

## Biochemical Features of Type 2 Diabetics in Kushtia District, Bangladesh.

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### Abstract

**Introduction:** Biochemical analysis or laboratory tests assist to determine what happening to the body internally. The aim of the present study was to access the biochemical features of type 2 diabetic patients in Kushtia district, Bangladesh. **Materials and Methods:** The cross-sectional study was conducted in type 2 diabetes mellitus patients who presented to the OPD in three referral diabetic centers in Kushtia district, Bangladesh from August 2016 to July 2017. A total of 282 patients were included in the study. The collected data were checked, entered and analyzed using the computer program Statistical Package for Social Sciences (SPSS) version 22. **Results:** Biochemical study showed that mean blood hemoglobin level was  $12.49 \pm 1.47$  g/dl, mean fasting blood glucose level of the patients was  $8.86 \pm 1.67$  mmol/L and blood glucose level two hours after breakfast was  $13.94 \pm 2.88$  mmol/L. The study showed that the patient having abnormal level of triglyceride (66%) were higher than normal level (34%). **Conclusion:** The subjects had higher triglyceride and LDL values (65.6% and 28.7% respectively). These higher percentages with abnormal lipid profile are likely to be more prone to cardiovascular diseases.

**Keywords:** Diabetes mellitus, Type 2 diabetes, Biochemical indices, Lipid profile.

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### Introduction:

Diabetes Mellitus (DM) is a serious health hazard all over the world. In the South East Asian region there were 72 million adults with DM in 2013 and it is expected to rise to more than 123 million by 2035<sup>1</sup>. Diabetes mellitus is a chronic condition that arises when the pancreas fails to produce enough insulin or when the body cannot use the insulin produced effectively<sup>2</sup>. It is an increasing threat to the world's health service. Formerly described as a "disease of affluence", it has now become evident that, owing to demographic changes, cultural transition and population ageing, diabetes is now also a "developing countries problem"<sup>3</sup>.

Type 2 diabetes accounts for more than 90% cases and is associated with older age and obesity<sup>4</sup>. It usually begins as insulin resistance, a disorder in which the cells do not use insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce it<sup>5</sup>. The resulting hyperinsulinemia helps maintain normal glucose tolerance. In many individuals, this condition corresponds to the metabolic syndrome of insulin resistance which is defined by obesity, insulin resistance, hyperlipidemia, hyperinsulinemia and hypertension, and do not progress to diabetes always<sup>6</sup>. During the progression of the disease, beta cell function declines and the patient then has a fasting hyperglycemia. It occurs mostly after 40 years in obese subjects and its prevalence increases with age<sup>7</sup>. Glycemia is the concentration of glucose circulating in the blood. The glucose in the blood from two sources: an exogenous origin (food provides carbohydrates such as sugar, starches, fruits, which are degraded by enzymes, mainly glucose) and endogenous origin since the liver is an organ producing glucose through two pathways, glycogenolysis and gluconeogenesis<sup>8</sup>. Increased rates of hepatic glucose production result in the development of overt hyperglycaemia, especially fasting hyperglycaemia, in patients with type 2 diabetes<sup>9</sup>. In such conditions, lipolysis in adipose tissue is promoted leading to elevated circulating levels of free fatty acids<sup>10</sup>. In addition, kinetics of whole-body protein metabolism are elevated, and net balance is diminished in type 2 diabetes, independently of obesity<sup>11</sup>.

Type 2 diabetes is a disease associated with abnormal carbohydrate metabolism which arises due to insulin deficiency as insulin is the key hormone responsible for glucose homeostasis in blood<sup>12</sup>. Consequently, elevation of blood glucose predominantly affects RBC's, vascular endothelial cells and walls of capillaries which often leads to microvascular complications in T2DM including retinopathy,

nephropathy and neuropathy<sup>13</sup>. Hyperglycaemia can lead to vascular complications through various mechanisms<sup>14</sup>.

Deformability of RBC's is one of the haemorheological parameters which is altered in type 2 diabetic patients. RBCs of type 2 diabetic patients tend to aggregate more easily when compared with healthy subjects. Excessive aggregation of RBC is one of the most important features in type 2 diabetic patients with poor glycaemic control. This has a direct effect on the WBV<sup>15</sup>.

