

## A Study on Biomarkers in a Spatially Distributed Type – 2 Diabetes mellitus Groups in Southern Tamil Nadu, India

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**Abstract:** Diabetes, a dreaded disease already ravaged a huge population worldwide, whether it is inherited through generations or invited by the people by their uncontrolled way of life is still obscure. Biomarkers assay is a boon to the diseased to opt proper prophylactic measures to curb or eradicate diseases. The elevated levels of various biomarkers related to inflammation of vital organs, liver function, kidney function and other vital parameters in our diabetic cases reveals the extent of organ(s) damage in these subjects. It is also evident that the levels of various biomarkers are similar in our diabetic subjects, irrespective of their habits or habitats.

**Keywords:** alanine aminotransferase, aspartate aminotransferase, blood urea nitrogen, gammaglutamyl transferase, glycated haemoglobin.

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### I. Introduction

Diabetes, a multifactorial disease due to deficiency or diminished effectiveness of endogenous insulin. There is no cure for this dreaded disease, but with proper management the diseased can lead a normal life.

Abnormal high blood sugar resulting from the insufficient levels of insulin evokes disordered metabolism in the diseased subjects<sup>1</sup>. It produces acute complications like ketoacidosis and nonketotic hyperosmolar coma<sup>2</sup> and serious long-term complications such as cardiovascular diseases, stroke, chronic kidney problems, even failure of kidney, and also can cause damage to the eyes<sup>3</sup>.

Biomarker is a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes or pharmacological responses to a therapeutic intervention<sup>4</sup>. Biomarker assays gives useful information about the levels of these substances in the patients and pave ways to curb or eradicate disease(s).

The present study tries to explore the extent of damage caused by diabetes and its related complications by the way of analyzing certain vital biomarkers in the selected cases of spatially distributed population in Kanya kumari District, Tamil Nadu, India.

### II. Materials and methods

The present study is undertaken in high range, midland and coastal areas of Kanyakumari District, Tamil Nadu, the Southern landmark of India<sup>5</sup>. The study population includes Kaani tribe (Scheduled Tribe-high range community)<sup>6,7</sup>, Nadar (Backward Community-Midland settlers)<sup>8</sup>, Nair (Forward Community-Midland settlers)<sup>9</sup> and Mukkuvar (Most Backward Community-Coastal population)<sup>10</sup>.

The study consists of 4 ST male and 4 female diabetics (experimental group) and equal number of non-diabetics (control group) in both sexes, 8 male and 8 female diabetics and same number of non-diabetics in both Nadar and Mukkuvar communities and 10 males and females each in both diabetic and non-diabetic groups in Nair community.

Diabetics are screened by the method described elsewhere<sup>11</sup> and priorities have been given to human values during the collection of samples. For the collection of blood and urine samples well trained staff nurses are used. Standard methods are used for the estimation of blood sugar (fasting and post-prandial)<sup>12</sup>, serum insulin<sup>13</sup>, C-peptide<sup>14</sup>, HbA<sub>1c</sub><sup>15</sup>, C-reactive protein<sup>16</sup>, ferritin<sup>17</sup>, IgG<sup>18</sup>, in (urine), IgM<sup>19</sup>(inurine), TSH, fT<sub>3</sub>, fT<sub>4</sub>, TT<sub>3</sub> and TT<sub>4</sub><sup>20-22</sup>, cholesterol<sup>23</sup>, Tg<sup>24</sup>, LDL-C, VLDL-C and HDL-C<sup>25</sup>, ALP<sup>26</sup>, LDH<sup>27</sup>, GGT<sup>28</sup>, AST<sup>29</sup>, ALT<sup>30</sup>, bilirubin (total)<sup>31</sup>, BUN<sup>32</sup>, creatinine<sup>33</sup>, albumin (in urine)<sup>34</sup>, creatine kinase<sup>35</sup>, ChE<sup>36</sup> and amylase<sup>37</sup>. Statistical analysis are made with SPSS statistical package(Version – 11)<sup>38</sup>.

