1.78 p=0.00), Entropy (mean difference -0.02 p=0.00), liver (0.24 p=0.00), Pancreas (mean difference 0.17 p=0.02), Coronary vessels (mean difference 0.14 p=0.14), Cerebral vessels (mean difference 0.19 p=0.00) left kidney (mean difference 0.15 p=0.00), right kidney (mean difference 0.24 p=0.00; Table 26).

Table 21: Independent Sample‘t’ test; diabetes-normal

Parameter	**Diabetes**	**Normal**	**t**	**df**	**p**	**Mean**
Area	12003.320	11487.860	1.596	56.675	0.116	515.460
Intensity	84.065	78.087	4.075	70.164	0.000	5.978
Form Coefficient	11.344	14.934	-3.651	40.784	0.001	-3.590
Entropy	1.965	1.862	2.821	55.251	0.007	0.103
Fractality	1.848	1.923	-2.271	30.317	0.030	-0.075

Liver	0.274	-0.045	2.868	62.216	0.006	0.319
Immune Organs	0.085	-0.196	3.699	66.439	0.000	0.281
Pancreas	0.220	-0.261	3.691	50.377	0.001	0.481
Coronary	0.213	-0.131	4.295	48.965	0.000	0.344
Cerebral	0.263	-0.021	4.052	65.358	0.000	0.284
Left Kidney	0.258	-0.049	3.072	53.868	0.003	0.307
Right Kidney	0.242	-0.092	3.732	69.411	0.004	0.334

df- degree of freedom; p-level of significance,<0.5 considered significant; t-student ‘t’ test

Table 22: Independent Sample‘t’ test; diabetes-pre diabetes

Parameter	**Diabetes**	**Pre diabetes**	**t**	**df**	**p**	**Mean**
Area	12003.320	11597.770	1.658	17.811	0.114	405.550
Intensity	84.065	77.388	2.655	16.611	0.017	6.676
Form Coefficient	11.344	15.502	-2.399	13.519	0.032	-4.158
Entropy	1.965	1.770	3.571	16.307	0.002	0.195
Fractality	1.848	1.987	-4.041	12.922	0.001	-0.139
Liver	0.274	0.105	1.477	27.664	0.151	0.169
Immune Organs	0.085	5.975	-15.681	12.421	0.000	-5.890

Pancreas	0.220	0.096	0.968	23.075	0.343	0.124
Coronary	0.213	-0.050	3.344	22.295	0.003	0.263
Cerebral	0.263	-0.007	2.752	18.912	0.013	0.270
Left Kidney	0.258	0.053	1.658	18.679	0.114	0.205
Right Kidney	0.242	-0.062	2.504	20.437	0.021	0.304

df-degree of freedom; p-level of significance,<0.5 considered significant; t-student ‘t’ test

Table 23: Independent Sample‘t’ test; normal-pre diabetes

Parameter	**Normal**	**Pre diabetes**	**t**	**df**	**p**	**Mean**
Area	11487.860	11597.770	-0.231	23.045	0.819	109.910
Intensity	78.087	77.388	0.273	17.527	0.788	0.698
Form Coefficient	14.934	15.502	-0.298	19.020	0.769	-0.567
Entropy	1.862	1.770	1.567	20.849	0.132	0.092
Fractality	1.923	1.987	-1.362	32.524	0.183	-0.064
Liver	-0.045	0.105	-1.187	32.350	0.244	-0.150
Immune Organs	-0.196	5.975	-16.375	12.585	0.000	-6.171
Pancreas	-0.261	0.096	-2.315	34.320	0.027	-0.357
Coronary	-0.131	-0.050	-0.849	34.314	0.402	-0.081
Cerebral	-0.021	-0.007	-0.138	21.550	0.892	-0.014
Left Kidney	-0.049	0.053	-0.740	25.851	0.466	-0.102
Right Kidney	-0.092	-0.062	-0.244	22.019	0.809	-0.031

df- degree of freedom; p-level of significance,<0.5 considered significant; t-student ‘t’ test

Table 24: Combined highly significant results of Independent Sample‘t’ test

		t	**df**	**p-value**	**Mean of differences**
Av. Intensity	DAI,NAI	4.075	70.164	0.0001194	5.978
	DAI ,PDAI	2.655	16.611	0.017	6.676
Form Coefficient	DFC,NFC	-3.651	40.784	0.001	-3.590
	DFC ,PDFC	-2.399	13.519	0.032	-4.158
Entropy	DEN,NEN	2.821	55.251	0.007	0.103
	DEN ,PDEN	3.571	16.307	0.002	0.195
Fractility	DFR,NFR	-2.271	30.317	0.030	-0.075
	DFR ,PDFR	-4.041	12.922	0.001	-0.139
Liver	DLI,NLI	2.868	62.216	0.006	0.319
Immunity	DIM,NIM	3.699	66.439	0.000441	0.281
	DIM ,PDIM	-15.681	12.421	1.479e-09	-5.890
	NIM ,PDIM	-16.375	12.585	7.362e-10	-6.171
Pancreas	DPA, NPA	3.691	50.377	0.001	0.481
	NPA ,PDPA	-2.315	34.320	0.027	-0.357
Coronary	DCO,NCO	4.295	48.965	8.259e-05	0.344
	DCO ,PDCO	3.344	22.295	0.003	0.263
Cerebral	DCE,NCE	4.052	65.358	0.0001376	0.284
	DCE ,PDCE	2.752	18.912	0.013	0.270
Left Kidney	DLT,NLT	3.072	53.868	0.003	0.307
Right Kidney	DRT,NRT	3.732	69.411	0.004	0.334
	DRT, PDRT	2.504	20.437	0.021	0.304

df-degree of freedom; p-level of significance,<0.5 considered significant; t-student ‘t’ test; D-diabetes; PD-pre diabetes; N-normal; AI -average intensity; FC- form coefficient; EN-entropy; FR-fractility; LI-liver; IM-immunity; PA-pancreas; CO-coronary, CE-cerebral; LT-left kidney; RT-right kidney

Table 25: Independent sample‘t’ test controlled –uncontrolled diabetes

Parameter	**Controlled**	**Uncontrolled**	**t**	**df**	**p**	**Difference of means**
Area	11919.310	12071.670	-0.412	57.855	0.6819	-152.36
Cerebral	0.273	0.255	0.2136	57.045	0.8316	0.019
Coronary	0.279	0.158	1.5316	54.857	0.1314	0.121
Entropy	1.977	1.954	0.57251	50.813	0.5695	0.023
FC	10.747	11.833	-1.2867	53.368	0.2038	-1.085
Fractality	1.840	1.855	-1.0802	53.726	0.2849	-0.014
Immune	0.196	-0.006	2.2044	52.786	0.03188	0.201
Intensity	85.721	82.710	1.5403	55.54	0.1292	3.011
Liver	0.373	0.192	1.334	57.739	0.1874	0.181
Left Kidney	0.338	0.192	1.3318	58	0.1881	0.145
Pancreas	0.297	0.156	1.026	56.992	0.3092	0.141
Right Kidney	0.394	0.118	2.4989	55.651	0.01544	0.276

df- degree of freedom; p-level of significance,<0.5considered significant;t-student‘t’ test

Table 26: Pre –post results by paired‘t’ test

	t	**df**	**P**	**Mean of differences**
Total Area	3.8737	36	0.0004	630.4649
Av. Intensity	-0.6810	36	0.5002	-0.3887
Form Coefficient	-4.3354	36	0.0001	-1.7830
Entropy	-3.5140	36	0.0012	-0.0297
Fractality	-0.4084	36	0.6854	-0.0020
Liver	4.5659	36	5.614e-05	0.2467
Immunity	0.9274	36	0.3599	0.0517
Pancreas	2.3382	36	0.0250	0.1763
Coronary Vessels	4.3967	36	9.331e-05	0.1422
Cerebral Vessels	4.1166	36	0.0002	0.1924
Left Kidney	3.0564	36	0.0042	0.1567
Right Kidney	4.3051	36	0.0001	0.2481

df- degree of freedom; p-level of significance,<0.5 considered significant; student ‘t’ test

CHAPTER 8		
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8.0 DISCUSSION

8.1 CORRELATION STUDY: FBS AND EPI PARAMETERS

Fasting Blood Sugar (FBS) is an established biochemical marker to check glucose levels in the blood. Research continues to develop new technologies and new bio markers 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 three stages are normal, pre diabetes and diabetes. Summary of results is presented in Table 27

Table 27: FBS and EPI correlation in three categories

FBS / with	**Normal**	**Pre diabetes**	**Diabetes**
Area	Yes	No	Yes
Intensity	No	No	Yes
Entropy	No	No	Yes
Form Coefficient	Yes	No	No
Pancreas	No	Yes	No
Immune Organs	No	No	Yes
Left kidney	No	No	No
Right kidney	No	Yes	No

For normal subjects the FBS value is in the range of 70-100mg/dl. In this condition as expected no organ is affected due to diabetes. 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 which in turn, signifies irregular flow of energy in the system. Thus a normal FBS is correlated to these two parameters. There could be small variations in FBS within the normal limits, in this group. Since no two human bodies function alike, there would be variation in *Area* and *Form coefficient* between two normal persons as well within the same person under different conditions, which is natural. The more interesting observation is in the case of pre diabetes where FBS is showing relationship with pancreas and right kidney. While both organs are prone in diabetes, the relationship in pre diabetes 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 (*Dallas M.E, 2015*). Kidney damage from diabetes may begin much sooner than previously thought, according to the above study. A recent study has shown that above normal sugar levels which is found in pre diabetes could also result in kidney abnormalities that could finally cause kidney failure (*Navarro A, 2015; Chamow J.A, 2015*). The results of blood test may not indicate anything abnormal in pre diabetes but the subtle effects are already seen to be happening in some connected organs. Our study on EPI clearly demonstrates this and significantly, is aligned 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 readings. For our study we considered these two groups as one. In this group we find that FBS is related both to general EPI parameters as well the organ values. Among organs are Immune organs and left kidney are most important in diabetes. Obviously with the disease now in a full blown stage, the immune organs

will be affected. Regarding left kidney, perhaps it indicates that diabetes affects both kidneys. Further, 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 manifestation of disease. Earlier studies on EPI were mostly focused on comparison of parameters in the two states viz., pre post intervention where the reference for comparison was the EPI parameter itself (Sharma B, 2014). 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 could help a healer in diagnosis and to assess the effectiveness of treatment (Korotkov, 2010). An additional analysis was carried out to check the correlation of EPI parameters with FBS separately for males and females. It was observed through the analysis that the response towards towards diabetes is slightly different in the two genders. Modern medical literature indicates that Indian men are more susceptible towards diabetes type 2 while complications of diabetes are more severe in women. Our regression analysis results indicate that more EPI parameters correlate with FBS in case of males than females. This is perhaps due to the reason that immune system of females is stronger than males.

8.2 CORRELATIONAL STUDY: HbA1c AND EPI PARAMETRS

In the case of HbA1c, the reading is an average of sugar levels in blood over a period of three months. EPI parameters are based on the molecular state within the body at the particular moment the measurements are taken (Balaban R.S, 2005). It depends on the level of oxidized state and the quantum of free radicals in the body at the instant (Rubik

B, 2202). This can vary from time to time depending on many factors viz., biochemical changes which itself depend on some gross as well as subtle aspects of energy flow (Cifra M, 2012). Therefore, it may not be possible that a correlation between HbA1c and EPI parameters be established, be it in the case of normal, pre diabetes or diabetes. EPI measures overall energy levels of the body which are associated with the organs /systems. These are dependent on many factors such as stress at that point of time. In the case of alternative medicine, be it through yoga, naturopathy or homeopathy, EPI can be a very valuable tool for the healer to monitor effects on the participant. The readings of EPI reflect current changes unlike HbA1c which is a measure over a period of three months. In fact there is no correlation between the two which has been demonstrated scientifically through this study. Though it is beyond the scope of this study but there is literature which shows the difference between Fasting Blood Sugar (FBS) and HbA1c. Afternoon and evening plasma glucose (post lunch, pre dinner, post dinner and bed time) show higher correlation with HbA1c than morning time points (pre-breakfast, post-breakfast and pre-lunch) (Gill G.V, 1994). In one study, it has been argued that HbA1c should not be recommended as a routine test for screening of diabetes. There are problems in standardization (Tanaka Y, 2001) and factors like abnormal haemoglobin, anaemia and some drugs affect the results (Kilpatrick E.S,2008).Also there are demographic factors like race and gender (GindeA.A,2008; Anand S.S,2003). These strengthen our argument that even though both FBS and HbA1c are the biomarkers for diagnosis of diabetes, yet they may not have a correlation. It is a strong revelation that if ever we have to correlate EPI parameters with biochemical parameters, the later must not be the average values based over a period of time. Therefore, between the HbA1c and FBS, it is the FBS that should be considered for scientific study on EPI.

