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Pattern of Biochemical Parameters in Newly Diagnosed Diabetes Mellitus Subjects

Hajira Ishaq[1], Faiz Mohammad[2], Salma Shazia[3], Mohammad Shabbir Khan[4], Feroz Khan[5], Mohammad Hashir Ahmad[6], Zahoor Ahmed[7]

[1,4,7]Department of Biochemistry, Khyber Medical College, Peshawar, KPK, Pakistan.
[2]Institute of Chemical Sciences, University of Peshawar, Khyber Pakhtunkhwa, Pakistan.
[3]Department of Forensic Medicine, Ayub Medical College, Abbottabad, KPK, Pakistan.
[5,6]Department of Biochemistry, Rehman Medical College, Peshawar, KPK, Pakistan.

Correspondence: *Dr. Zahoor Ahmed*
zakhan70@yahoo.co.uk

Abstract

Objective: To study the spectrum of biochemical parameters of newly diagnosed diabetic patients and contrast with healthy subjects and assess the level of knowledge of newly diagnosed diabetic patients regarding diet, exercise, potential complications, and treatment, and educate them about the potential outcomes of DM.

Materials and Method: The present prospective study was carried out in major health organizations of district Peshawar, ICS, and PHRC, KMC, Peshawar, KPK, Pakistan on 150 newly diagnosed patients with a history of diabetes less than 6 months constituted group-A and a same number of subjects were included by convenient sampling technique from the general population with the same age, sex and socio-economic status who were apparently normal healthy individuals served as controls (Group-B). All the biochemical parameters viz., fasting and random blood sugar, HbA1C, and lipid profile were performed at PHRC, KMC, Peshawar using standard kits procured from Elethich France.

Results: Fasting blood glucose level of newly diagnosed diabetic patients (Group-A) was compared with group-Band a highly significant change was noted ($p<0.000$), similarly on comparison of HbA1C remarkable change ($p<0.030$) was noted. An important change ($p<0.05$) was noted in serum total cholesterol for group-A when compared with the normal healthy individual (group-B). A highly significant change ($p<0.001$) was recorded for both HDL-c and LDL-c when compared with respective normal healthy individuals.

Conclusion: Diabetes mellitus is quite common in our population. The demographic characteristic of diabetes mellitus shows that it almost equally affects both males and females. Diabetes mellitus has a strong taste for individuals with passive lifestyles i.e., more common in populations with low physical activity.

Key Words: Newly Diagnosed Diabetic Patients, Lipid Profile, PHRC, and ICS.

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Introduction

Diabetes mellitus (DM) is a cluster of metabolic derangement distinguished by high level of blood glucose resulting from defects in insulin action, insulin secretion either, and or both.[1] There are two main types of diabetes, type-1and type-2, previously called insulin dependent (IDDM) and non-insulin dependent diabetes mellitus (NIDDM) respectively. IDDM is distinguished by loss of the insulin formingβ-cells of pancreas, leading to varying degrees of insulin insufficiency. While NIDDM is due to several effects like insulin resistance, defective insulin secretion, or reduced insulin reactivity, which almost certainly involves the insulin receptor in cell membranes NIDDM (Type-2; T2DM) is more extensive universal health problem, closely linked to the epidemic of corpulence. Individuals with T2DM are more prone to macrovascular complications (like cardiovascular co morbidities) and microvascular complications (including nephropathy, retinopathy and neuropathy), due to elevated blood glucose level (hyperglycemia) and individual components of the insulin resistance (metabolic) disorders.

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Environmental factors (such as obesity, lack of physical activity and unhealthy diet) and genetic elements according to the multiple pathophysiological disruptions that are responsible for impeding glucose homeostasis in NIDDM.[2]