### III. Results

Some of the vital parameters in serum and urine samples of the selected diabetics and non-diabetics are given in table 1. It is evident from the table that, except insulin a significant level of increase of serum sugar (fasting and post-prandial), C-peptide, HbA<sub>1c</sub>, C-reactive protein, ferritin, Ig-Gas well as Ig-M in urine samples are observed in the selected male and female diabetic cases than their respective non-diabetics.

Thyroid profile study revealed that, there is an altered level of TSH, fT<sub>3</sub>, fT<sub>4</sub>, TT<sub>3</sub> and TT<sub>4</sub> in diabetics than their non-diabetic counterparts and the values are statistically highly significant (p = < 0.01). Studies on

lipid profile showed except HDL-C, an enhanced level of cholesterol, Tg, LDL-C and VLDL-C in diabetics of both sexes than their respective controls ( $p < 0.01$ ) (table .2).

An elevated level of serum ALP, LDH, GGT, AST, ALT, creatine kinase, ACP and amylase and a decrease of lipase is detected in diabetic subjects than their non-diabetic controls. A high level of serum BUN, creatinine and albumin are also observed in diabetics than their respective non-diabetics ( $p < 0.01$ ) (table.3.).

#### IV. Discussion

Diabetes, a monster which devastates the global community at an alarming rate. It's hereditary as well as non-hereditary origin stunned the mankind and the global community is handicapped to eliminate this disease in this modern day also. The surge of this disease is a new threat and challenge to the modern world. The disease has already swallowed a sizeable number of human population in almost all the continents of the world barring from age, sex, race, religion or region.

Diabetes prevalence is a global scenario<sup>39,40</sup> and it is considered as one of the potential causes of death and disability in the entire world<sup>41</sup>. A statistically significant low level of insulin<sup>1</sup> is followed by higher level of fasting and post-prandial sugar and high level of Hb A<sub>1</sub>C<sup>42</sup> is common among diabetics. Our study too supports this view. A high level of inflammatory markers such as C-peptide<sup>43,44</sup> and C-reactive protein<sup>45,46</sup> and ferritin<sup>47,48</sup> an acute phase protein in diabetics are reported by earlier reports and it is true in our study also ( $p < 0.01$ ).

Previous studies revealed that elevated levels of urinary markers such as IgG<sup>49</sup> and IgM<sup>50</sup> and albumin<sup>51</sup> is an impairment of kidney function. An altered levels of IgG, IgM and albumin is observed in our diabetic subjects ( $p < 0.01$ ). A high level of BUN<sup>52</sup> and serum creatinine<sup>52,53</sup> is an indicator of kidney dysfunction. An enhanced levels of BUN and creatinine noticed in our diabetics ( $p < 0.01$ ) showed that they are at the risk of renal dysfunction.

Earlier reports say high levels of serum ALT<sup>54</sup>, AST<sup>52</sup>, ALP<sup>55</sup>, GGT<sup>56</sup>, LDH<sup>52</sup> and bilirubin (total)<sup>54</sup> reveal liver problems. A statistically significant increased levels of these substances are noticed in our diabetic cases than their respective controls ( $p < 0.01$ ). Clinical hypothyroidism in diabetics are reported by many researchers<sup>57,58</sup> and a marked level of increase of TSH, fT<sub>3</sub>, fT<sub>4</sub>, TT<sub>3</sub> and TT<sub>4</sub> are observed in our diabetic subjects of both sexes than their respective counterparts ( $p < 0.01$ ).

Abnormalities in lipid profile is one of the common complications in diabetes mellitus<sup>59,60</sup>. A noticeable level of increase of cholesterol, triglyceride (Tg), low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) and decrease of high density lipoprotein cholesterol (HDL-C) is observed in our diabetics than their respective controls ( $p < 0.01$ ). Reports say enhanced levels of amylase<sup>61</sup>, creatine kinase<sup>62</sup> and choline esterase<sup>63</sup> are associated with heart disease in diabetic subjects. A similar higher levels of these marker enzymes are detected in our diabetic cases than their respective controls ( $p < 0.01$ ).

