RESEARCH PAPER

Biochemistry, risk factors and major chronic complications of type 2 diabetes among patients of Southern Punjab, Pakistan

Muhammad Naeem[*1], Maryam Pakiza[1], Arsalan Ashraf[1], Hafiz Muhammad Zeshan Safdar[1], Arslan Rasool[2], Hafiza Samia Rasool[2], Muhammad Tjammal Rehman[2], Tayyeba Razzaq[3], Ghafoor Ahmad[3]

[1]Department of Biochemistry, University of Agriculture, Faisalabad, Pakistan

[2]Department of Biochemistry, Government College University, Faisalabad, Pakistan

[3]Institute of Chemical Sciences, Bahauddin Zakariya University, Multan, Pakistan

Abstract

Nearly, half of the diabetic population in Pakistan not diagnosed properly and approximately half of the affected population in the beginning characterized diabetic patients is seen to comprise the chronic diabetic complications. This study was conducted to estimate the existing status of chronic complications associated with diabetes mellitus. This research was conducted at Department of Diabetes, Jampur located in southern region of Punjab, Pakistan from February 2017 to June 2017. A comprehensive evaluation of medical history and clinical and laboratory tests of blood samples were performed to analyze the dyslipidemia and related complications. A neuropathy disability score normally greater than zero was used to access peripheral neuropathy as standard parameters with range in low, medium and high. An opthalmoscopic performed comprehensive examination of dilated retina. Obesity, low HDL, High LDL and total cholesterol were considerably higher in females. Neuropathy level was higher in patients with short diabetes duration at the same time as other chronic complications were higher in patients with long diabetes duration and with high age group. This research will be useful for administration and control of secondary complications in diabetic patients of Pakistan.

* **Corresponding Author:** Muhammad Naeem ✉ biochemist444@gmail.com

Introduction

The Global prevalence of Diabetes is 8.8% of which 80% victims are from low to middle income countries. Type 2 diabetes mellitus (T2DM) is the most common type of diabetes that covers 90% of the diabetic occupants. Still more than half of the diabetic population is declared to be undiagnosed. High infirmity and fatality rate by diabetes type 2 has lessened the caliber of life, IDF reports 5M deaths by the year 2015, likewise it casts a huge economic burden to check and cure the acute and chronic complications. Type II diabetes shows a direct alliance with complications, until then on identification. Firstly, there can be two or more indications of disorder or may be not any. It holds up the identification, aggregating the chance of comorbidities that are often chronic micro and macrovascular complications (Hussain *et al.*, 2013).

T2DM is highly contagious and fatal and it also decreased the expectancy of life to a great extent. According to IDF report in 2015, 5M deaths were caused by type 2 diabetes mellitus. It is because of complications in diagnosis and treatments. It causes huge economic burden on environment (Cho *et al.*, 2018). Macro vascular complications include heart diseases, cerebrovascular disorders and peripheral vascular disorders. In most cases patients die due to myocardial infraction and stroke (Herman *et al.*, 2012). Micro vascular complications include retinopathy, kidney disorders and nervous disorders. (Hussain *et al.*, 2013).

There is a need of proper management and early screening of both diabetes type because it will be a good outcome for the patients to fight this disease (Khanam *et al.*, 2011). Over weight and obesity are found huge risk indicators for Diabetes. Proper management and early screening of Diabetes type can be a good outcome for the patients to combat the diabetic complications .Age gender are also main risk factors increase the diabetic causes micro and macro vascular complications in patients. Obesity is also the major contributing factor for Diabetes.

Materials and methods

The research was carried out in field and laboratory to analyze various changes in blood diagnosed with diabetes mellitus. The methods and procedures for each experiment are given below.