8.3 DIABETES TYPE 2 AND YOGA

The purpose of this study was to evaluate whether the parameters of EPI are indicative of some aspects of diabetes mellitus type 2. In the first study three stages of diabetes were considered viz., normal, pre diabetes and diabetes. Independent‘t’ test between diabetes and normal, diabetes and pre diabetes, normal and pre diabetes showed significant results. There is noticeable difference in the parameters between diabetes and normal and the difference is highly significant. Average intensity, entropy, liver, pancreas, immune organs coronary vessels, cerebral vessels, left kidney, right kidney all are more in diabetes state than the normal. Higher values are indicative of disorder. Fractality and form coefficient are a measure of irregularity in the external contour. The images are more regular in normal condition than the diabetes and hence have a higher value in normal condition. This is in line with the theory of EPI that the average intensity and entropy are high with aging and progression of disease, form coefficient and fractality are lesser. Similarly, there is noticeable difference in the selected parameters in diabetes and pre diabetes and is highly significant. However, the difference in integral area of liver, pancreas and left kidney is not significant. This could be due to the fact that these organs are affected at the pre diabetic stage itself as they would be at the diabetic stage (Bhat Romesh.K, et.al 2016). Another important aspect is immune organs. Results indicate that immune organs get more compromised at the pre diabetic stage which paves the way for disease to progress and become devastating, the body becomes vulnerable to multiple problems. This study has revealed the noticeable differences in the three stages i.e., normal, pre- diabetes and diabetes. In the second study we considered controlled diabetes and uncontrolled diabetes. The controlled diabetes as per American Diabetes Association was considered as FBS <126 mg/Dl and above this as uncontrolled. There was small noticeable but significant difference in the

immune organs. It is a negative difference in line with the earlier argument that immune organs are compromised much earlier than the extreme manifestation of the disease in this case of diabetes mellitus type 2. In rest of the parameters there is no significant change. It perhaps shows the state of these organs in the diabetes whether controlled or uncontrolled. Here is a very important observation that EPI parameter of Immune organs: 1. has correlation with diabetes (study 1); 2.is the only parameter where there is difference in all the three conditions i.e., normal vs pre diabetes, pre diabetes vs diabetes and diabetes vs normal (study 3); 3.shows significant change in controlled and uncontrolled diabetes. This highlights the role of immune organs in diabetes type 2. While the role of immunity is well known in the case of diabetes type 1, its role in diabetes type 2 is not established in modern medicine. The present study shows the role of immune organs in diabetes type 2 (Pickup 2004; Shu.et.al 2012).This paves the way for change in approach for the management of diabetes type 2, by inclusion of immune therapy along with conventional diabetes medicine. In the pre post study, we observed sizeable differences in many parameters from the paired‘t’ test. These are total area, form coefficient, entropy, coronary vessels, cerebral vessels, pancreas, left kidney and right kidney. The intervention of yoga makes the change. How much is the effect of this change or conversely what is the correct change to make a visible change in a diabetic subject is a topic for another research. As mentioned earlier, area increases with aging and with disturbed state of health. Reduction in the area indicates improvement. Entropy is indicative of stability of energy field and negative sign shows that a correction has happened in post state. Results show stability is more and hence the disturbance is less in the post state. Similarly, there is increase in form coefficient and hence the improvement in irregularity of the image. Liver, pancreas coronary vessels, cerebral vessels, kidneys are the organs that are affected by diabetes. We see reduction in the

integral area of these parameters taking them towards normal values after yoga intervention, how so ever little it may be. Thus we see that 7 days of yoga related to diabetes brings general feeling of well being and some changes at the organ level, howsoever subtle it may be. The broad clues taken from all this study is that EPI does indicate changes at the general level as well organ/system level in the different conditions of diabetes. However for a change to percolate to a good health the duration of the SDM yoga practice needs to be of much longer duration. There is direct evidence of progressive change in most of the selected parameters from normal to pre diabetes to diabetes (Table 3-4 and Fig.10-21). These findings if properly applied by the practitioners can help them a lot to know about the disease, design therapy and monitor the effect of therapy.

9.0 APPRAISAL

9.1 STRENGTH OF THE STUDIES

9.1.1 CORRELATION STUDY: FBS AND EPI PARAMETERS

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 pre diabetes, much before the disease is fully developed (as per modern medicine norms). EPI indicating correlation between FBS and right kidney at the pre diabetic stage is the greatest strength of this study. It enables the practitioner to design an organ specific therapy for different stages of the disease. The greatest strength is that EPI though new in concept corroborates with the established modern science.The study also shows the difference in response to diabetes type 2 between males and fwmales.

9.1.2 CORRELATION STUDY HbA1c AND EPI PARAMETERS

It is demonstrated through EPI that there is no correlation between HbA1c and EPI parameters. This is in agreement with many research papers from modern medicine which show no correlation between FBS and HbA1c though both are biomarkers for diabetes. Through this observation, it is proved that EPI depicts the current bio energy/homeostasis state as FBS indicates the present sugar status, unlike HBA1c which is an averaged out value over 03 months.

9.1.3 DIABETES TYPE 2 AND YOGA

This is the exclusive study on various aspects of diabetes. The difference in three states i.e., normal, pre diabetes and diabetes is demonstrated through EPI. Effect of yoga in diabetics and the changes in controlled and uncontrolled diabetes have been presented.

This study shows the changes and effects in the direction which strengthen confidence in EPI technology. More research will make this instrument a reliable tool for diagnostics and the delight for medical practitioners in future. The greatest strength of this study is that it shows the role of immune organs in diabetes type 2 which which may be expected to shift the management of this disease.

9.2 LIMITATION OF THE STUDIES

9.2.1 CORRELATION STUDY FBS AND EPI PARAMETERS

There were unequal numbers of subjects in the three categories and also unequal number of males and females within a category.The work needs to be taken up on much larger sample sizes especially for the pre diabetes. The distinction between the controlled diabetes and uncontrolled diabetes needs to be studied in detail and mechanism worked for that. The linear regression equation needs to be more refined and residual error reduced.

9.2.2 CORRELATION STUDY HbA1c AND EPI PARAMETERS

The sample size was small especially for the normal and pre diabetics. HbA1c could not be taken at different intervals over a period and correlation study repeated with EPI parameters.

9.2.3. DIABETES TYPE 2 AND YOGA

The changes in different states/ conditions need to be corroborated with modern medicine diagnostics. At the moment there is no technology in modern science with the exception of EPI that could notice changes at the subtle level. There was no funding for this project and hence the work had to be carried with that constraint.

9.3 IMPLICATIONS OF THE STUDIES

9.3.1 CORRELATION STUDY: FBS AND EPI PARAMETERS

The changes at the organ level namely pancreas and right kidney in the pre diabetic stage are an outstanding observation through EPI. This is an observation in modern medical system as late as December 2015. It puts lot of confidence in EPI technology and paves the way for future integration into modern and holistic medicine. Further, through regression analysis a relationship is established between FBS and EPI parameters in the three conditions. That means we can have an idea of FBS values through EPI. A holistic practitioner needs to concentrate more on specific organs in normal, pre diabetes and diabetes.

9.3.2. CORRELATION STUDY: HbA1c and EPI PARAMETERS

Unlike FBS, there is no correlation between HbA1c and EPI parameters. This study clearly demonstrates that in future studies HbA1C should not be considered for any correlation with EPI parameters. It saves lot of effort on the part of researcher once he is aware of the choice of biochemical parameter.

9.3.3 DIABETES TYPE 2 AND YOGA

EPI parameters do depict the trend as the disease progresses from normal to pre diabetes and diabetes. This establishes the strength of the underlying principle and technology. No significant changes between controlled and uncontrolled diabetes shows that compromises in energy at the organ level set in with diabetes. The role of immune therapy along with conventional medicine in the management of diabetes type 2 is the biggest implication of this study. Regarding the SDM module for diabetes, it needs to be followed for longer duration.

9.4 SUGGESTIONS FOR FUTURE STUDIES

9.4.1 CORRELATION STUDY FBS AND EPI PARAMETERS

Future work should encompass more diseases with large sample sizes. Work can be undertaken for the calibration of EPI to FBS values. This would be related to instrumentation as well development of necessary software. Haematology parameters related to Immunity and kidney can be correlated to EPI parameters and FBS in pre diabetes.

9.4.2 CORRELATION STUDY HbA1c AND EPI PARAMETERS

Though the results are well-supported by the previous studies, it would be further interesting to explore by including other biochemical parameters used as markers for other diseases. Also further work on other diseases may be undertaken with large sample sizes. It would be interesting to shortlist other biochemical parameters which give the averaged out values like HbA1c and carry the research. To further strengthen the present study diabetic patch may be used to monitor the glucose levels on 24 hr basis and compare with EPI taken at regular intervals.

9.4.3 DIABETES TYPE 2 AND YOGA

It is proved from this study that as we move from normal to pre diabetes and diabetes, EPI parameters show a upward trend. Similarly there is a change in the parameters in the pre and post conditions. To know actually how much change in the parameters corresponds to positive change as per modern medicine criteria, can be the topic for future research. Subjects must follow SDM module at least for 03 months before considering them for research. Further, it is also suggested that future study should attempt to follow the subjects after the completion of study in order to find out prolonging effects of yoga practices

9.5 CONCLUSION

9.5.1 CORRELATION STUDY: FBS AND EPI PARAMETERS

EPI can measure subtle energies which would be highly helpful to modern medicine as well the holistic medicine for pre emptive action against disease. The protocol of medicine might change and lead to formulating energy based paradigm. More research in the field of EPI will make this change happen sooner than later. Similar research can be taken 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.

9.5.2 CORRELATION STUDY: HbA1c AND EPI PARAMETERS

Through this study it is demonstrated that the reference marker for correlation between EPI parameters and biochemical parameters is not HbA1c.This will be very helpful for the future research on usability of EPI in the holistic scenario and as a supplementary tool for diagnostics. It is a very important revelation for further research on making EPI a perfect diagnostic tool.

9.5.3 DIABETES TYPE 2 AND YOGA

This study was meant to look at diabetes from the perspective of EPI. The role of immunity comes into prominence in the case of diabetes type 2. This will completely shift the paradigm of management of treatment of disease. The parameter of immune organs can give an idea whether the diabetes is under control or not. A 07 days yoga camp on diabetes control and management would produce changes which can be seen through EPI in a large number of parameters, general and organ specific. It also demonstrates that duration needs to be longer to percolate the effect to achieve good health.

References

1. Adey W. R. Tissue interaction with non ionizing electromagnetic fields. Physiol. Rev, 1981; 61: 435–514.

2. Akhmetelli GG, Boldyreva US, Komissarov NV, et al. Diagnostics of Allergy Etiology Using Gas Discharge isualization (EPI) Technique. Workbook: St Petersburg, Russia; 2004:54-58.

3. Aleksandrova E. V., Zarubina T. V., Kovelkova M. N., Strychkov P. V., Yakovleva E. G. GDV analysis of arterial hypertension, 2011.

4. Alexandrova R., Fedoseev G., Korotkov K. G., Philippova N., Zayzev S., Magidov M., Petrovsky I. Analysis of the bioelectrograms of bronchial asthma patients, 2002.

5. Alexandrova R.A., Fedoseev B.G., Korotkov K.G., et al. Measuring the human energy field: State of the science. National Institute of health, 2003; 70-81.

6. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care, 2010; 33(1): 62-69.

7. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care, 2011; 34(1): 62-69.

8. Anand S.S., Razak F., Vuksan V., et al. Diagnostic strategies to detect glucose intolerance in a multi ethnic population. Diabetes Care, 2003; 26(2):290-6

9. Balaban R.S., Nemoto S., Finkell T. Mitochrondia oxidants and aging. Cell, 2005; 120:483-495.

10. Barrett B., Marchand L., Scheder J.O., Plane M, B., Maberry R., Appelbaum D., Rakel D., Rabago D. Themes of Holism, Empowerment, Access and legitimacy define complementary, alternative and integrative medicine in relation to conventional biomedicine. The journal of alternative and complementary medicine, 2004; 9(6):937-947.

11. Bhat Romesh. K., Guru Deo., Mavathur R., Srinivasan T.M. "Correlation of Electro Photonic Imaging Parameters with Fasting Blood Sugar in Normal, Pre diabetic and Diabetic Study Participants". Journal of Evidence Based Complementary and Alternative Medicine, 2016; 1-8.

