ORIGINAL ARTICLE

To Evaluate the Level of Serum Cholesterol, Uric Acid, Urea, Creatinine and Urine Albumin in Diabetic Patients from Peshawar

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ABSTRACT
Diabetes Mellitus is a metabolic disorder that causes chronic hyperglycemia. Its progression may lead to the dysfunction of multiple organs such as kidneys, eyes, blood vessels and neurons. It is caused by a combination of two basic factors that are abnormal insulin secretion and sensitivity of tissues to insulin. Group of parameters were selected in this study that have some relation with diabetes mellitus which included serum uric acid, cholesterol, urea, creatinine and urine albumin. The aim of this study was to find the impact of diabetes mellitus on these parameters. The blood and urine samples were collected according to the recommended protocol. The biochemical parameters had been determined by Micro-lab 300 biochemistry analyzer and urine qualitative was performed through uric-v3 strips. A cross-sectional study was carried out by 105 diabetic subjects and their samples were collected from different laboratories of district Peshawar. The mean age was 44 ± 12.54 years and samples were comprised of 50.48%male and 49.52% females. According to our findings among 105 diabetic patients 29% had elevated uric acid, 69% cholesterol, 57% urea, 39%creatinine and 40% urine albumin levels respectively. The overall result concluded that these parameters must be considered or taken seriously to monitor and to limit its progression to irreversible changes.
Keywords: cholesterol, creatinine, diabetes mellitus, nephropathy, serum urea, uric acid, urine albumin.

INTRODUCTION
Diabetes mellitus (DM) is a metabolic disorder that causes chronic hyperglycemia (1,2,3). It is linked with longstanding damage, and failure of many organs, predominantly the kidneys, nerves, heart, and blood vessels (4). DM is mainly classified into diabetes mellitus Type I, diabetes mellitus Type II and gestational diabetes. This abnormality is mainly caused by two basic factors that includes abnormal insulin secretion and sensitivity of tissues to insulin (5). In a 24-hour period, the normal arterial plasma glucose level is 100mg/dl. The level of glucose rises up to 150–165mg/dl after eating a meal and falls to 55mg/dl after moderate exercise or fasting (2).

Diabetes mellitus can lead to many complications that causes devastating changes in the body and apparently, those changes are irreversible. It may increase mortality and morbidity among the diabetic patients (2,3). These include macrovascular and microvascular complications (1,3). There are some blood and urine parameters that should be monitored such as uric acid, urea, creatinine, cholesterol and urine albumin to avoid further complications because, all of these have a relation with diabetes mellitus.

Uric acid (UA) is the final product of the purine catabolism (6). While UA has been linked to kidney illness and articular gout, recent research has shown that it could also be connected to cardiovascular (CV) disorders (6,7,8). It also has some connection with metabolic disorders such as diabetes mellitus. Uric acid and diabetes are closely associated (9). High levels of UA may distress the liver, insulin sensitivity and insulin clearance. Poor lipid metabolism in people with higher UA levels may increase fasting and postprandial insulin levels (10). It also decrease glomerular filtration rate and skeletal muscle insulin sensitivity (11).

Urea is the breakdown product of purine metabolism synthesized in the liver which is excreted out in the urine. While, creatinine is a chemical compound left over from energy producing processes in your muscles. Serum urea and creatinine are two Important indicators used in the diagnosis kidney diseases (12). Since, uncontrolled diabetes mellitus advances to diabetic nephropathy. Due to the high blood sugar, the blood vessels of the kidneys are affected that causes the abnormality in glomerular filtration rate (GFR). Once the GFR is affected, it will not allow the urea and creatinine to be filtered out normally (12,13).

Albuminuria is one of the important indicator for the progression of kidney disease (14). Albumin is a serum protein, with a size considerably larger than the pores of the glomerular filtration membrane, so albuminuria is best known as a biomarker of glomerular dysfunction(15,16). Since, high blood sugar causes defect in GFR. It can develop albuminuria, and some studies have suggested a significant link between DM and albuminuria (15,17).

Cholesterol is a waxy substance found in our body. Increased level of cholesterol causes many pathological conditions such as diabetes mellitus, hyper tension and heart disease (18).There is a significant link between diabetes mellitus and cholesterol (19,20). Several observations suggests that the accumulation of cellular cholesterol may lead to pancreatic β-cell dysfunction (19). The lipid abnormality is linked with the accumulation of fatty acids and cholesterol in pancreatic β-cells which may contribute to the defect in the pancreatic islets.(19,21).

METHODS AND MATERIALS
In this study, total 105 diabetic samples were randomly collected from different laboratories in district Peshawar. It comprised of 53 males and 42 females aged 20-75 years. These patients were classified into 11 age groups, with 5 years in each group. The samples were collected during 25 April to 30 June 2022. Venous blood was collected from the patients by proper aseptic technique. Urine samples from the same subjects were collected in a sterile urine bottle. The samples were transferred to MLT Skill Lab 1 of Abasyn University in an ice container to prevent deteoriation and contamination. For the authenticity of the study, these samples were re-tested for glucose level. The estimation of glucose was done by glucose oxidase peroxidase (GOD-POD) method. The modified Jaffe's method was used to quantify creatinine, while the Urease-Berthelot method was used to assess urea. The measurement of uric acid was done using the uricase technique. Cholesterol was also measured using the peroxidase method on the 300-semi automated clinical chemistry analyzer. Urine albumin was estimated by the uric 3v dipstick method.