A significant percentage of type 2 diabetic patients have abnormal serum lipid. Recent studies have revealed that insulin resistance is not only associated with hyperglycaemia alone, but also with several other disorders which are associated with the concentrations of lipoproteins<sup>16</sup>. In type 2 diabetic patients, typical abnormalities frequently observed in lipid profile are elevated total and VLDL cholesterol, triglyceride, low levels of HDL, and a large number of dense LDL particles<sup>17</sup>. It is well understood that diabetic dyslipidemia is a major hallmark of metabolic syndrome and found to play an extensive role in the pathogenesis of CVD<sup>18</sup>. Creatinine is a protein and its assay in blood and urine can evaluate renal function. If the rate is high, it means that renal function is disturbed<sup>19</sup>.

**Materials and Methods:**

A descriptive, cross-sectional study was conducted from August 2016 to July 2017 among 282 (male were 144, female were 138, 142 resided in urban area and 140 resided in rural area) type 2 diabetic patients attending OPD in three referral diabetic centers in Kushtia district, Bangladesh. After arriving in the center the participants were asked about their fasting status by field volunteers. The investigation was carried out only after reporting of fasting state by the participants. Subjects were asked to sit on a chair and an appropriate blood was taken from the patients. Data were summarized in mean ± SD, frequency & percentage and presented in tables using Statistical Package for Social Science (SPSS) version 22. For all analyses, p value <0.05 was considered statistically significant.

**Results:**

The mean blood hemoglobin level was 12.49±1.47g/dl, in which male hemoglobin level was 12.85±1.48g/dl and of female was 12.11±1.36g/dl. The mean fasting blood glucose level of the patients was 8.86±1.67mmol/L and blood glucose level two hours after breakfast was 13.94±2.88mmol/L. The mean serum creatinine level of the male patients were 1.17±1.05mg/dl and female were 1.26±1.05mg/dl. The patients mean total cholesterol, low density lipoprotein; high density lipoprotein and triglyceride levels were 197.23±48.99mg/dl, 117.21±44.65 mg/dl, 34.9 6±5.38mg/dl and 225.30±74.08mg/dl respectively (Table-I).

**Table-I: Mean biochemical indices of the respondents (Diabetic Patients).**

Biochemical indices	Male	Female	Male & female Combined	P-value	Normal Range
Blood hemoglobin level (g/dl)	12.85 ± 1.48	12.11 ± 1.36	12.49 ± 1.47	.000	M:14-18, F:11.5-16.5
Fasting blood glucose (mmol/L)	8.69 ± 1.48	9.04 ± 1.84	8.86 ± 1.67	.080	< 7.0
Bl. Glucose 2 hours after breakfast	13.86 ± 2.92	14.01 ± 2.84	13.94 ± 2.88	.673	< 11.1
Serum creatinin (mg/dl)	1.17 ± 1.05	1.26 ± 1.05	1.22 ± 1.05	.480	0.70 – 1.20
Total cholesterol (mg/dl)	198.49 ± 51.87	195.92 ± 45.96	197.23 ± 48.99	.660	Up to 200
LDL (mg/dl)	119.66 ± 48.34	114.65 ± 40.45	117.21 ± 44.65	.347	< 150
HDL (mg/dl)	35.31 ± 5.53	34.59 ± 5.21	34.96 ± 5.38	.263	M: >45, F: >35
Triglycerides (mg/dl)	217.57 ± 70.95	233.37 ± 76.63	225.30 ± 74.08	.073	50 - 150
HDL = High density lipoprotein LDL = Low density lipoprotein					

The mean fasting blood glucose levels for female in rural area was 9.16±2.03 and urban area was 8.93±1.65. Mean two hours after blood glucose levels for male in rural area was 14.36±2.92 and urban area was 13.32±2.83. Mean blood hemoglobin levels for male and female living in rural area were 12.75±1.49 and 11.98±1.36 (Table-II).