Diabetic patients are 2-4 times more prone to myocardial infarction, five times more prone to gangrene, seventeen times more prone to kidney failure, and twenty-five times more prone to blindness as compared to the non-diabetic population.[3] Diabetic patients have a greater likelihood of having dyslipidemia, hypertension, and obesity.[4] Central (coronary) and peripheral arterial arteriosclerosis appear to be associated with lipid abnormalities in diabetes.[5-6] In patients with diabetes mellitus (DM), years of poorly managed hyperglycemia lead to multiple, primarily vascular impediments (angiopathies) that influence small vessels, large vessels, or both. The way by which vascular disease develops includes; glycosylation of serum and tissue proteins with the development of advanced glycosylation end products, superoxide production, activation of protein kinase-C; a signaling molecule that increases vascular permeability and causes endothelial dysfunction, accelerated hexosamine biosynthetic and polyol pathways leading to sorbitol collection within tissues, hypertension, and dyslipidemias that commonly accompany diabetes mellitus, arterial microthromboses and proinflammatory and prothrombotic effects of elevated blood sugar level and high level of insulin in the blood that decrease vascular autoregulation.[7] Hypertension is more common in diabetic patients than non-diabetic individuals because of lipid accumulation (atherosclerosis) in blood vessels, which leads to intravascular resistance, and is more predominant in type-2 diabetes (NIDDM).[8] Recent evidence indicates that concentration of low-density lipoprotein cholesterol (LDL-c) is well controlled in patients with good glycemic control[9-10] and insulin administration over a period of hours to weeks improves lipoprotein and lipid levels in diabetic patients.[11]

Both type-1 (IDDM) and type-2diabetes (NIDDM) have genetic tendencies. In type-2 diabetes, the chances of inheritance are more common. TCF7L2, FTO, WFS1, KCNJ11, PPARG, SLC30A8, IGF2BP2, NOTCH2, JAZF1 and HHEX[12] genes are closely associated with NIDDM. Inherited obesity is also a common cause of type 2 diabetes.[13] The cells of obese individuals have low number of mitochondria than normal people and are thus prone to insulin resistance.[14]

Universally 425 million adult individuals are living with DM, according to the latest 2016 data from WHO.[15] Diabetes universality is rising rapidly; previous 2013 estimates from the International Diabetes Federation (IDF) put the number at 381 million people diagnosed with diabetes[16]. The number is projected to almost double by 2030[17]. Diabetes mellitus occurs throughout the universe but is more common (especially type 2) in more developed countries. The greatest increase in prevalence is, however, occurring in low and middle-income countries[15] including in Asia and Africa, where most patients will probably be found double by 2030.[17-18] The increase in occurrence in developing countries follows the trend of urbanization and change in lifestyle, including inactive lifestyles, less physical work and the international nutrition transition, marked by high intake of foods that are high energy-dense but less nutritious (saturated fats, often high in sugar and sometimes referred to as the western pattern diet).[18]

From the literature survey, it has been noted that a lot of research work has been done to determine the lipid profile in diabetic patients, but the same problem pertaining to the population residing in Peshawar district of Province Khyber Pakhtunkhwa (KPK) has not been investigated so far, especially in case of newly diagnosed diabetic patients.

Materials and Methods

The present prospective study was conducted in major health organizations of district Peshawar, Institute of Chemical Science, University of Peshawar (ICS), and Pakistan Health and Research Council (PHRC), Khyber Medical College (KMC), Peshawar, KPK, Pakistan on 150 newly diagnosed patients with a history of diabetes less than six months constituted group-A and the same number of subjects were included by convenient sampling technique from the general population with the same age, sex and socio-economic status who were apparently normal healthy individuals served as controls (Group-B). 150 in each group sample size was calculated by using WHO sample size calculation with the level of significance 5% and power of test 80%. For collection of data informed written acceptance was taken from all of examinees as this is the cornerstone of ethics in clinical research and were interviewed using a well-defined questionnaire. 25 subjects refused to give

their particular for the study so they were not considered in our research. All the subjects were examined before taking blood samples for investigations purpose. For body mass index (BMI) therefore, heights and weights were measured with a height weight machine and BMI was calculated as weight in Kg divided by the square of height in meters.[19] Blood pressure was measured with help of a mercury sphygmomanometer to look for systolic and diastolic blood pressure (SBP and DBP) respectively.[20] Blood samples of 5 mL and 2 mL (with EDTA) were collected from the antecubital vein of patients with a good quality disposable syringe of BD in all aspects. All the biochemical parameters viz., fasting and random blood sugar, HbA1C, and lipid profile were measured using standard kits procured from Elethich France.[21] Standard

Statistical package for social sciences (SPSS) version 23.0 was used for data entry. Descriptive statistics and an independent sample t-test were used for data analysis. Significance was noted in all variables comparison in the form of p-value.