12. Boeffetta P., Mclarren D., Chen Y., Inoue M., Sinha R., et.al. Body mass index and diabetes in Asia: a cross sectional pooled analysis of 900000 individual in Asia cohort consortium. PLOS ONE, 2011; 6:e19930.

13. Bushinsky et.al. Decreased bone carbonate content in response to metabolic but not respiratory, acidosis. American Journal of Physiology; 265(4): 530-536.

14. 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.

15.Centre for Disease Control. Cerebovascular disease mortality and medicare hospitalization-United States, 1980-1990.MMWR, 1992; 41:477-480.

16. Charnow J.A. Kidney damage linked to Pre diabetes. Renal and Urology News, 2015.

17. Chen C.L., Tsai H.W. Modeling the physiological glucose-insulinsystem on normal and diabetic subjects. Comput Methods Programs Biomed, 2010; 97:130-140.

18. Chinamayananda S. Katha Upanishad. Mumbai, India: Central Chinmaya Mission Trust, 2002.

19. Cifra M., Wijk E., Eduard, Koch H., Bosman, S., Wijk R. V. Spontaneous Ultra-Weak Photon Emission from Human Hands Is Time Dependent. Radio engineering, 2007; 16(2): 15–19.

20. Cifra M. Measurement of spontaneous photon emission from the human body. Technical aspects, Parameters, Time and temperature dependant fluctuations of photon emission, 2012; 56:388-92.

21. Ciesielska I. L. W., Szadkowska I., Masajtis J., Goch, J. H. Images of corona discharges in patients with cardiovascular diseases as a preliminary analysis for research of the influence of textiles on images of corona discharges in textiles users. AUTEX Research Journal, 2010; 26–30.

22. Cohen Y., Chang L.H., Litt L., Kim F., Severinghaus J.W., Weinstein P.R., Davis R.L., Germano I., James T.L. Stability of Brain Intracellular Lactate and 31P-Metabolite Levels at reduced intracellular pH during prolonged hypercapnia in rats, J Cereb Blood Flow Metab, 1990; 10(2): 277-284.

23. Chernyak G.V., Sessler D.I. Perioperative Acupuncture and related technique. Anesthesiology, 2005, vol 102, 1031-1049.

24. Dallas M.E. Prediabetes: a precursor to kidney disease. https:// www.kidney.org/news/prediabetes-precursor-kidney-disease.Published, 2015.

25. Davidson M.B., Schriger D.L., Peters A.L., et.al. Relationship between fasting plasma glucose and glycated hemoglobin. Potential for false positive diagnosis of type 2 diabetes using mew diagnostic criteria. The journal of the American medical association 1999; 281(13):1203-1210.

26. Davies. The mechanism of hydrochloric acid production by the stomach, 1951; 26(1): 87-120.

27. Davis P.H., Dambrosia J.M., Schoenberg D.G., et al. Risk factors for ischemic stroke: a prospective study in Rochester, Minnesota. Ann Neurol, 1987; 22:319-327.

28. Deo G., Ravi K. I., Srinivasan T. M., & Kuldeep, K. K. Effect of anapanasati meditation technique through electrophotonic imaging parameters: A pilot study. International Journal of Yoga, 2015; 8(2):1337–1341. doi:10.4103/0973-6131.158474.

29. Dobrin, R., Kirsch, C., Kirsch, S. et al. Experimental measurements of the human energy field. In S. Krippner (ed.), Psychoenergetic Systems: The Interface of Consciousness, Energy and Matter. New York, Gordon & Breach, 1979; 230.

30. Dr. Stephen Thomas Chang, *The Complete Book of Acupuncture.* Berkeley: Celestial Arts, 1976; 14.

31. Felix K.., Yolanda S.K.., Thomas C.M., et.al. Tracing from fat tissue, liver, and pancreas: A neuro anatomical framework for the role of the brain in type 2 diabetes. Journal Endocrinology ISSN: 0013-7227.

32. Fowler M.J. Microvascular and Macrovascular complications of diabetes. Clinical diabetes, 26(2), 77-82.

33. 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.

34. Gibson U. S. Effect of listenting to music and focused meditation on the human energy field as measured by the gdv and the profile of mood states (poms). In K. G. Korotkov (Ed.), Measuring Energy Fields. Fair Lawn, USA: Backbone Publishing Co, 2004; 209-222.

35. Gill G.V., Hardy K.J., Patrick A.W., Masterson A. Random blood glucose estimation in type 2 diabetes: Does it reflect overall glycemic control? Diabet Med, 1994; 11:705-708.

36. Ginde, A.A., Cagliero, E., Nathan, D.M., Camargo, C.A. Value of risk stratification to increase the predictive validity of HbA1c in screening for undiagnosed diabetes in the US population. J Gen Intern Med, 2008; 23(9); 1346-1353.

37. Gupta N., Khera S., Vempati R.P., Sharma R., Bijlani R.L. Effect of yoga based lifestyle intervention on state and trait anxiety. Indian J Physiol Pharmacol, 2006;21:108-113.

38. Hacker G. W., Pawlak E., Pauser G., Tichy G., Jell H., Posch G., Hutter J. Biomedical evidence of influence of geopathic zones on the human body: scientifically traceable effects and ways of harmonization. Research in Complementary and Natural Classical Medicine, 2005; 12(6): 315–327.

39. Hakked C. Role of pranayama (yogic breathing) in improving the endurance and performance of compititive swimmers. Swami Vivekananda Yoga Anusandhana Samsthana, 2013.

40. Halliwell B. Free radicals, antioxidants and human disease: curiosity, cause, or consequence. The Lancet, 1994; 344(8924):721–724.

41. 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.

42. Hong E.S., Khang A.R., Yoon J.W., et. al. Comparison between sitagliptin as add on therapy and insulin dose increase therapy in uncontrolled Korean type 2 diabetes–CSI study .Journal of pharmacology and therapeutics, 2012; 14(9): 795-802.

43. Hoyle. The action of carbon dioxide gas on an insect spiracular muscle. Journal of Insect Physiology, 1960; 4(1): 63-79.

44. Ignatov I., Antonov A., Galabova T. Medical Biophysics – Biophysical Fields of Man, Gea Libris, Sofia, 1998

45. Ilza Veith. *The Yellow Emperor's Classic of Internal Medicine*. An ancient Chinese medical text . Berkeley: University of California Press, 1949.

46. 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.

47. Jakovcic et.al. Biochemical and Stereological analysis of rat liver mitochrondiain different thyroid states,

48. Jaideva S. Shiv sutras.The yoga of supreme identity, 1979.78; 77(3):887-901.

49. Jonas WB, Chez RA, Duffy B, Strand D. Investigating the impactof optimal healing environments. Altern Ther Health Med. 2003;9:36-40.

50. Jung H.H et.al. Left-right asymmetry of bio photon emission from hemiparesis patients. Indian J Exp Biol, 2003; 41(5):452.

51. Kafatos M.C., Chevalier G., Chopra D., Hubacher J., Kak S., Theise ND. Biofield science: current physics perspectives. Glob Adv Health Med, 2015; 4(suppl):25-34.

52. Kosuri M., Sridhar G.R. Yoga practice in diabetes improves physical and psychological outcomes. Metab Syndr Related Disorder, 2009; 7(6):515-517.

53.Kiang J.G., Ives J.A., Jonas W.B. External bioenergy-induced increases in intracellular free calcium concentrations are mediated by Na+/Ca2+ exchanger and L-type calcium channel. Mol. Cell Biochem, 2005; 271:51

54. Kilpatrick E.S. Haemoglobin A1c in the diagnosis and monitoring of diabetes mellitus. J Clin Pathol, 2008; 61(9):977-982.

55. Klein S.L., Flanagan K.L. Sex difference in immune responses. Nat Rev Immunol, 2016;16:626-638.

56. Kogan A. K., Grachev S.V., Eliseeva S.V., Bolevich S. [Carbon dioxide, a universal inhibitor of the generation of active forms of oxygen by cells (deciphering one enigma of evolution)], Izv Akad Nauk Ser Biol, 1997; (2):204-217.

57. Korotkov K.G., Williams B., Wisneski L.A. Assessing biophysical energy transfer mechanisms in living systems: the basis of life processes. Journal of Alternative and Complementary Medicine (New York, N.Y.), 2004; 10(1): 49–57.

58. Korotkov K.G. Human energy field: Study with GDV bioelectrography. Saint Petersburg: Backbone Publishing Co. 2002c.

59. Korotkov K.G., Shelkov O., Shevtsov A., et.al. Stress reduction with osteopathy assessed with GDV electrophotonic imaging: effects of osteopathy treatment.Journal of Alternative and Complementary Medicine (New York, N.Y.), 2012; 18(3): 251–257.

60. Korotkov K.G., Popechitelev E. P. Method for gas-discharge visualization and automation of the system of realizing it in clinical practice. Meditsinskaia Tekhnika, 2002; (1):21–25.

61. Korotkov K. G., Matravers P., Orlov D. V., Williams B. O. Application of electrophoton capture (EPC) analysis based on gas discharge visualization (GDV) technique in medicine: a systematic review. Journal of Alternative and Complementary Medicine (New York, N.Y.), 2010; 16(1): 13–25.

62. Kostyuk N., Cole P., Meghanathan N., Isokpehi R. D., & Cohly H.H. Gas discharge visualization: an imaging and modeling tool for medical biometrics.International Journal of Biomedical Imaging, 2011; 196460.

63. Kostyuk N., Rajnarayanan R. V., Isokpehi R. D., Cohly H. H. Autism from a biometric perspective. International Journal of Environmental Research and Public Health, 2010; 7(5): 1984–95. doi:10.3390/ijerph7051984.

64. Kreier F., Kap Y.S., Mettenleiter T.C., 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.

65. Krnjevic K., Randic M., Siesjo B. K. Cortical CO_2 tension and neuronal excitability, 1965; 176(1): 105–122.

66. Korotkov K. Non-local Consciousness Influence to Physical Sensors: Experimental Data. Philosophy Study, 2011; (4): 295-304.

67. Korotkov K.G., Shelkov A., Shertsov A., Mohan D., Paoletti S., Mirosnichenko D., Labkovskaya E., Robertson L. Stress reduction with osteopathy assessed with GDV electro photonic imaging: effects of osteopathy treatment. J Altern Complement Med, 2012; 18 (3):251-257.

68. Kushwah K.K., Srinivasan T.M., Nagendra H.R., Ilavarasu J.V. Development of normative data of electro photonic imaging technique for healthy Indian population: A normative study. Int J Yoga, 2016; 9 (1): 49-56.

69.Laffey et.al. Carbon dioxide attenuates pulmonary impairment resulting from hyperventilation, 2003; 3(11):2634-2640

70. Lakshmanjoo S. Vijnana Bhairava: The practice of Centering Awareness, 2003.

71. 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.

72. Manyam B.V. Diabetes mellitus, Ayurveda and Yoga. The journal of Alternative and complementary medicine, 2004;10(2): 223-225

73. Meenakshy K. B. Electrodermal study of acupuncture meridian endpoint energies in health and various conditions including type 2 diabetes mellitus. Swami Vivekananda Yoga Anusandhana Samsthana, 2015.

74. Muehsam D., Chevalier G., Barsotti T., Gurfein B.T. An overview of biofield devices. Glob Adv Health Med, 2015; 4(suppl):42-51.

75. Mohan V., Sandeep S., Deepa R., Shah B., Verghese C. Epidemiology of type 2 diabetes: Indian Scenario. Indian J Med Res, 2007; 125:217-230.

76. Misra P., Upadhya, R.P., Misra, A., Anand, K.A review of the epidemiology of diabetes in rural India.Diabetes Res Clin Pract, 2011; 92(3):303-311.

77.Nagarathna R, Nagendra HR. Integrated Approach Yoga Therapy for Positive Health. Bengaluru, India: Swami Vivekananda Yoga Prakashana; 2009.

78. Navarro A. Pre diabetes linked to early kidney damage. Risks, ways to improve blood sugar control. Tech times, 2015.

79. National Centre for Health Statistics. Annual summary of births, marriages, divorces, and deaths: United States. Monthly vital statistics report. Hyattsville, MD: Public Health Service,1994; 42(13)

80. Natahan D.M., Buse J.B., Davidson M.B., Ferrannini E., Holman R.R., Sherwin R., Zinnan B. Diabetologia, 2009); 52:17-30; DOI 10.1007

81. Niharika N. Effect of integrated yoga lifestyle module on acugraph measures. Swami Vivekananda Yoga Anusandhana Samsthana, 2012.