Area and time of study

In the outpatient department of Iqbal diabetes Jampur district Rajanpur, a study was made.100 patients with diabetes mellitus were involved in this study. All of these patients had their first experience at this clinic for treatment and diagnosis. All patients were diagnosed according to international standards by WHO. These international standards include Fasting blood glucose greater than or equal to 7mmol/L and random plasma glucose greater than 11.2mmol/L, under drug treatment of diabetes for six months. All patients were the resident of same district and all were more than 18 years old Most patients belonged to low income families. Complications such as cardiovascular disorders, renal illness, retinopathy and nervous disorders were considered in this study because these complications developed after the diagnosis of type 2 diabetes mellitus. The history of all these patientys was taken to get information about their complications. All information taken from patients was intended to kept confidential. Medical history was taken to know if they had any heart disease or cerebrovascular disorders or another complication. More over urine tests and blood tests were also performed in registered and certified labs.

Collection of samples

The detail of methods used to assess different complications is as follows. All patients were tested to check blood glucose level by using standard and digital glucose meter. The average of these obtained values is calculated. The result showed, in fasting condition hyperglycemia was found to be greater than 126mg/dL. Blood pressure was also measured by using standard sphygmomanometer. Systolic pressure of 140mmHg and diastolic pressure of 90mmHg were found. All these patients were under treatment with antihypertensive drugs (Khanam *et al.*, 2011).

Diabetic retinopathy was also tested by using ophthalmoscope. Blood vessels of retina were examined. Medical history was taken if these patients had any cataract or laser treatment.

On the basis of serum creatinine glomerulas filtration rate was measured. Severe retinopathy was defined due to increase in serum creatinine levels. Creatinine levels of more than 3mg/dL and glomerulas filtration rate of less than 15ml/minute was found. Peripheral neuropathy was identified by using neuropathy disability score (Maniarasu *et al.*, 2017).

Data analysis

The obtained data were analyzed by statistical software SPSS v.21.A p-value less than 0.05 were taken as significance level and p value greater than 0.05 was not statistically significant. This software provided most accurate statistically results.

Results and discussion

Our study was done on 100 patients of diabetes included both gender with 68% are males and 32% are females. Patients ages reported 27% patients were along with -39 years, 25% were involving 40-49 years, 26% were included 59-60 years, 14% were along with 60-69 years and 8% were 70 and above along with 70 years old. The diagnosed patients with diabetes mellitus type at the age 30 were 3%, 30-39 years patients were 27%, patients above 40 were 25%, patients at 50 were 27% and after patients 60 were 10%. In this study 52% patients were found with diagnosed positively with disease diabetes family history, 35% patients reported as one diabetic parent and 4% had their family relationship with diabetes. 15% were reported in smokers who do smoking in past and 35% were 3% female smokers.

Table 1. Mean Values For Metabolic Risk Factors of Patients (N=100).

Parameters		Male					Female				
Profile		Mean	SD	T	p value	95% CI of difference		Mean	SD	T	p value	95% of CI of difference
Age		51.65	11.46	284.88	0	48.863	54.373	48	11.24	106.19	0	205.72
BMI (kg/m2)	25	27.7	5.21	24.53	0	90.202	91.475	29.3	5.51	86.67	0	156.63
Waist to Hip Ratio	M 90, F 80	90.94	2.5	67.06	0	177.01	208.37	84.87	3.46	29.35	0	42.454
FPG (mg/dl)	144	193	65.13	110.58	0	146.11	155.07	21.8	73.98	118.55	0	103.81
systolic BP (mmHg)	85	83	10.5	90.86	0	194.43	201.57	80	22.6	85.4	0	51.5
Diastolic BP(mmHg)	130	130	20.3	35.09	0	154.96	161.92	136	21.7	115	0	47.5
Cholesterol (mg/dl)	200	197.6	14.62	76.74	0	38.405	43.037	210	11.14		0.0003	155.8
Triglycerides (mg/dl)	150	158.11	14.23	6.64	0	107.21	112.94	161	10.68	4.91	0	0.2558
Low HDL (mg/dl)	130	40.5	9.57	0.34	0	0.2777	0.5164	45.7	8.68	4.91	0	0.2558
High LDL (mg/dl)	M 40, F 50	110	11.85	2.034	0.01	0.123	0.532	105	5.05	4.03	0	0.1698

Table 2 below shows metabolic comparison of mean values of various selected variables with set standard values that designed for risk factors in reaction of patients of diabetes mellitus type 2 diseases. These parameters were analyzed by using the statistical analytical test that included the one sample t-test.