Results

Table I depicts the general features of both study groups, including sex, age, SBP, DBP and BMI. In group A (newly diagnosed diabetic patients) male patients outnumbered females with male to female ratio of 1.56:1 while the average age was 43.62±7.59 years. In case of controls (group-B) male to female ratio was 1.78:1, and mean age was noted to be 43.52±7.10 years. There was no significant difference between mean ages in both groups. P value was significant in case of systolic and diastolic blood pressures (p<0.000). Similar observations were noted for BMI when compared with controls (p<0.025). Table II reveals the distribution of fasting blood glucose and glycosylated haemoglobin (HbA1C) between the cases and controls. When the fasting blood glucose levels of group-A and B were compared, a significant p-value were noted (p<0.001) and similar comparison of HbA1C also showed a significant value (p<0.030).

Only remarkable change (p<0.05) was noted in cholesterol for newly diagnosed diabetic patients (group-A) when compared with the normal healthy individuals (group-B). However, this change was highly significant (p<0.000) in serum triglycerides when compared with controls. In case of group-A, mean±SD of high-density lipoprotein was 40.12±4.96 mg/dL, while low-density lipoprotein was observed to be 103.90±19.01 mg/dL. In normal healthy individuals, it was 47.04±2.63 mg/dL and 87.04±16.69 mg/dL respectively. Highly significant (p<0.001) were noted for both HDL-C and LDL-C when compared with the respective normal healthy individual (Table III).

Table II: Comparison of Fasting Blood Glucose and HbA1C in Newly Diagnosed Diabetic Patients (Group-A) with Normal Healthy Individuals (Group-B).

Group	Total Number	Fasting Blood Sugar (mg/dL)	HbA1C
A	150	161.73±31.98	6.74±0.88
B	150	91.34±5.78	4.99±0.58
***p*-value**	-	0.000	0.030

Table IV depicts the details of the financial condition of the study population. The data reveals that majority of the patients (group-A) belongs to low income group constituting 61% followed by high and middle income groups making 21% and 18% of the patients respectively. The results were noted in the same fashion in group-B where the maximum numbers of subjects 52% were note to belong from low income group followed by high and middle income groups i.e., 26% and 22% respectively. The comparison of occupation

Table I: General Features of newly diagnosed Diabetic Patients (Group-A) and Normal Healthy Individuals (Group-B).

Group	Total Number (n=300)	Gender		Age (Years)	SBP (mmHg)	DBP (mmHg)	BMI (Kg/m^2)
		Male	Female				
A	150	91	59	43.62±7.59	126.66±10.06	78.65±7.10	27.74±5.14
B	150	96	54	43.52±7.10	118.10±5.88	81.90±3.62	23.97±4.25
***p*–value**	-	0.832		0.937	0.000	0.001	0.025

Table III: Comparison of Lipid Profile of Newly Diagnosed Diabetic Patients (Group-A) with Normal Healthy Individuals (Group-B)

Group	Number (n=300)	Cholesterol (mg/dL)	Triglycerides (mg/dL)	HDL-C (mg/dL)	LDL-C (mg/dL)
A	150	186.05±19.64	180.92±45.42	40.12±4.96	103.90±19.01
B	150	156.32±19.79	153.98±23.85	47.04±2.63	87.04±16.69
***p*-value**	-	0.051	0.000	0.001	0.001

(physical activities) and its association with family history and knowledge of diabetes mellitus in the study subjects is given in Table V.

Table IV: Distribution of newly diagnosed diabetic patients (Group A) and Controls (Group B) on the basis of Socio-economic Status.

Group	High Income (%)	Middle Income (%)	Low Income (%)
A	21	18	61
B	26	22	52

Table V: Distribution of Newly Diagnosed Diabetic Patients (Group-A) and Control Subjects (Group-B) on the Basis of Physical Activities and knowledge about Diabetes Mellitus.

Group	Minimal Physical Activities	Moderate Physical Activities	High Physical Activities	Knowledge of DM
A (n=150)	76%	20%	04%	60%
B (n=150)	54%	36%	10%	78%
p-value	0.024	0.022	0.021	0.023

Individuals of group A (patients) with minimal physical activity were maximum (76%) while individuals with maximum physical activity constituted a small number i.e. 4% and the patients with moderate physical activity were 20%. In group B the percentage of individuals was found to 54%, 36 % and 10% for minimal, moderate and maximal activities respectively. Majority of individual were aware of the detail knowledge of diabetes mellitus in both the groups A and B constituting 60% and 78% respectively. Significant changes were noted for occupation and knowledge ($p<0.02$) and ($p<0.02$).