82. Nyenwea E.A., Jerkinsb T.W., Umpierreze G.E., Kitabchia A.E. Management of type 2 diabetes ; evolving strategies for the treatment of patients with type 2 diabetes. Metabolism, 2010, 1-23.

83. Ofori S.N., Unachukwu C.N. Hollistic approach to prevention and management of type 2 diabetes mellitus in a family setting. Diab Metab Syndr Obes, 2014; Vol. 7: 159-168.

84. Olalde Rangel J. A., & Del Castillo O. Report on the First International Congress on Systemic Medicine, Gas Discharge Visualization (GDV) and Electro-oncotherapy (ECT). Evidence-Based Complementary and Alternative Medicine, 2005; 2(2): 255–256.

85.Pantalone K.M., Hobbs T.M., Wells B.J., et al. Clinical characteristics,complications, comorbidities and treatment patters among patients with type 2 diabetes mellitus in a large integrated health system. BMJ Open Diabetes Res Care, 2015; 3: e000093.

86. Pecoits-Filho R., Abensur H., Betonico C.C., et al. Interactions between kidney disease and diabetes: dangerous liaisons. Diabetol Metab Syndr, 2016; 8:50.

87. Pickup J. C. Inflammation and Activated Innate Immunity in the Pathogenesis of Type 2 Diabetes. Diabetes Care, 2004; 27(3):813-823.

88. Pouwer F., Kupper N., Adriananse M.C. Does emotional stress cause type 2 diabetes mellitus? A review from the European depression in diabetes (EDID) Research Consortium. Discov med, 2010; 9(45): 112-118.

89. Radha V., Mohan V. Genetic pre disposition to type 2diabetes among Asian Indians. Indian J Med Res. 2007: 259-274.

90. Rahn O. Protozoa need carbon dioxide for growth, 1941; (5):197-199.

91. Rajindar, S. S. Oxidative Stress, Caloric Restriction, and Aging. Science, 1996; 273(5271):59-63.

92. Rao RM., Nagendra H.R, 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.

93. Rao T. I., Kushwah K. K., & Srinivasan T. M. Effect of Indian devotional music on students and performers measured with electron photonic imaging. Online International Interdisciplinary Research Journal, 2014; 4(4): 284-291.

94. Ramachandran A., Jali M.V., Mohan V., Snehlata C., Vishwanathan M. High prevalence of diabetes in an urban population in South India. BMJ, 1988; 297: 597-599.

95. Ram S. Commentary on Patanjali Yoga Sutras

96. Ripsin C.M., Kang H., Urban R.J. Management of blood glucose in type 2 diabetes mellitus. Am Fam Physician, 2009; 79.

97. Rockville M.D: Agency for Health Care Policy and Research, 1995. (AHCPR publication no. 95-0662)

98. Rother K.L. Diabetes treatment-Bridging the divide. N Engl J Med, 2007; 356(15):1499-1501.

99. Rubik B. The biofield hypothesis: Its bio physical basis and role in medicine. J Altern Complement Med, 2202; 8(6):703.

100. Rubin R.J., Altman W.M., et al. Health CARE Expenditures for people with diabetes mellitus,1992. J Clin. Endocrinol Metab,1994;78:809 A-F

101. Russo M., Choudhri A.F., Whitworth G., Weinberg A.D., Bickel W., Oz M.C. Quantitative analysis of reproducible changes in high-voltage electrophotography. J of Alternative and Complementary Medicine, 2001; 7(6):617-629.

102. Salmon & Hotchkiss. Hypercapnic acidosis in ARDS. A tolerated side effect or an important therapeutic modality, 2007.

103. Sankaracarya. Eight Upanisads. Advaita Ashrama, 2009.

104. Sarang P., Telles S. Effects of two yoga based relaxation techniques on heart rate variability (HRV). International Journal of Stress Management, 2006; 13(4): 460–475. doi:10.1037/1072-5245.13.4.460.

105. Satyananda S . Prana the Universal Force. Yoga, 1982.

106. Schoenberg B.S. Epidemiology of cerebovascular disease. South Med J, 1979; 72:331-336.

107. 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.

108. Sharma B., Hankey A., Nagendra, H. R. Gas discharge visualization characteristics of an Indian diabetes population Voice of Research, 2014; 2(4); 28–33.

109. Sharma R., Gupta N., Bijlani R.L. Effect of yoga based lifestyle intervention on subjective well being. Indian J Physiol Pharmacol. 2008; 52(2): 123-131.

110. Shaw E.E., FlierJ.S. Adipose tissue as an endocrine organ . J Clin Endocrinol Metab, 2004;89:2548-2556.

111. Shaw J.E., Sicree R.A., Zimmet P.Z. Global estimate of prevalence of diabetes for 2010 and 2030. Diabetes Res Clin Pract, 2010; 87(1): 4-14.

112. 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.

113. Shu C.J., Benoist C., Mathis D. The immune system's involvement in obesity-driven type 2 diabetes. Semin Immunol, 2012; 24(6): 436-442.

114. Shu J.J., Sun Y. Developing classification indices for Chinese pulse diagnosis. Complementary therapies in medicine, 2007; 15(3): 190-198.

115. 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.

116. Srinivasan TM. Bridging the mind-body divide. Int J Yoga, 2013; 6:85-86.

117. Srinivasan TM. Prana and electrons in health and beyond. Int J Yoga, 2014;7:1-3

118. Strider J.W., Masterson C.G., Durham P.L Treatment of mast cells with carbon dioxide suppresses degranulation via a novel mechanism involving repression of increased intracellular calcium levels, Allergy, 2010;66(3): 341-350.

119. Supuran & Scozzafava. Carbonic anhydrase inhibitors: Aromatic sulfonamidesand Disulfonamides act as efficient tumor growth inhibitors.Jr of Enzyme Inhibition, 2000; 15(6): 597-610.

120. Surivit R.S., Schneider M.S., Feinglos M.N. Stress and diabetes mellitus. Diabetes care, 1992; 15(10)

121. Swaroopananda S. The Yoga of Synthesis-The Three Gunas and the Four Paths of Yoga . Sivananda Yoga Life, 2005; 42-47.

122.Tanaka Y., Atsumi Y., Matsuoka K., et al. Usefulness of stable HbA1c for supportive marker to diagnose diabetes mellitus in Japanese subjects. Diabetes Res Clin Pract, 2001; 53(1): 4 5-5.

123. Thakar V.J. Evolution of diseases i.e., Samprapti Vijnana. Ancient science of life, 1981;1(1): 13-19.

124.Thornton S., Kimberly Schipke**.** The Mutation Point from Energetic to Symptomatic Disease States explored in the Light of New Technologies which Quantify the Human Biofield Anatomy and Physiology, 2015.

125. 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.

126. Timothy M.D., Zhang Y., Chen Y.J., et al. The economic burden of diabetes. Health affairs. 2010; 29(2): 297-303.

127. 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-insulindependent onset of disease. Diabetes, 1993;42:359-362.

128. Vanden Elshont . Effects of hypercapnia and hypocapnia on respitratory resistance in normal and asthametic subjects Thorax, 1991; 46:28-32.

129. Vannucci R.C., Towfighi J., Heitjan D.F., Brucklacher R.M. Carbon dioxide protects the perinatal brain from hypoxic-ischaemic damage: an experimental study in the immature rat, Paediatrics, 1995; 95(6): 868-874.

130. Vempati R. P., & Telles S. Baseline occupational stess levels and physiological responeses to a two day stress management program. Journal of Indian Psychology, 2000; 18 (1&2): 33–37.

131. Vincent M.B. What is the role of complementary and alternative medicine in public health. Am J Public Health, 2002; 92(10):1562-1564.

132. Wild S., Roglie G., Green A. Prevalence of diabetes. Estimates for the year 2000 and projections for 2030. Diabetes Care, 2004; 27(5)

133. Xu Y.X., Chen G.Z., Li L.J., Liu S.H. Research on the Effect of Light and Heat Sensing along Meridian of Chinese Medicine. Journal of Lasers in Medical Sciences, 2012; 3(1):6-14.

134. Yakovleva E.G., Struchkov K.G., Zarubina T.V., 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.

135. Yakovleva E., Korotkov K. G. Electrophotonic applications in medicine.San Bernardino, 2015.

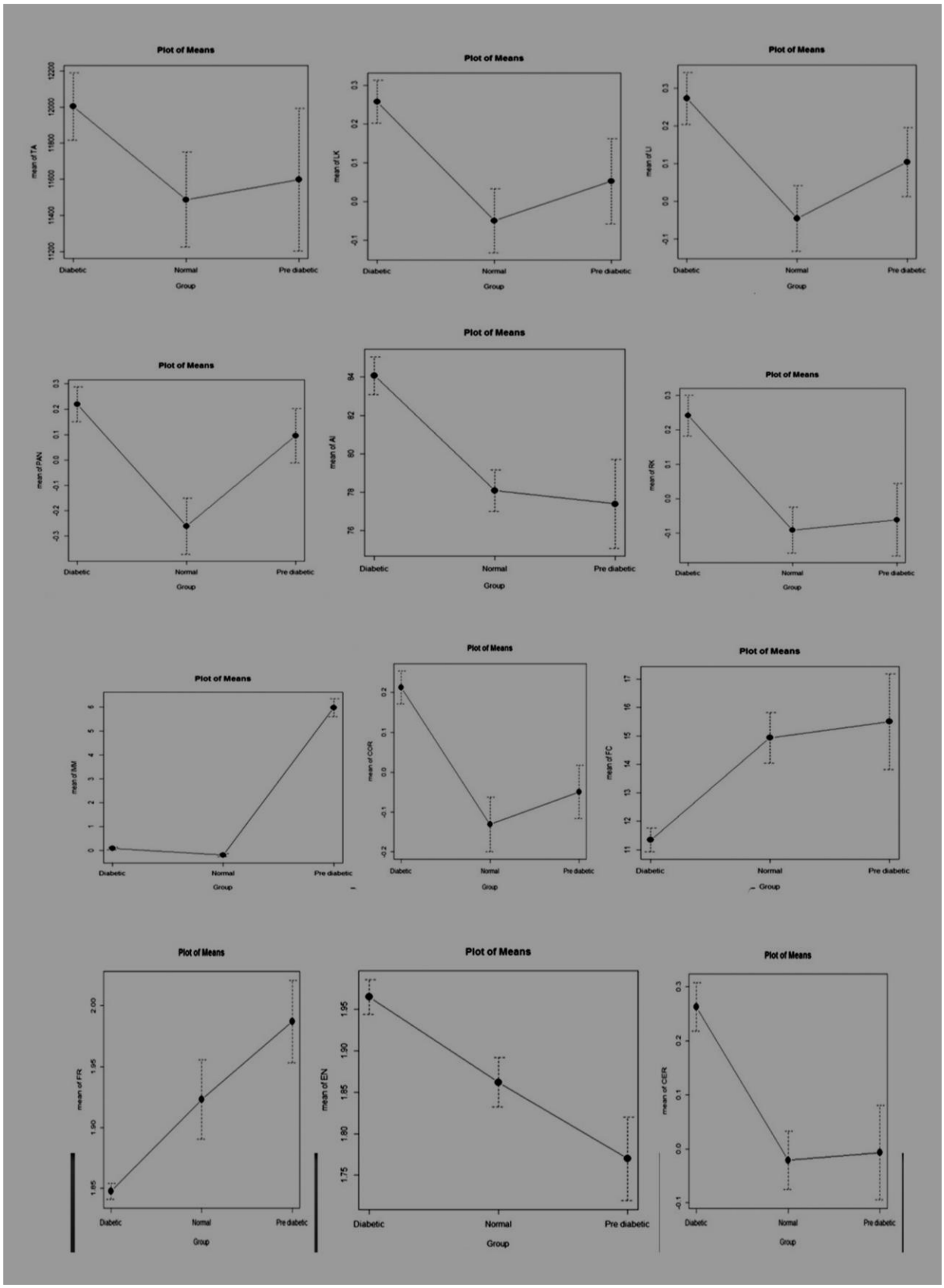
136. Yang J.M., Choi C., Hyun-hee J., et al. Left-right and Yin-Yang balance of biophoton emission from hands. Acupunct Electrother Res, 2004; 29:197-211.

137. Yung K.T. A birdcage model for the Chinese meridian system part I: A channel as a transmission line. The American journal of Chinese medicine, 2004; 32(5)

138. Zimmet P., Dowse G., Finch C., Serjeantson S., King H. The epidemiology and natural history of NIDDM: Lessons from South Pacific. Diabetes Metab Rev, 1990; 6:91-124.