**Table-II: Mean biochemical indices of the respondents (Diabetic Patients) in correlation to place of residence.**

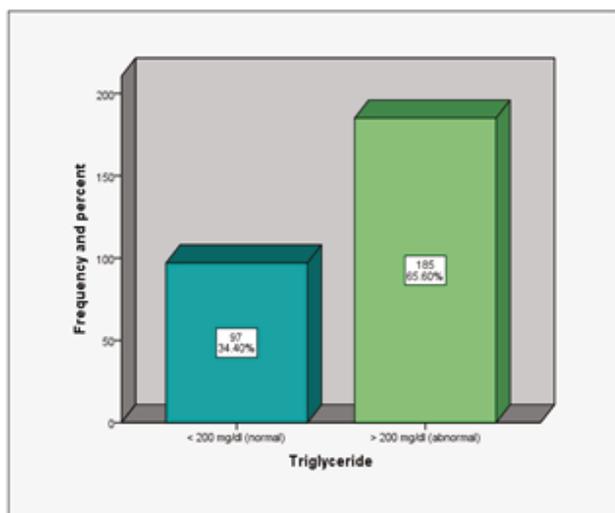
Biochemical indices:	Male	Female	Male & Female Combined
Blood hemoglobin level (g/dl)			
Urban	12.95 ± 1.48	12.23 ± 1.36	12.58 ± 1.46
Rural	12.75 ± 1.49	11.98 ± 1.36	12.39 ± 1.48
Fasting blood glucose (mmol/L)			
Urban	8.57 ± 1.43	8.93 ± 1.65	8.76 ± 1.55
Rural	8.79 ± 1.52	9.16 ± 2.03	8.96 ± 1.78
Bl. Glucose 2 hours after breakfast			
Urban	13.32 ± 2.83	13.92 ± 2.81	13.63 ± 2.82
Rural	14.36 ± 2.92	14.11 ± 2.90	14.25 ± 2.90
Serum creatinin (mg/dl)			
Urban	1.34 ± 1.25	1.23 ± 1.07	1.28 ± 1.16
Rural	1.01 ± 0.79	1.29 ± 1.03	1.14 ± 0.92

The distribution of patients with normal and abnormal levels of various lipid constituents differed. Majority of the patients 65.6% had abnormal levels of triglyceride followed by 31.2% with abnormal total cholesterol, 28.7% with abnormal LDL and 40.8% with abnormal HDL (Table-III).

**Table-III: Lipid profile of the respondents (Diabetic Patients).**

Lipids categories	Normal		Abnormal		Total		Normal values (mg/dl)
	(n)	(%)	(n)	(%)	(n)	(%)	
Total cholesterol	194	68.8	88	31.2	282	100.0	Up to 200
LDL	201	71.3	81	28.7	282	100.0	< 150
HDL	167	59.2	115	40.8	282	100.0	M >45, F >35
Triglycerides	97	34.4	185	65.6	282	100.0	50-150

According to Figure 1, the patient having abnormal level of triglyceride (66%) were higher than normal level (34%).



**Figure-1: Showing distribution of normal and abnormal triglyceride level of the diabetics.**

#### Discussion:

This study showed that mean fasting blood glucose levels for female in rural area was  $9.16 \pm 2.03$  and urban area was  $8.93 \pm 1.65$ . So, the mean fasting blood glucose levels for females showed a fairly different values compared to mean following fasting blood glucose in our urban and rural population. Mean two hours after blood glucose levels for male in rural area was  $14.36 \pm 2.92$  and urban area was  $13.32 \pm 2.83$ . Here, the mean two hours after blood glucose levels for males showed fairly different values compared to mean following two hours after blood glucose in our urban and rural population.

Study showed that the respondents had abnormal triglyceride in high percentage (65.6%)<sup>20</sup>. The mean values for lipid profile of the study were total cholesterol  $197.23 \pm 48.99$ mg/dl, low density lipoprotein  $117.21 \pm 44.65$ mg/dl, high density lipoprotein  $34.96 \pm 5.38$ mg/dl and triglyceride  $225.30 \pm 74.08$ mg/dl. Dyslipidemia does exist in diabetes mellitus and they are always at risk of macro-vascular complications. The abnormalities of lipid profile in diabetics include elevated total cholesterol, triglyceride, low density lipoprotein (LDL) and reduced high density lipoprotein (HDL)<sup>21</sup>.

#### Conclusion:

Diabetes mellitus is a major public health problem that requires proper medical and dietary management. The subjects had higher triglyceride and LDL values (65.6% and 28.7% respectively). These higher percentages with abnormal lipid profile are likely to be more prone to cardiovascular diseases. The high intake of fruit and vegetables among the diabetics could be because of high level of awareness on the importance of fruits and vegetables to diabetes management as vegetables contain fiber, which helps reducing cholesterol thereby controlling

blood glucose. Diabetes patients should be counseled to adopt healthy eating habits and encouraged them to improve their diets in order to prevent diabetes and its complications.

**Conflict of Interest:** None.

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