The overall frequency of complications both gender included in study, male and female shown individual values. The mainly recurrent risk factor designed was higher level of sugar related to Hyperglycemia 86% accompany by several other factors 59% were high level of fat included in group of obese patients, 58% included other group, abnormal lipids.

Frequency of chronic complications related to microvascular was as follow: retinopathy frequency was 43%, neuropathy 60%; nephropathy Frequency was 36. Seventy five percent patients under diabetic medications, 10% were taken insulin in the form of injections and 15% were under assigned balanced diet. Incidence of triacylglycerol, total level of Cholesterol and higher rate of blood pressure seen higher in females.

Elevated triacylglcerol were seen in younger. Data is given in table 3 below values of HDL, LDL, TGL, neuropathy, systolic blood pressure.

Table 2. Occurrence of diabetes complications with respect to Gender.

Parameters	Gender			Chi square test
Metabolic risk factors	Overall %	Male	Female	p-value
FPG>144 (mg/dl)	86	83.8	90.6	Ns
TGL>150 (mg/dl)	68	60.3	84.4	0.016
HDL<40 male,<50female	70	67.6	75	0
LDL>130 (mg/dl)	57	47	78	Ns
Obesity (BMI>25)	59	55.9	65.6	0
Systolic HTN>130	90	89.7	90.6	0
Diastolic HTN>85	51	51.5	50	0.031
Total Chl.>200 (mg/dl)	36	27.9	53.1	0.014
Neuropathy	60	60.3	59.4	Ns
Retinopathy	43	42.6	43.8	ns
Nephropathy	36	39.7	28.1	ns
Stroke	5	7.4	0	Ns
CVD	6	7.4	3.1	Ns

Table 3. Frequency of Diabetes Complications according to Age.

Metabolic Risk Factors	Age Group		Chi square test
Parameters	< 40 Years	≥ 40 Years	p-value
FPG>144mg/dl	92.6	83.6	Ns
TGL>150mg/dl	85.2	61.6	0.025
HDL<40 male,<50female	63	72.6	Ns
LDL>130mg/dl	52	61.5	Ns
Obesity (BMI>25)	55.6	60.3	Ns
Systolic HTN>130mmHg	81.5	93.2	0.084
Diastolic HTN>85mmHg	37	56.2	0.089
Total Chl.>200mg/dl	37	35.6	Ns
Neuropathy	59.3	60.3	Ns
Retinopathy	29.6	47.9	Ns
Nephropathy	14.8	43.8	0.007
Stroke	0	6.8	Ns
Cardiovascular disease	11.1	4.1	Ns

Table 4. Frequency of Diabetes Complications according to Duration of Diabetes.

Risk Factors	Duration of Diabetes		Chi square test
Parameters	< 10 Years	≥ 10 years	P-value
FPG>144 (mg/dl)	84.4	91.3	Ns
TGL>150 (mg/dl)	71.4	56.5	Ns
HDL<40	67.5	78.3	Ns

Risk Factors	Duration of Diabetes		Chi square test
male,<50female			
LDL>130 (mg/dl)	57.2	72.1	0.056
Obesity (BMI>25)	54.5	73.9	0.097
Systolic HTN>130mmHg	89.6	91.3	Ns
Diastolic HTN>85	49.4	56.5	Ns
Total Chl.>200mmHg	37.7	30.4	Ns
Neuropathy	61	56.5	Ns
Retinopathy	40.3	52.2	Ns
Nephropathy	18.2	95.7	0
Stroke	1.3	17.4	0.002
CVD	6.5	4.3	Ns

In our current study more than 50% population indicated positive family Diabetes Mellitus type 2 history that showed a strong rise of the disease inherited in this locality. Furthermore, some other factor also contribute that lead to change in BMI included eating pattern, sleeping and lack of exercise that ultimately lead to develop the illness and its interrelated complications. About 3/4 of the diabetic patients showed poor glycemic control on their first visit to the OPD and moreover half of the diabetic population had diabetes for > 5 years. This study showed the great accountability of diabetes and its connected complications for > 5 years. A great number of diabetic patients was said to take exogenous insulin but only 10% of patients were used insulin therapy. It was also studied patients with diabetes dyslipidemia also had high concentration of triglyceride and low in HDL in India (Miah *et al.*, 2018).