139. Zimmet P.Z. The pathogenesis and prevention of diabetes in adults. Diabetes care, 1995 ; 18:1050-1064.

Figure 10-21: Graphical representation of various parameters in normal, pre diabetic and diabetic state.



Appendix B

Table 28: one way ANOVA

	Diabetes		**Normal**		**Pre diabetes**				
	Mean	Std dev	Mean	Std dev	Mean	Std dev	df	p	F
Area	12003.320	1451.203	11487.860	1416.931	11597.770	1425.588	2	< 1	1.410
Intensity	84.065	7.616	78.087	5.862	77.388	8.346	2	< .001	9.029
Form Coefficient	11.344	3.239	14.934	4.792	15.502	6.064	2	< .001	10.270
Entropy	1.965	0.160	1.862	0.161	1.770	0.182	2	< .001	9.371
Fractality	1.848	0.050	1.923	0.174	1.987	0.121	2	< .001	10.820
Liver	0.274	0.532	-0.045	0.469	0.105	0.329	2	< .05	4.152
Immune Organs	0.085	0.380	-0.196	0.312	5.975	1.342	2	< .001	612.800
Pancreas	0.220	0.533	-0.261	0.595	0.096	0.387	2	< .001	7.862
Coronary	0.213	0.320	-0.131	0.369	-0.050	0.240	2	< .001	12.040
Cerebral	0.263	0.347	-0.021	0.290	-0.007	0.314	2	< .001	8.976
Left Kidney	0.258	0.431	-0.049	0.446	0.053	0.397	2	< .01	5.265
Right Kidney	0.242	0.461	-0.092	0.359	-0.062	0.380	2	< .01	7.212

Appendix C

SDM YOGA MODULE

Sl No.	Contents
1.	Lectures on diabetes
2.	Prayer , Bhajan, Meditation
3.	Breathing, Loosening, Suryanamaskar Kriya, Asana, Pranayama.
4.	Advanced Relaxation Technique.

Yoga Saptaha – Daily Schedule

6. 00 a.m to 6.10 a.m	Bhajan, Prayer, Breathing Practices, Loosening Practices.
6.10 a.m to 6.50 a.m	Surya Namaskar, Quick relaxation technique, Vakaraasana, Nadi Shudhi and Bhramari Pranayama
6.50 a.m to 7.00 a.m	Break
7.00 a.m to 7.30 a.m	Lecture on Diabetes and 'Stop Diabetes Movement', Adhi-Vyadhi concept and Diet, Panchkosha and Cyclic Meditation
7.30 a,m to 8.00 a.m	Cyclic Meditation practice

Cyclic Meditation

Sl No	Contents	Duration
1	Opening Prayer –Avartana Dhayana Mantra	1 min
2	Instant Relaxation Technique	1 min
3	Centering	3 min
4	Standing Posture - Ardhakaticakrasana	3 min
5	Quick Relaxation Technique	5 min
6	Sitting Postures - Vajrasana, Sasankasana, Ustrasana	5 min
7	Deep Relaxation Technique	15 min
8	Closing Prayer	2 min

Appendix D

SWAMI VIVEKANANDA YOGA ANUSANDHANA SAMSTHANA, BENGALORE
(Declared as Deemed-to-be University under Section 3 of the UGC Act, 1956)

Demographic details

1. **Name**_____ **Age**_____ years

2. **Gender**: Male / Female

3. **Are you fresher**? Yes/ No

4. **Do you practice Yoga ?** Yes/ No

If yes, since how many Years ----- Months…… How many hours/ minutes per day?

5. **Do you have any health problem?** Yes/ No

If yes, can you mention type of ailment you have _____

6. **Are you on Medication?** Yes/ No

7. **Have you been practicing any activities** (Tick the appropriate Box)?

Exercise Walking Jogging Yoga None

8. **Diet** (Tick the appropriate Box):

Vegetarian/ Non-Vegetarian

9. **Any other habits** (Smoking, alcohol, drugs etc.)

10. **E-mail address:** _____

11. **Contact Mobile/Phone Number**_____

12. **State** _____

Appendix E

SWAMI VIVEKANANDA YOGA ANUSANDHANA SAMSTHANA, BENGALORE
(Declared as Deemed-to-be University under Section 3 of the UGC Act, 1956)

INFORMED CONSENT

You are being invited to participate in the research related event which is likely to be beneficial to the society.

Title of the study: Correlation of EPI parameters with biochemical parameter in pre-diabetes .

Purpose of the Study: To establish the EPI pattern for Pre-diabetes so that EPI can be used as diagnostic and monitoring tool for diabetes.

Investigator: Romesh Kumar Bhat

Guide: Dr. T. M. Srinivasan

Co-guide: Dr. Ramesh Mavathur

Safety issues

About the instrument: The instrument EPI is non-invasive and hence there won‘t be any harm to you. Your participation is absolutely voluntary, and you are free to withdraw yourself from the study at any time without any reason, there will not be any charge for your participation, and confidentiality of your details will be maintained. For checking the fasting sugar levels we would require blood samples for the (FBS) test on the inaugural day of camp. This is a normal blood test and a quantity of 5ml will be taken by expert professionals for this test. The procedure of the experiment was explained to me and I have given my consent for being a subject for the study.

Date …….. Signature of the participant

Appendix F

स्वामी विवेकानन्द योग-अनुसन्धान-संस्थानम्
Swami Vivekananda Yoga Anusandhāna Samsthānam
(Declared as Deemed-to-be University under Section 3 of the UGC Act, 1956)
Eknath Bhavan, # 19, Gavipuram Circle, Kempegowda Nagar, Bangalore - 560 019
Ph: 080 - 2661 2669, Telefax: 080 - 2660 8645
E-mail: svyasa@svyasa.edu.in Website: www.svyasa.edu.in

RES/IEC-SVYASA/66/2015 March 21, 2016

To,
Dr. Srinivasan T M
Professor,
Davison of Yoga and Physical Science
S-VYASA University,
Bangalore.

Reference:

"Correlation between GDV and Biochemical parameters in Pre-Diabetes". - Committee Approval of the above mentioned study.

Dear Dr. Srinivasan T M,

We have received from you the following study related documents vide your letter dated June 20, 2015

1	Project Proposal
2	Informed consent form

Ethics committee meeting was held on July 25, 2015 at 2:00 PM to 5:00 PM at Eknath Bhavan, Bangalore. Above documents were examined and discussed in the meeting. After due consideration, the committee has decided to approve conducting the aforementioned study.

APPROVED
Subramanyal
INSTITUTIONAL ETHICS COMMITTEE
SVYASA, BANGALORE

स्वामी विवेकानन्द योग-अनुसन्धान-संस्थानम्
Swami Vivekananda Yoga Anusandhāna Samsthānam
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E-mail: svyasa@svyasa.edu.in Website: www.svyasa.edu.in

This is to confirm that neither Dr. Srinivasan T M nor any staff participating in this study were involved in the voting procedures and decision making.

The Institutional Review Board / Independent Ethics Committee (IEC) are expected to be informed about the progress of the study / any changes in the protocol and patient information / informed consent. The investigators are also expected to submit a copy of the final report to IEC for records.

This approval is valid up to the completion of the study at the site.

Please submit to the IEC, the status report of the study as per the SOPs.

The IEC is organized & operates according to the requirements of ICH-GCP, Indian Council of Medical Research Guidelines & Schedule Y.

Best Wishes,

Subramanya P.

Dr. Subramanya P,
Member Secretary,
Institutional Ethics Committee,
S-VYASA, Bangalore.

Appendix G

RAW DATA OF DIABETES MELLITUS TYPE 2 PARTICIPANTS(WITH FBS REPORTS)															
P No.	AREA	INT	FC	EN	FR	AGE	SEX	**FBS**	LI	IMM	PAN	COR	CER	LK	RK
1	10288.5	79.5	14.0	2.1	1.8	41	M	74	0.50	0.48	0.73	0.51	0.37	0.34	0.26
2	11824.5	79.2	14.2	1.9	1.9	66	M	74	-0.40	0.28	0.67	0.47	0.38	-0.44	0.56
3	12330	80.9	13.3	2.1	1.8	55	M	78	0.34	0.16	-0.13	0.13	0.14	0.35	0.29
4	10706	85.1	9.6	2.0	1.8	50	F	78	0.87	0.19	0.59	0.07	0.16	0.54	0.68
5	13539	94.1	8.6	1.8	1.9	64	M	84	0.99	0.54	0.56	0.56	0.53	0.98	0.82
6	12127.5	79.7	11.8	2.0	1.9	58	F	87	-0.15	-0.40	-0.09	-0.01	0.08	-0.21	0.27
7	12102	92.5	8.2	1.9	1.8	59	F	89	0.98	0.40	0.69	0.30	0.36	0.40	0.83
8	13556.5	95.4	7.6	2.1	1.9	55	M	90	0.85	0.60	0.99	0.55	0.68	0.98	0.66
9	14083.5	97.0	7.4	2.0	1.8	64	M	91	1.07	0.34	0.77	0.45	0.56	0.84	0.98
10	12057.5	80.9	8.2	2.1	1.8	63	M	91	0.20	0.07	0.14	0.10	-0.16	0.24	0.32
11	10927.5	82.1	12.7	2.0	1.8	61	M	92	0.34	-0.24	-0.46	0.13	0.11	0.09	0.45
12	13199.5	101.9	7.1	1.7	1.8	68	M	92	0.43	0.17	0.05	0.11	0.08	0.19	0.41
13	13317	93.0	7.8	2.0	1.7	52	M	96	0.04	-0.01	0.25	0.06	-0.11	-0.38	-0.58
14	10918	81.5	15.9	2.0	1.8	50	M	97	-0.01	-0.09	-1.25	0.19	0.21	0.24	0.28
15	12691.5	88.7	8.7	2.0	1.9	60	M	97	0.41	0.41	0.87	0.91	0.69	0.45	0.37
16	9921	96.3	5.3	2.0	1.8	63	F	97	-0.10	0.16	0.06	0.72	0.95	0.15	0.15
17	11740.5	71.4	19.7	2.1	1.9	40	F	98	-0.86	0.11	-0.05	0.04	-0.41	0.22	-0.08
18	9729	84.7	9.3	1.8	1.8	57	M	105	-0.21	0.28	-0.52	0.18	0.07	0.11	0.35
19	11163.5	77.1	13.2	1.9	1.7	44	F	112	0.44	0.15	0.64	0.27	0.27	0.19	0.43
20	10947.5	81.8	11.4	2.0	1.9	50	M	112	0.08	0.05	0.20	0.23	0.37	0.31	0.19
21	10377	89.5	7.4	1.9	1.9	65	M	115	0.43	0.29	0.45	0.20	0.25	0.35	0.48
22	12690	94.0	8.2	2.0	1.8	52	M	118	0.83	0.38	0.42	0.35	0.48	1.08	0.78
23	12795	84.0	11.0	2. 0	1.8	69	M	119	1.21	0.64	1.04	0.36	0.22	0.80	0.90