#### V. Conclusion

Biomarkers assay gives valid information about the extent of the damage caused by diabetes, which is useful to take solid measures for effective management strategies to control diabetes for the sake of human health and welfare. A remarkable level of increase of almost all the selected biomarkers reveals the organ(s) damage in the diseased and it paves way to the patients to opt better treatments to reduce and/or avoid further complications, however large scale studies are imminent to curb the disease related complications.

If the present alarming rate of increase of diabetes will prevail in the future, there will be no normal persons at one stage. If you want to escape from the clutches of this deadliest demon, try to be a good follower nor than a preacher of good ideals. The present study confirmed that both habits and habitats are having no role on diabetic complications, which is brought to light by the similar way of expression of some of the selected biomarkers in the patients.

We need not accumulate amassing wealth to our future generations, but we have to transfer healthy germplasm which is utmost important and it is the need of the hour and the future as well.

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**Table.1.** shows some of the important parameters in serum/urine samples of the selected diabetics and non-diabetics.

(n=120 cases; 30 male + 30 female diabetics; 30 male + 30 female non-diabetics; values are ± SD)

Parameters	Male		Female	
	Non-diabetics	Diabetics	Non-diabetics	Diabetics
*Sugar (F) <sup>1</sup>	82.15 ± 10.36	142.66 ± 9.85	83.44 ± 7.55	143.75 ± 16.71
*Sugar (PP) <sup>2</sup>	103.45 ± 6.84	175.92 ± 5.25	108.45 ± 4.31	182.75 ± 10.6
*Insulin <sup>3</sup>	34.3 ± 0.61	15.3 ± 2.1	33.9 ± 1.79	17.65 ± 2.15
*C-peptide <sup>4</sup>	0.42 ± 0.2	1.06 ± 0.13	0.54 ± 0.1	1.06 ± 0.07
*Hb A <sub>1c</sub> <sup>5</sup>	5.08 ± 0.4	8.37 ± 1.7	5.12 ± 0.54	8.4 ± 1.4
*C-reactive protein <sup>6</sup>	0.42 ± 0.06	0.55 ± 0.05	0.41 ± 0.04	0.57 ± 0.07
*Ferritin <sup>7</sup>	46.95 ± 4.51	296.02 ± 35.7	49.52 ± 5.2	307.69 ± 41.75
*IgG <sup>8</sup> (urine)	1480 ± 46	1865 ± 62	1498 ± 54	1908 ± 78
*IgM <sup>9</sup> (urine)	104.33 ± 4.61	170.5 ± 12.1	103.7 ± 5.1	172.5 ± 9.43

(Units : mg/dl<sup>1,2,8,9</sup>, µl/ml<sup>3</sup>, ng/ml<sup>4,7</sup>, %<sup>5</sup>, mg/l<sup>6</sup>,  
t values : diabetics vs non-diabetics, p = < 0.01-highly significant\*)

**Table.2.** reveals thyroid and lipid profiles in serum of the selected diabetics and non-diabetics.

(n=120 cases; 30 male + 30 female diabetics; 30 male + 30 female non-diabetics; values are ± SD)