In one study it is reported that macro vascular complication (coronary artery disease, peripheral arterial disease, and stroke) contribute 6% cardiovascular disease and 1% heart stroke out of 7%, it was comparatively less than the results of 18% of the diabetic patients to have macro vascular complications 12% CVDs problems and 6% strokes were found in another study (Ogurtsova *et al.*, 2015).

The Occurrence of neuropathy was 60% in all diabetic patients. A current study in India was conducted to measure the frequency of neuropathy that was 59% as in previous study. Out of 60% diabetic patient the prevalence of foot ulcer was almost 20% that was a high proportion.

This is due to undeveloped areas where health facilities are not provided and had poor life style. Medical facilities and instructions about the diabetic complication reduce the chances of peripheral neuropathy and foot wounds (Oliveira *et al.*, 2009). A high in cholesterol level, triglycerides, Hypertension and obesity was documented more prevalent in females than in male. In our recent study the occurrence of diabetic retinopathy and mental disorder was about 36% that was less than 40% in India. Diabetes complication also contributes to kidney disease. The normal working state of kidneys was determined by calculation that were based on the parameters of glomerular filtration rates by measuring urine test for micro albuminuria and serum-creatinine ratio. About 5% diabetic patients were diagnosed with end stage renal disease. Early diagnosis and proper treatment can cure the kidney failures. Triglycerides and hypertension increased progressively within increase of age but diabetes period had no noteworthy effect on these parameters, indicating that these risk factors emerged for short period of diabetes.

Conclusion

The diabetic complications disturbed overall metabolic process in patients suffering from especially type 2 diabetes. This study needs more healthcare centre with more facilities, proper laboratory testing and changing life styles. Modern screening methods for the diabetes must be designed with high level of quality standards helpful against chronic complications of diabetes. Research at advanced level should be needed with better methodology to combat a number of risk factors and the complications associated with diabetes.

Conflict of interest

The authors declared that there is no conflict of interest regarding the publication for this research. All authors contributed towards this clinical research.

References

Abougalambou S, Abougalambou A. 2015. Risk factors associated with diabetic retinopathy among type 2 diabetes patients at teaching hospital in Malaysia. Diabetes Metabolic Syndrome **9(2),** 98-103.

Chatterjee S. Khunti K, Davies MJ. 2010. Type 2 diabetes. Lancet. **389(10085),** 2239-2251.

Cho N, Shaw J, Karuranga S, Huang Y. 2018. IDF Diabetes Atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Research and clinical practice **138,** 271-281.

Herman WH, Zimmet PJ. 2012. Type 2 diabetes: an epidemic requiring global attention and urgent action. Diabetes Care **35(5),** 943-944.

Hussain S, Qamar MR, Iqbal MA, Ahmad A. 2013. Risk factors of retinopathy in type 2 diabetes mellitus at a tertiary care hospital, Bahawalpur Pakistan; Pakistan Journal of Medical Sciences **29(2),** 536.

Miah M, Yousuf M. 2018. Analysis the significant risk factors on type 2 diabetes perspective of Bangladesh; Diabetology and Metabolic Syndrome **24(5),** 111-116.

Ogurtsova K, Fernandes J, Huang Y, Linnenkamp U, Guariguata L. 2017. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040; Diabetes Research and clinical practice **128,** 40-50.

Oliveira A, Valente J, Leite I, Schramm J, Azevedo A. 2009. Global burden of disease attributable to diabetes mellitus in Brazil; Artizo **25(6),** 1234-1244.