24	13071	84.7	11.4	1.9	1.8	50	M	120	0.19	0.09	0.09	0.22	0.16	0.27	0.18
25	11441	82.1	11.6	2.0	1.8	71	M	120	0.81	0.41	0.70	0.40	0.45	0.68	0.56
26	10665.5	75.2	16.6	2.2	1.8	36	F	121	0.47	-0.24	0.35	-0.13	0.12	0.28	-0.03
27	13612	82.4	10.1	1.8	1.9	50	F	125	0.32	0.06	0.27	0.17	0.37	0.07	0.13
28	12148	93.2	7.8	2.0	1.8	36	M	126	0.37	0.53	0.82	0.98	1.12	0.52	0.34
29	12251.5	78.2	15.3	2.1	1.9	60	M	127	0.34	-0.09	-0.31	0.10	0.34	0.53	0.45
30	12299.5	90.4	8.1	1.8	1.8	29	F	129	0.09	0.01	-0.14	-0.35	0.16	-0.08	0.11
31	11385.5	78.2	14.3	2.0	1.9	56	M	132	0.89	0.40	0.68	0.38	0.27	0.45	0.55
32	7952	72.4	16.6	2.0	1.7	43	M	133	-0.47	-0.47	-1.09	0.18	0.05	-0.13	-1.94
33	11427	98.8	6.0	1.8	1.8	57	F	135	-0.50	-0.66	-0.68	-0.64	-0.43	-0.83	-0.44
34	13767	74.8	16.1	2.1	1.9	63	F	138	0.16	0.07	0.13	0.18	0.28	-0.21	-0.35
35	13572.5	82. 0	13.3	2.0	1.9	35	F	150	-0.52	-0.26	0.18	0.17	0.22	-0.34	-0.20
36	13224	97.7	8.1	2.1	1.8	60	F	151	0.45	-0.04	0.46	0.19	0.25	0.48	0.01
37	13266	74.2	18.1	2.2	1.9	48	M	153	-0.12	0.10	-0.07	0.23	0.29	0.24	0.18
38	12806	86.1	10.5	2.0	1.9 1	62	M	154	-0.03	-0.02	-0.19	0.19	0.16	0.03	0.18
39	11048	80.1	12.4	1.9	1.8	60	F	156	0.23	0.04	0.22	0.09	0.07	-0.20	-0.12
40	11287.5	81.7	14.9	2.0	1.9	52	F	157	0.48	0.41	-0.15	0.39	0.46	0.72	0.60
41	12189	93.9	7.5	2.0	1.9	44	M	159	0.13	0.37	0.47	0.86	0.88	0.20	0.28
42	14862.5	88.4	7.8	2.0	1.8	45	F	163	0.95	0.21	0.23	-0.22	0.17	0.53	-0.04
43	12119	83.6	11.9	2.0	1.9	59	M	164	0.24	-0.33	0.27	0.09	0.17	0.08	-0.01
44	12986	90.8	8.2	2.0	1.8	61	M	175	1.24	0.67	0.85	0.40	0.46	0.71	0.81
45	11723.5	75.2	11.6	1.9	1.9	58	M	176	1.73	1.49	1.57	1.28	1.48	1.88	1.30
46	7563	65.3	17.4	1.4	1.8	60	F	188	-0.80	-0.26	1.08	-0.48	-0.81	-0.35	-0.51
47	14038	89.0	8.0	2.0	1.9	54	M	188	0.22	-0.18	0.18	0.11	0.27	0.17	0.08
48	13340.5	82.9	12.3	2.0	1.9	40	F	194	-0.75	0.13	0.31	0.16	0.34	0.16	0.23
49	11427.5	78.7	13.7	2.1	1.9	51	F	194	0.22	0.16	0.17	0.11	-0.06	0.06	0.14
50	8606	80.4	11.8	2.0	1.9	52	F	198	-0.44	-0.68	-0.86	0.21	0.44	0.04	0.33
51	13104	87.8	10.4	1.9	1.9	49	M	202	0.33	-0.38	0.39	-0.08	0.06	0.41	0.38
52	11428	83.3	10.3	2.1	1.9	51	M	207	0.41	-0.78	0.24	0.08	0.15	0.16	0.26

53	10540.5	73.7	14.5	2.1	1.9	43	F	220	0.09	-0.54	-0.25	-0.06	-0.16	-0.51	-0.03
54	11727.5	82.0	11.7	1.8	1.9	64	M	235	0.73	0.16	0.68	0.46	0.59	0.74	0.60
55	12087	76.3	13.5	2.1	1.8	52	F	247	-0.82	-0.35	-0.65	0.07	0.13	0.14	-0.02
56	12095	76.5	11.4	1.9	1.9	40	F	279	0.35	0.18	-0.09	-0.08	0.32	0.11	-0.15
57	13350	82.5	11.7	1.2	1.9	50	F	299	0.29	0.22	0.51	0.17	0.37	0.08	0.11
58	12839	82.7	12.1	2.0	1.9	50	F	323	0.38	-0.02	-0.13	-0.09	0.24	0.14	0.28
59	12439	86.7	10.6	1.9	1.9	73	M	326	0.20	-0.15	-0.09	0.05	0.03	0.25	0.08
60	13465.5	82.0	12.5	1.9	1.8	58	M	415	0.27	-0.13	0.42	0.10	0.09	0.17	0.39
RAW DATA OF NORMAL PARTICIPANTS (WITH FBS REPORTS)															
61	10220.5	78.7	14.0	1.7	2.0	42	F	81	-0.12	-0.06	0.11	-0.29	-0.23	-0.05	0.07
62	12545	80.2	16.4	2.0	1.8	60	F	99	0.18	0.14	0.19	0.08	0.21	0.10	-0.09
63	10313.5	72.7	21.8	1.7	1.8	44	M	92	-0.04	-0.52	-0.09	0.08	-0.85	-0.21	-0.87
64	11490	80.7	15.0	1.8	1.9	46	F	88	0.06	0.26	0.07	0.09	0.24	0.38	-0.20
65	11719.5	92.4	7.9	1.7	1.9	55	F	89	0.37	0.07	0.26	-0.10	0.15	0.22	-0.31
66	11614	77.6	15.8	1.7	2.4	40	F	94	0.26	0.11	0.19	-0.48	0.22	0.39	-0.14
67	13500	82.4	10.0	1.8	1.9	42	F	82	0.37	-0.18	0.49	-0.02	0.18	-0.26	0.17
68	12104	76.6	14.8	1.7	1.9	40	F	96	-0.29	-0.38	-0.14	-0.25	-0.34	0.07	0.28
69	12384	81.9	**13.3**	1.9	1.9	38	F	87	0.28	-0.28	0.20	-0.07	0.08	0.16	0.16
70	12219.5	87.3	11.1	1.8	2.2	42	M	90	0.28	0.10	0.20	-0.02	0.14	0.17	-0.01
71	11774	79.9	14.5	2.0	1.8	59	F	93	0.23	0.01	0.05	-0.13	-0.09	0.23	0.12
72	8087	72.1	20.2	1.6	1.8	35	F	85	-0.60	-0.29	-2.02	-1.71	-0.56	-1.65	-1.29
73	11846.5	80.5	9.9	2.0	2.2	47	F	85	0.62	-0.20	-0.24	-0.09	0.08	0.31	0.19
74	11761	75.1	14.1	1.9	1.7	34	F	90	-0.27	-0.10	-0.70	-0.05	0.09	-0.83	0.06
75	13212.5	78.3	14.5	1.4	2.0	40	M	87	0.23	-0.15	0.16	0.11	0.16	0.15	0.21
76	8856.5	68.6	24.4	2.0	2.0	37	F	96	-0.88	-0.26	-1.98	-0.11	-0.27	-0.01	-0.09
77	10367.5	65.2	29.4	1.7	1.7	68	M	99	-0.51	-0.43	-0.76	0.12	0.32	-0.45	-0.52
78	11283	76.1	15.5	1.7	2.0	32	F	83	0.17	-0.44	-0.63	0.07	0.13	0.36	0.15
79	12636.5	71.5	18.9	1.7	2.0	25	M	85	-0.17	0.13	-0.06	0.21	0.05	0.12	0.07
80	10709	73.8	13.4	1.9	2.2	40	M	88	0.24	-0.16	-0.26	-0.42	-0.23	0.10	-0.02

81	11119.5	82.3	8.3	1.9	1.8	37	F	77	0.17	-0.06	-0.13	-0.46	-0.13	-0.06	-0.09
82	10482.5	74.6	17.4	2.0	1.9	41	M	83	-1.18	-0.61	-0.53	0.17	0.21	-0.81	-0.41
83	10954	70.6	18.2	2.1	1.9	33	F	84	-0.33	-0.09	-0.26	0.02	-0.24	0.11	0.07
84	8637.5	81.7	10.5	2.0	1.7	60	F	77	-1.12	-0.83	-0.76	-0.16	0.07	0.02	-0.45
85	10951	74.7	15.4	2.1	1.8	38	M	87	-0.40	-1.16	-0.71	-0.63	-0.02	-0.58	-0.38
86	12631.5	85.4	13.4	2.0	1.9	36	M	86	0.22	-0.20	0.16	0.03	0.14	-0.02	0.01
87	12688.5	81.6	10.6	1.9	1.8	54	M	98	0.15	-0.14	-0.20	-0.04	-0.60	0.10	0.08
88	14008	84.7	10.0	1.9	1.8	68	M	98	0.72	0.21	0.26	0.08	0.34	0.36	0.44
89	13025	77.4	14.4	2.0	1.9	56	M	91	0.05	-0.18	-0.44	0.16	0.14	0.16	0.12
RAW DATA OF PRE-DIABETIC PARTICIPANTS (WITH FBS REPORTS)															
90	12464.5	91.4	10.4	1.9	1.8	60	F	108	0.63	0.11	0.54	-0.25	0.20	0.42	0.30
91	11745	82.7	14.4	1.9	1.9	31	F	246	-0.33	-0.37	0.48	0.13	0.01	0.35	-0.75
92	11595	79.8	11.9	1.7	2.1	35	F	142	0.33	0.07	0.02	-0.04	-0.03	-0.04	0.17
93	12298	92.9	7.0	1.9	1.8	55	F	142	0.38	-0.06	0.39	-0.16	0.15	0.03	-0.17
94	10317.5	73.1	16.5	1.5	2.1	40	M	102	0.01	-0.38	-0.31	-0.58	-0.38	-0.46	-0.20
95	8161.5	66.8	31.8	1.9	2.1	43	M	135	-0.37	-0.82	-0.86	0.18	-0.85	-0.99	-0.92
96	12104.5	75.3	14.6	2.0	1.9	65	F	103	0.26	0.07	0.39	-0.04	-0.07	0.04	0.15
97	11679.5	76.3	13.5	1.5	2.1	52	F	107	-0.36	-0.36	0.10	-0.25	0.08	0.17	-0.17
98	13599	80.	12.6	2.0	1.8	68	M	136	0.35	0.06	0.37	0.17	0.21	0.27	0.20
99	12175	70.8	17.8	1.6	2.0	41	F	102	-0.07	-0.51	-0.19	0.18	-0.14	0.13	0.18
100	10143	64.7	21.7	1.6	2.0	53	M	116	0.05	-0.06	0.24	0.05	0.29	0.10	0.12
101	11210.5	73.4	16.0	1.8	2.0	54	F	102	0.47	0.07	0.14	0.23	0.19	0.54	0.22
102	13275	78.8	13.2	1.7	2.0	68	M	130	0.01	-0.10	-0.06	-0.27	0.25	0.13	0.07
RAW DATA OF DIABETES MELLITUS TYPE 2 PARTICIPANTS (WITH HbA1c REPORTS)															
P No.	AREA	INT	FC	EN	FR	AGE	SEX	**HbA1c**	LI	IMM	PAN	COR	CER	LK	RK
103	13617.1	82.7	13.7	1.9	1.9	35	F	6.3	-0.52	-0.26	0.18	0.17	0.22	-0.34	-0.20
104	12615.5	79.0	12.3	2.0	1.9	58	F	7.3	-0.15	-0.40	-0.09	-0.01	0.08	-0.21	0.27