Parameters	Male		Female	
	Non-diabetics	Diabetics	Non-diabetics	Diabetics
*TSH <sup>1</sup>	2.08±0.12	3.91±0.14	2.27±0.11	4.1±0.21
*fT <sub>3</sub> <sup>2</sup>	2.15±0.1	2.94±0.12	2.29±0.13	3.17±0.09
*fT <sub>4</sub> <sup>3</sup>	0.82±0.03	0.92±0.04	0.79±0.04	0.99±0.02
*TotalT <sub>3</sub> <sup>4</sup>	0.66±0.05	0.94±0.02	0.64±0.01	0.97±0.05
*Total T <sub>4</sub> <sup>5</sup>	6.49±0.27	7.94±0.31	6.4±0.21	8.11±0.3
*Cholesterol <sup>6</sup>	188.3±20.61	214.23±44.72	197.2±38.75	229.73±57.44
*Tg <sup>7</sup>	160.57±19.72	211.53±22.6	178.03±27.32	242±29.54
*LDL-C <sup>8</sup>	103.77±7.47	138.2±9.41	121.37±8.7	155.53±9.4
*VLDL-C <sup>9</sup>	24.57±4.1	28.77±3.11	22.67±3.3	23.67±3.25
*HDL – C <sup>10</sup>	46.23±3.3	43.93±1.02	48.9±3.21	44.21±1.62

(Units : µlu/ml<sup>1</sup>, pg/ml<sup>2</sup>, ng/dl<sup>3</sup>, ng/ml<sup>4</sup>, µg/dl<sup>5</sup>, mg/dl<sup>6-10</sup>,  
t values : diabetics vs non-diabetics, p = < 0.01-highly significant\*)

**Table.3.** explains some of the selected biomarkers in the serum and urine samples diabetics and non-diabetics. (n=120 cases; 30 male + 30 female diabetics; 30 male + 30 female non-diabetics; values are  $\pm$  SD)

Parameters	Male		Female	
	Non-diabetics	Diabetics	Non-diabetics	Diabetics
*ALP <sup>1</sup>	181.1 $\pm$ 7.2	259.3 $\pm$ 7.3	190.4 $\pm$ 9.12	261.7 $\pm$ 5.71
*LDH <sup>2</sup>	363.4 $\pm$ 11.3	435.6 $\pm$ 8.11	373.8 $\pm$ 4.9	448.7 $\pm$ 17.13
*GGT <sup>3</sup>	22.9 $\pm$ 3.5	35.3 $\pm$ 1.9	24.6 $\pm$ 3.1	34.87 $\pm$ 4.15
*AST <sup>4</sup>	29.41 $\pm$ 1.7	41.43 $\pm$ 2.2	28.1 $\pm$ 2.4	42.5 $\pm$ 1.91
*ALT <sup>5</sup>	31.61 $\pm$ 0.97	40.3 $\pm$ 1.51	33.53 $\pm$ 1.81	41.91 $\pm$ 1.52
*Bilirubin <sup>6</sup> (total)	0.7 $\pm$ 0.04	0.88 $\pm$ 0.12	0.72 $\pm$ 0.13	0.92 $\pm$ 0.2
*BUN <sup>7</sup>	9.92 $\pm$ 1.21	19.57 $\pm$ 2.51	9.89 $\pm$ 1.33	19.15 $\pm$ 1.59
*Creatinine <sup>8</sup>	0.73 $\pm$ 0.03	1.05 $\pm$ 0.02	0.75 $\pm$ 0.06	1 $\pm$ 0.09
*Albumin <sup>9</sup> (urine)	24.9 $\pm$ 1.9	53.8 $\pm$ 4.47	25.6 $\pm$ 2.71	52.5 $\pm$ 3.77
*Creatine kinase <sup>10</sup>	6.1 $\pm$ 0.86	10.02 $\pm$ 1.3	6 $\pm$ 0.09	10.45 $\pm$ 0.9
*ChE <sup>11</sup>	7003 $\pm$ 302	8408 $\pm$ 161	7127 $\pm$ 128	8065 $\pm$ 152
*Amylase <sup>12</sup>	6.2 $\pm$ 0.6	9 $\pm$ 0.7	6.71 $\pm$ 0.51	9.1 $\pm$ 0.35

(Units : Iu/l<sup>1-6</sup>, mg/dl<sup>7-9</sup>, U/l<sup>10,11</sup>, IU/l<sup>12</sup>,

t values : diabetics vs non-diabetics, p = < 0.01 highly significant\*)