Discussion

Diabetes mellitus is one of the most familiar and alarming problems faced by humans in day-to-day life. Not only the common men are suffering from the misery of diabetes but also it is a big challenge for medical professionals in their routine practice. If the diabetes is not managed and controlled properly long-standing hyperglycemia and ultimately disturbances of lipid metabolism will lead to vasculopathy. Diabetes mellitus is a medical condition that can affect both sex and almost all ages with a relatively greater incidence in the middle decades of life. Complications of atherosclerosis and thromboembolic events are common in diabetes mellitus.[22] Great number of studies have revealed that diabetes mellitus is causing changes in the plasma lipids and lipoproteins and these changes play a key job in the development of cardiovascular abnormalities in these patients, and in turn increase incidence and prevalence rate of these complications in diabetic patients as compared to those individuals who are non-diabetic our results are consistent with these results.[23] Our results

are further augmented by Connor EB and Co-workers (1982) who conducted study on relation between lipid profile and diabetes mellitus and found a positive relation between these.[24]

In the present study the age range was from 30 to 60 year and out of these the majority of diabetic patients were found in the age range of 30 to 50 years. The data documented by Mathy SC *et al.,* (2005)[25] related to age groups in diabetes shows results similar to our study. In current study the newly diagnosed male diabetic patients outnumbered the newly diagnosed female diabetic patients. Ubiquity of diabetes according to Choi BCK *et al.,* (2001) was higher in male in almost all age groups in contrast to the female[26], so this is in agreement with the present study. The mean age for both patients and controls in our study was 43.57 years collectively while the mean age was 43.62 and 43.52 years for patients and controls respectively (Table-1). However contradictive results have been reported by Mathy S.C, and colleagues (2005) and the mean age group documented by them was 58.6 years[25]. This difference in age of the above two mentioned studies may be due to the geographical, socioeconomic status, sample size, and designs of the two studies. Moreover, we have carried out it on the newly diagnosed subject whereas no such information was given in the study conducted by Mathy *et al.,*(2005)[25] The present study reveals that most of the newly diagnosed diabetic subjects fall in low-income group and thus show a direct relationship between the disease and socioeconomic status. A similar trend in results was shown by Mathy, S .C, and Co-workers and thus their results are in agreement with the present study.[25]

In many studies close relation between diabetes (type-2) with BMI was observed. This relation was significant in study carried out by Hollbrook T. L *et al.,* (1989); Chan J.M *et al.,* (1994) and Hanson R L and Co-workers had all observed the same experience. Increasing weight is an important predictor of higher BMI and ultimately higher risk for type-2 diabetes mellitus. After third decade of life i.e. after 30 years of life increased incidence of weight gain occur which results in high BMI and may end in diabetes mellitus. When high BMI stays for a longer time, the possibility of diabetes is further enhanced[27-30]. In this study the BMI of diabetic patients

were highly significant than the control healthy individuals and thus our study is in agreement with the aforesaid studies. A study conducted by Laakaso *et al*., (1985) shows low level of high density lipoprotein (HDL) in patients with diabetes[31]. Similar findings were observed in the present study showing almost the same results regarding the level of plasma triglycerides and cholesterol and HDL level. As mentioned the lipid irregularity encountered in diabetes mellitus are raised triglycerides, cholesterol, LDL, and low level of HDL[32,33]. The current study (Tables-3) detected the same results in diabetic subjects as compared to controls with significantly higher levels of triglycerides, cholesterol, low-density lipoprotein, and low level of high-density lipoprotein. Schwartz *et al.* found same results in their study[32]. Alaupovic *et al.,* (1992)[33] have documented a markedly increase the concentration of triglycerides in diabetic patients and the same has been reported by Maty SC *et al.,* (2005)[25] and others.[34-38] In our study we found the same trend in results with high levels of triglycerides in diabetics as compared to control group.

Conclusion

The following conclusions were drawn from the present research work. Diabetes mellitus is quite common in our population. The demographic characteristic of diabetes mellitus shows that it almost equally affects males and females. Diabetes mellitus has strong taste for individuals with passive lifestyles i.e., more common in population with low physical activity or sedentary lifestyle. Diabetes has mercy for none but poverty is the worst victim i.e., diabetes mellitus affects individuals from all socioeconomic groups but is more common in individuals with low income. As increase in the level of lipid was observed in diabetes therefore equal importance should be given to lipid profile and fasting plasma glucose in management and in follow up of the patients with diabetes mellitus.

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