105	13526.2	78.0	14.0	2.1	1.8	55	M	7.4	0.34	0.16	-0.13	0.13	0.14	0.35	0.29
106	12812.7	88.9	9.6	2.0	1.8	36	F	7.5	0.47	-0.24	0.35	-0.13	0.12	0.28	-0.03
107	8546.7	75.2	15.3	2.1	1.8	43	M	7.8	-0.47	-0.47	-1.09	0.18	0.05	-0.13	-1.94
108	13584.2	82.5	11.4	2.0	1.9	40	F	7.9	-0.75	0.13	0.31	0.16	0.34	0.16	0.23
109	12318	84.2	12.4	1.9	1.9	60	F	8.2	0.23	0.04	0.22	0.09	0.07	-0.20	-0.12
110	12989.1	88.1	8.0	1.9	1.7	72	F	8.2	0.37	-0.21	-0.04	0.03	0.07	0.25	0.05
111	14780.5	90.8	7.0	2.0	1.7	45	F	8.7	0.95	0.21	0.23	-0.22	0.17	0.53	-0.04
112	11071.3	74.3	14.4	2.1	1.9	43	F	8.8	0.09	-0.54	-0.25	-0.06	-0.16	-0.51	-0.03
113	10125	75.2	17.7	2.0	1.8	60	F	8.8	0.45	-0.04	0.46	0.19	0.25	0.48	0.01
114	13110.2	82.7	13.3	2.0	1.9	59	M	9.7	0.24	-0.33	0.27	0.09	0.17	0.08	-0.01
115	13141.2	76.5	11.6	2.0	1.8	40	F	10.1	0.35	0.18	-0.09	-0.08	0.32	0.11	-0.15
116	13620.5	75.8	17.5	2.0	1.9	48	M	10.6	-0.12	0.10	-0.07	0.23	0.29	0.24	0.18
117	12778.2	78.4	12.6	2.0	1.8	52	F	10.7	-0.82	-0.35	-0.65	0.07	0.13	0.14	-0.02
118	14143.7	88.	8.6	2.0	1.8	66	M	11.3	0.39	0.09	0.20	0.19	0.23	0.12	0.46
119	13575.2	83.8	11.6	1.9	1.9	50	F	12.1	0.38	-0.02	-0.13	-0.09	0.24	0.14	0.28
120	14165.5	84.8	10.4	1.8	1.8	50	F	12.2	0.29	0.22	0.51	0.17	0.37	0.08	0.11
121	13183.6	80.5	13.0	1.9	1.8	58	M	13.2	0.27	-0.13	0.42	0.10	0.09	0.17	0.39
122	12778.2	78.4	12.6	2.0	1.8	52	F	10.7	-0.52	-0.26	0.18	0.17	0.22	-0.34	-0.20
123	14143.7	88.3	8.6	2.0	1.8	66	M	11.3	-0.15	-0.40	-0.09	-0.01	0.08	-0.21	0.27
124	13575.2	83.8	11.6	2.0	1.9	50	F	12.1	0.34	0.16	-0.13	0.13	0.14	0.35	0.29
125	14165.5	84.8	10.4	1.8	1.8	50	F	12.2	0.47	-0.24	0.35	-0.13	0.12	0.28	-0.03
126	13183.6	80.5	13.0	1.9	1.8	58	M	13.2	-0.47	-0.47	-1.09	0.18	0.05	-0.13	-1.94
RAW DATA OF NORMAL PARTICIPANTS (WITH HbA1c REPORTS)															
127	11679.5	76.3	13.5	1.5	2.1	52	F	4.3	-0.36	-0.36	0.10	-0.25	0.08	0.17	-0.17
128	12631.5	85.4	13.4	2.0	1.9	36	M	4.8	0.22	-0.20	0.16	0.03	0.14	-0.02	0.01
129	11668.5	78.6	15.5	2.1	1.8	25	M	4.8	0.12	-0.14	0.22	0.25	-0.03	-0.05	-0.38
130	11919.0	75.7	16.3	2.1	1.9	25	M	4.8	0.26	0.13	-1.10	0.07	0.19	0.42	-0.64
131	11476.0	81.9	11.8	2.0	1.9	28	F	4.8	0.35	-0.26	0.07	-0.07	-0.06	0.14	-0.18
132	12066.5	78.7	13.7	2.0	1.9	33	F	4.8	0.48	-0.65	-0.33	-0.08	0.16	-0.62	0.01

133	11119.0	78.6	18.4	2.0	1.9	22	M	4.8	0.38	-0.01	0.14	-0.16	0.08	0.11	0.10
134	11792.0	80.6	11.2	2.0	1.8	23	M	4.9	0.31	-0.25	-0.42	0.10	0.09	0.16	-0.32
135	11614.0	77.6	15.8	1.7	2.4	40	F	5	0.26	0.11	0.19	-0.48	0.22	0.39	-0.14
136	9176.0	72.5	20.0	1.9	1.8	40	M	5	-0.76	-0.30	-0.57	-0.46	-0.03	-0.41	-2.45
137	12815.5	83.0	14.3	2.0	1.9	35	M	5	0.44	0.29	0.46	0.22	0.22	-0.01	0.19
138	12498.0	89.7	10.0	1.9	1.9	22	F	5	0.04	0.15	-0.31	-0.02	0.06	0.08	-0.32
139	11307.5	87.2	8.7	2.1	1.8	35	F	5	0.75	-0.08	-0.32	-0.73	-0.04	-0.12	-0.15
140	11719.5	92.4	7.9	1.7	1.9	55	F	5.1	0.37	0.07	0.26	-0.10	0.15	0.22	-0.31
141	12384.0	81.9	**13.3**	1.9	1.9	38	F	5.1	0.28	-0.28	0.20	-0.07	0.08	0.16	0.16
142	8087.0	72.1	20.2	1.6	1.8	35	F	5.1	-0.60	-0.29	-2.02	-1.71	-0.56	-1.65	-1.29
143	10954.0	70.6	18.2	2.1	1.9	33	F	5.1	-0.33	-0.09	-0.26	0.02	-0.24	0.11	0.07
144	11230.0	74.5	18.5	1.8	1.9	55	F	5.1	0.30	-0.53	-0.60	-0.05	-0.57	-0.35	-0.27
145	12511.5	78.2	12.6	2.0	1.8	30	F	5.1	0.17	-0.69	-0.56	-0.03	0.05	-0.13	-0.12
146	10261.0	76.2	15.0	2.1	1.9	36	M	5.1	-0.18	-0.23	0.15	-0.48	-0.04	-0.17	0.47
147	12464.5	91.4	10.4	1.9	1.8	60	F	5.2	0.63	0.11	0.54	-0.25	0.20	0.42	0.30
148	10220.5	78.7	14.0	1.7	2.0	42	F	5.2	-0.12	-0.06	0.11	-0.29	-0.23	-0.05	0.07
149	10951.0	74.7	15.4	2.1	1.8	38	M	5.2	-0.40	-1.16	-0.71	-0.63	-0.02	-0.58	-0.38
150	13082.5	86.5	10.2	1.8	1.9	45	M	5.2	0.42	0.08	0.31	0.08	0.14	0.17	0.38
151	11349.5	76.2	21.6	2.0	1.9	64	M	5.2	-0.19	0.32	0.09	0.10	0.33	0.18	-0.30
152	10364.5	75.4	15.4	2.1	1.9	30	F	5.2	0.22	-0.59	0.08	0.07	0.06	-0.26	0.13
153	8780.5	75.0	23.3	2.0	1.8	36	M	5.2	-0.28	-0.31	0.04	-0.09	-0.72	0.35	0.08
154	11490.0	80.7	15.0	1.8	1.9	46	F	5.3	0.06	0.26	0.07	0.09	0.24	0.38	-0.20
155	12104.0	**76.6**	14.8	1.7	1.9	40	F	5.3	-0.29	-0.38	-0.14	-0.25	-0.34	0.07	0.28
156	10709.0	73.8	13.4	1.9	2.2	40	M	5.3	0.24	-0.16	-0.26	-0.42	-0.23	0.10	-0.02
157	8637.5	81.7	10.5	2.0	1.7	60	F	5.3	-1.12	-0.83	-0.76	-0.16	0.07	0.02	-0.45
158	14469.5	86.9	8.2	1.8	1.8	31	M	5.3	0.55	-0.10	0.36	0.20	0.13	0.36	0.53
159	12169.5	82.5	12.8	2.0	1.9	40	F	5.3	0.32	-0.14	0.11	-0.90	-0.07	-0.12	0.15
160	11789.5	82.4	12.4	2.0	1.8	28	F	5.3	0.26	0.16	0.12	-0.01	0.07	0.29	-0.02
161	10313.5	72.7	21.8	1.7	1.8	44	M	5.4	-0.04	-0.52	-0.09	0.08	-0.85	-0.21	-0.87

162	13500.0	82.4	10.0	1.8	1.9	42	F	5.4	0.37	-0.18	0.49	-0.02	0.18	-0.26	0.17
163	12219.5	87.2	11.1	1.8	2.2	42	M	5.4	0.28	0.10	0.20	-0.02	0.14	0.17	-0.01
164	11283.0	76.1	15.5	1.7	2.0	32	F	5.4	0.17	-0.44	-0.63	0.07	0.13	0.36	0.15
165	12279.5	73.1	19.2	1.9	1.9	38	M	5.4	-0.23	-0.34	0.46	-0.61	0.09	0.57	0.07
166	14520.5	86.6	13.1	1.9	1.9	50	M	5.4	0.56	0.23	0.40	0.23	0.26	0.52	0.53
167	10937.5	70.4	21.8	2.1	1.9	33	F	5.4	-1.10	0.18	-0.46	-0.28	0.14	-1.55	0.22
168	12636.5	71.5	18.9	1.7	2.0	25	M	5.5	-0.17	0.13	-0.06	0.21	0.05	0.12	0.07
169	11647.5	92.5	9.4	2.0	1.7	51	M	5.5	0.32	-0.02	0.24	0.17	0.17	0.29	0.16
170	12598.5	81.3	14.4	2.0	1.9	29	M	5.5	0.12	0.18	0.34	0.15	0.15	0.26	-0.06
171	13578.0	79.9	12.0	2.1	1.8	55	F	5.5	0.18	0.26	0.45	0.04	0.08	-0.62	-0.18
172	12687.0	84.4	13.2	2.1	1.9	32	M	5.5	0.15	0.17	0.36	0.11	0.15	0.03	-0.13
173	12670.5	77.7	11.0	2.0	1.9	35	F	5.5	0.48	-1.11	-0.49	-0.14	-0.20	0.15	0.28
174	10317.5	73.1	16.5	1.5	2.1	40	M	5.6	0.01	-0.38	-0.31	-0.58	-0.38	-0.46	-0.20
175	10482.5	74.6	17.4	2.0	1.9	41	M	5.6	-1.18	-0.61	-0.53	0.17	0.21	-0.81	-0.41
176	12428.0	87.0	11.0	2.0	1.8	41	M	5.6	0.35	0.23	0.25	0.27	0.28	0.34	-0.10
177	11846.5	80.6	9.9	2.0	2.2	47	F	5.7	0.62	-0.20	-0.24	-0.09	0.08	0.31	0.19
178	13212.5	78.3	14.5	1.4	2.0	40	M	5.7	0.23	-0.15	0.16	0.11	0.16	0.15	0.21
179	10367.5	65.2	29.4	1.7	1.7	68	M	5.7	-0.51	-0.43	-0.76	0.12	0.32	-0.45	-0.52
180	12145.5	91.7	9.3	1.9	1.9	52	F	5.7	0.06	0.30	-0.14	0.15	0.17	-0.15	0.36
181	8856.5	68.6	24.4	2.0	2.0	37	F	5.8	-0.88	-0.26	-1.98	-0.11	-0.27	-0.01	-0.09
182	11119.5	82.3	8.3	1.9	1.8	37	F	5.8	0.17	-0.06	-0.13	-0.46	-0.13	-0.06	-0.09
183	12545.0	80.2	16.4	2.0	1.8	60	F	5.9	0.18	0.14	0.19	0.08	0.21	0.10	-0.09
184	11774.0	79.9	14.5	2.0	1.8	59	F	5.9	0.23	0.01	0.05	-0.13	-0.09	0.23	0.12
185	10425.5	77.6	11.4	2.2	1.8	30	F	5.9	-0.91	-1.42	-0.02	0.06	-0.58	0.26	0.01
186	12104.5	75.3	14.6	2.0	2.0	65	F	6.1	0.26	0.07	0.39	-0.04	-0.07	0.04	0.15
187	13117.0	90.8	12.1	2.0	1.9	55	F	6.1	0.16	-0.16	0.26	0.24	0.20	0.28	0.19
188	11761.0	75.1	14.1	1.9	1.7	34	F	6.3	-0.27	-0.10	-0.70	-0.05	0.09	-0.83	0.06
190	13148.5	83.7	11.0	2.1	1.8	25	F	6.3	0.59	-0.07	0.41	0.01	-0.06	0.47	-0.03
191	14454.5	85.3	10.2	2.1	1.8	75	M	6.3	0.78	0.18	0.01	0.25	0.18	0.13	0.44

192	11372.0	84.1	10.3	2.0	1.9	42	F	6.4	0.27	0.08	0.20	0.15	-0.17	0.35	-0.13
RAW DATA OF PRE-DIABETIC PARTICIPANTS (WITH HbA1c REPORTS)															
193	11846.5	80.6	9.9	2.0	2.2	47	F	5.7	0.62	-0.20	-0.24	-0.09	0.08	0.31	0.19
194	13212.5	78.3	14.5	1.4	2.0	40	M	5.7	0.23	-0.15	0.16	0.11	0.16	0.15	0.21
195	10367.5	65.2	29.4	1.7	1.7	68	M	5.7	-0.51	-0.43	-0.76	0.12	0.32	-0.45	-0.52
196	12145.5	91.7	9.3	1.9	1.9	52	F	5.7	0.06	0.30	-0.14	0.15	0.17	-0.15	0.36
197	8856.5	68.6	24.4	2.0	2.0	37	F	5.8	-0.88	-0.26	-1.98	-0.11	-0.27	-0.01	-0.09
198	11119.5	82.3	8.3	1.9	1.8	37	F	5.8	0.17	-0.06	-0.13	-0.46	-0.13	-0.06	-0.09
199	12545.0	80.2	16.4	2.0	1.8	60	F	5.9	0.18	0.14	0.19	0.08	0.21	0.10	-0.09
200	11774.0	79.9	14.5	2.0	1.8	59	F	5.9	0.23	0.01	0.05	-0.13	-0.09	0.23	0.12
201	10425.5	77.6	11.4	2.2	1.8	30	F	5.9	-0.91	-1.42	-0.02	0.06	-0.58	0.26	0.01
202	12104.5	75.3	14.6	2.0	2.0	65	F	6.1	0.26	0.07	0.39	-0.04	-0.07	0.04	0.15
203	13117.0	90.8	12.1	2.0	1.9	55	F	6.1	0.16	-0.16	0.26	0.24	0.20	0.28	0.19
204	11761.0	75.1	14.1	1.9	1.7	34	F	6.3	-0.27	-0.10	-0.70	-0.05	0.09	-0.83	0.06
205	13148.5	83.7	11.0	2.1	1.8	25	F	6.3	0.59	-0.07	0.41	0.01	-0.06	0.47	-0.03
206	14454.5	85.3	10.2	2.1	1.8	75	M	6.3	0.78	0.18	0.01	0.25	0.18	0.13	0.44
207	11372.0	84.1	10.3	2.0	1.9	42	F	6.4	0.27	0.08	0.20	0.15	-0.17	0.35	-0.13
208	12298.0	92.9	7.0	1.9	1.8	55	F	6.6	0.38	-0.06	0.39	-0.16	0.15	0.03	-0.17
209	11595.0	79.8	11.9	1.7	2.1	35	F	6.7	0.33	0.07	0.02	-0.04	-0.03	-0.04	0.17
RAW DATA OF DIABETIC PARTICIPANTS (PRE SDM YOGA INTERVENTION)															
210	13911.3	90.0	9.7	1.9	1.8	64			0.37	0.27	0.29	0.20	0.93	32.9	0.28
211	13347.2	84.3	10.2	1.9	1.8	50			0.41	0.10	0.10	0.41	0.93	25.9	0.10
212	12373.8	77.3	14.6	2.0	1.9	70			0.09	-0.26	-0.10	0.11	0.85	35.9	-0.18
213	12880.0	78.2	13.2	1.9	1.9	55			0.23	-0.38	-0.32	0.02	0.88	28.4	-0.35
214	12803.5	82.2	10.2	1.9	1.8	57			0.75	-0.25	0.28	0.18	0.99	29.4	0.02
215	14613.5	79.6	15.2	2.0	1.9	54			-0.04	0.06	0.38	-0.37	1.01	27.9	0.22
216	13431.2	80.8	11.3	1.9	1.8	63			0.27	-0.11	0.09	0.22	0.83	32.4	-0.01
217	13825.5	88.0	8.8	2.0	1.8	68			0.54	0.08	0.55	0.44	0.89	34.9	0.31
218	13680.6	89.2	9.0	1.9	1.8	48			0.64	0.08	0.25	0.42	0.99	24.9	0.16

219	14057.4	81.0	12.6	1.9	1.9	48		0.24	0.25	0.23	0.06	0.93	24.9	0.24
220	12429.4	81.5	10.8	1.9	1.9	52		0.39	0.19	-0.07	0.22	0.84	26.9	0.06
221	12935.4	79.6	13.3	1.9	1.9	68		0.17	0.04	0.10	-0.06	0.98	34.9	0.07
222	14191.6	85.5	10.9	1.9	1.9	53		0.34	0.39	-0.17	0.00	1.04	27.4	0.11
223	13732.6	80.8	14.0	1.9	1.9	52		0.33	0.14	0.31	-0.44	0.75	26.9	0.22
224	13786.4	78.4	15.6	2.0	1.9	60		0.10	0.26	0.12	0.12	1.06	31.0	0.19
225	12472.0	78.2	13.8	2.0	1.9	46		0.14	-0.01	-0.32	-0.14	0.63	23.9	-0.16
226	12808.3	89.7	8.5	2.0	1.8	72		0.27	-0.01	-0.32	0.15	0.92	36.9	-0.16
227	13492.4	76.9	15.1	2.0	1.9	53		0.35	0.13	0.14	-0.11	0.96	27.4	0.13
228	13443.3	74.6	16.6	2.0	1.9	47		0.11	-0.42	-0.04	0.01	0.95	24.4	-0.23
229	14562.7	82.1	11.8	1.9	1.8	55		0.22	0.12	0.18	0.07	0.96	28.4	0.15
230	13928.0	81.6	13.3	2.0	1.9	56		0.21	0.18	0.51	0.00	0.70	29.0	0.35
231	14670.4	91.5	8.2	2.0	1.8	51		0.48	0.20	0.07	0.30	1.01	26.4	0.13
232	14102.9	91.8	8.1	1.9	1.8	55		0.67	0.04	0.25	0.22	0.82	28.4	0.14
233	14745.4	76.3	18.7	2.1	1.9	59		0.25	0.10	0.07	0.26	1.13	30.5	0.08
234	12300.9	77.9	13.0	1.9	1.8	50		0.18	-0.74	0.27	0.01	0.72	25.9	-0.24
235	13285.8	81.4	11.6	2.0	1.8	60		0.38	0.15	-0.04	0.17	0.92	30.9	0.06
236	13363.6	79.6	13.0	2.0	1.9	50		0.14	-0.20	-0.04	0.14	0.90	25.9	-0.12
237	12813.7	76.1	16.6	2.1	1.9	52		0.08	-0.65	-0.74	0.18	0.79	27.0	-0.69
238	14294.4	75.5	17.2	2.0	1.9	67		0.17	0.02	0.79	0.31	0.98	34.4	0.41
239	13716.5	83.6	10.5	1.9	1.9	50		0.31	0.03	0.20	-0.11	0.49	25.9	0.12
240	12325.9	74.2	17.6	2.0	1.9	65		0.22	-0.51	0.02	-0.26	1.00	33.4	-0.25
241	11590.1	70.8	18.6	2.0	1.9	46		-0.15	-0.61	-0.37	0.00	0.38	23.9	-0.49
242	14162.8	81.0	13.0	1.9	1.9	59		0.51	0.34	0.35	0.41	1.01	30.4	0.34
243	12496.3	86.8	8.5	1.9	1.8	67		0.47	0.09	0.16	0.33	0.88	34.4	0.12
244	13911.0	82.0	12.2	2.0	1.9	55		0.59	0.13	0.22	0.37	0.82	28.4	0.17
245	13299.2	80.2	11.9	1.9	1.9	56		0.13	-0.38	0.45	0.21	1.01	28.9	0.03
246	14380.4	83.3	12.6	1.9	1.8	56		0.27	-0.11	0.45	0.23	0.90	28.9	0.17

RAW DATA OF DIABETIC PARTICIPANTS (POST SDM YOGA INTERVENTION)

247	13382.6	92.5	8.4	1.9	1.8	64		0.26	0.03	0.04	0.04	0.16	0.15	0.10
248	13205.1	86.2	11.3	1.9	1.8	50		0.30	0.02	0.41	-0.20	0.09	0.01	0.10
249	11793.5	78.0	17.0	2.0	1.9	70		-0.55	-0.17	0.14	0.24	0.12	-0.88	-0.18
250	13399.2	80.7	12.9	1.9	1.9	55		0.44	-0.11	-0.20	0.09	0.19	0.28	0.24
251	12174.8	82.3	12.3	2.1	1.8	57		0.27	0.14	-0.39	-0.13	-0.25	0.17	0.22
252	13585.3	74.8	19.1	2.0	1.9	54		0.01	0.17	-0.71	0.22	0.07	0.07	0.42
253	13629.2	80.4	14.8	2.0	1.8	63		0.17	-0.18	0.17	0.05	0.19	0.39	0.25
254	14199.7	88.6	9.3	1.9	1.8	68		0.69	-0.01	0.34	0.11	0.11	-0.07	-0.34
255	13081.4	85.7	11.8	1.9	1.9	48		0.15	0.13	0.20	0.08	0.08	0.00	0.23
256	11291.0	77.3	17.8	2.1	1.8	48		-0.09	0.02	-0.12	-0.71	-0.23	-0.32	0.04
257	11283.1	80.1	13.6	2.0	1.9	52		-0.58	-0.20	0.04	-0.16	-0.13	-0.20	-0.41
258	12748.3	81.8	13.7	2.0	1.9	68		0.24	0.07	-0.30	0.13	0.14	0.07	-0.48
259	15190.5	91.8	10.5	1.9	1.9	53		0.23	0.19	-0.34	0.23	0.33	0.18	0.28
260	9771.5	74.8	24.4	2.0	1.9	52		-0.95	-0.40	-1.20	-0.22	-0.31	-0.35	-1.23
261	12815.9	77.1	18.4	2.1	1.9	60		-0.41	0.25	0.15	-0.09	0.18	-0.46	-0.74
262	10278.0	77.8	19.6	2.0	1.9	46		-0.47	-0.60	-0.42	-0.34	-1.03	0.18	-0.65
263	12810.0	85.7	11.4	1.9	1.8	72		0.21	-0.01	0.04	0.08	0.08	-0.05	-0.20
264	12628.2	80.0	15.6	2.0	1.9	53		-0.24	0.03	-0.57	0.23	0.11	0.17	0.31
265	13979.3	75.6	17.5	2.0	1.9	47		0.14	0.02	-0.10	0.23	0.29	-0.08	0.40
266	14110.5	84.3	12.4	1.9	1.9	55		0.04	0.08	-0.09	0.23	0.19	0.28	-0.14
267	12883.9	80.1	15.5	2.0	1.9	56		-0.04	-0.46	-0.21	0.08	0.18	-0.04	0.31
268	14035.4	91.0	9.0	2.0	1.8	51		0.33	0.19	0.11	0.10	0.12	0.27	0.08
269	13056.6	87.8	10.6	1.9	1.8	55		0.35	-0.18	-0.23	0.06	0.04	0.21	0.30
270	13346.6	76.4	20.7	2.1	1.9	59		-0.09	0.36	0.26	0.20	0.21	-0.22	0.09
271	12175.0	78.7	15.1	2.0	1.8	50		-0.51	-0.39	-0.16	-0.06	0.13	-0.39	-0.17
272	11577.9	77.3	16.9	2.0	1.9	60		-0.18	-0.02	-0.04	-0.02	0.12	0.11	-0.52
273	12408.6	81.1	13.3	2.0	1.9	50		0.14	-0.09	0.15	-0.12	0.10	-0.03	0.02

274	12202.6	75.5	17.7	2.1	1.9	52		-0.13	-0.30	0.27	-0.16	0.09	-0.20	0.13
275	14600.8	85.3	13.1	2.0	1.9	67		0.19	0.10	0.46	0.30	0.20	0.17	0.32
276	12324.9	79.7	15.4	2.0	1.9	50		0.16	-0.91	-0.52	-0.17	-0.03	0.00	0.07
277	12088.2	77.5	17.6	2.0	1.8	65		0.28	0.17	-0.73	-0.75	-0.69	0.37	0.31
278	10192.5	78.7	17.7	2.0	1.8	46		-0.60	-1.08	0.16	0.00	-1.32	-0.16	0.11
279	14070.7	84.2	13.8	2.0	1.9	59		0.37	0.16	0.30	0.25	0.16	0.16	0.22
280	13565.4	87.1	10.0	1.9	1.8	67		0.44	-0.07	0.18	-0.25	0.20	0.25	0.27
281	13318.3	80.9	14.2	2.0	1.9	55		0.38	-0.22	0.15	0.21	0.06	0.41	0.17
282	13503.7	84.7	10.9	2.0	1.9	56		0.37	0.16	0.29	0.10	0.11	0.07	0.16
283	14130.0	84.6	12.5	1.9	1.8	56		0.34	-0.03	0.19	0.08	0.23	0.22	0.18

Appendix H

Publications from Doctoral Work

1. Bhat R.K., Guru Deo., Mavathur R., Srinivasan T.M. Correlation of Electro Photonic Imaging Parameters with Fasting Blood Sugar in Normal, Pre diabetic and Diabetic Study Participants. Journal of Evidence Based Complementary and Alternative Medicine, 2016; 1-8

2. Bhat R.K.., Mavathur R., Srinivasan T.M. Diabetes type 2 and Yoga: EPI Perspective. Internationla Journal of Yoga (awaiting issue).

3. Bhat R.K., Guru Deo., Mavathur R., Srinivasan T.M. Electro Photonic Imaging Parameters (EPI) of diabetes type 2 and their correlation with Glycated Hemoglobin (HbA1c).International Research Journal of India, 2016;vol 2 issue 3.