The normal ranges of the biomarkers are given below:
Random blood glucose: 80– 160 mg/dl
Uric acid: 3.4– 4.0 mg/dl in males and 2.4 - 5.7 mg/dl in females
Cholesterol: 100 – 200 mg/dl
Urea: 10–50 mg/dl
Creatinine: 0.5 – 1.5 mg/dl

The mean values and standard deviation for serum urea, creatinine, uric acid, cholesterol, glucose and urine albumin levels were calculated with MS Excel software.

RESULTS
Gender wise distribution: Total 105 diabetic patients were

recruited for this study aged 20-75 years. It comprised of 50.48% of males and 49.52% of females as shown in the given pie chart Figure 1.0.
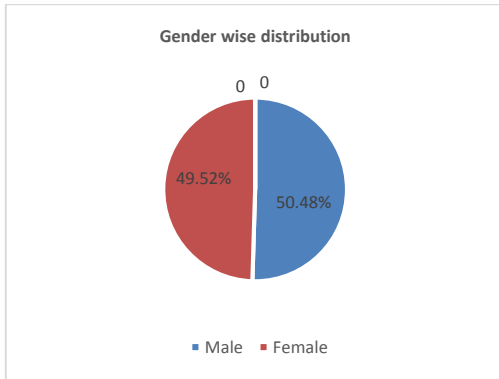

Figure 1.0: Gender wise distribution among 105 patients.

The Mean and (± S D) of the parameters were calculated with MS Excel, which is shown in the table (1.0).

Table 1.1: The mean and standard deviation of age, sugar, urea, creatinine, uric acid, cholesterol and urine albumin

Parameter	Mean	Standard Deviation
Age	44	± 12.54
Random Blood sugar	259	± 89.4
Urea	35	± 14.72
Creatinine	1.2	± 0.52
Uric acid	4.4	± 1.32
Cholesterol	212	± 72.54
Urine Albumin	0.5	± 0.80

Table 1.2: Age wise distribution among 105 diabetic samples that were collected randomly

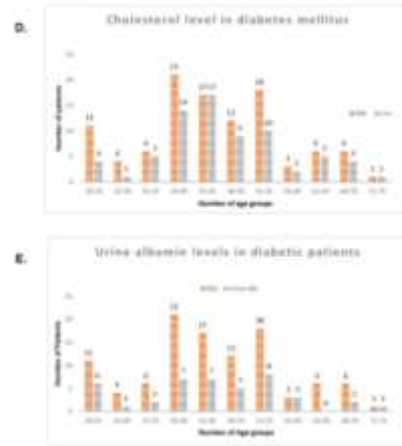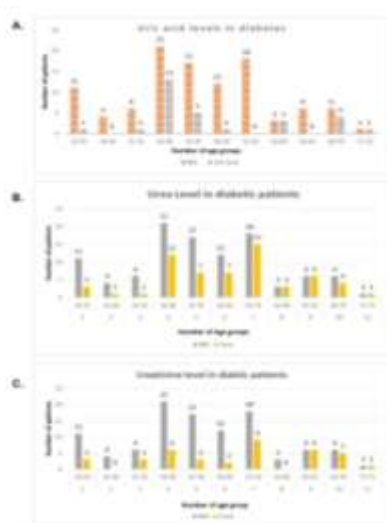| #	Age (Years)	Male	Female
1	20-25	7	4
2	26-30	2	2
3	31-35	1	5
4	36-40	10	11
5	41-45	11	6
6	46-50	7	5
7	51-55	8	10
8	56-60	2	1
9	61-65	4	2
10	66-70	1	5
11	71-75	0	1

Figure 1.1: shows the elevation of level of uric acid, urea, creatinine, cholesterol and urine albumin with increase of blood sugar and age. The x-axis in the graph shows the number of age groups and the y-axis shows the number of patients. (A) The level of uric acid was found elevated in the age group of 36-40 years and about 28% of diabetic patients had elevated uric acid. The lowest elevation was recorded in the age group of 71-75 years. (B) Urea was found 57% elevated in the diabetic patients. The highest elevation was recorded in 51-55 years of age group. With the increase of age, the patients were having high urea and high blood sugar. (C) Creatinine level was found high 36% in diabetic patients. The highest elevation was recorded in 51-55 years of age group as it is increasing with age. (D) Total 69% of the diabetic patients had elevated cholesterol level. The highest elevation was recorded in 41-45 years of age group, consisting of 18 patients having high blood sugar and cholesterol level. (E) The final result of urine albumin showed that out 105 patients, 40% patients had high urine albumin levels. The lowest elevation was recorded in 71-75 years of age group

Age wise distribution: The diabetic patients were segregated in 11 groups as shown in the table (1.2). It starts from 20-25 years having 11 patients. The age group of 36 to 40 years old had the maximum number of patients (21), while 71 to 75 years old had the lowest number of patients (1).

DISCUSSION

Diabetes mellitus(DM) is a series of metabolic illnesses characterized by chronic hyperglycemia. The main causes of DM includes, abnormal insulin secretion and poor sensitivity to insulin. It can progress to the damage of several vital body organs such as kidneys, eyes, nervous system, and peripheral system. The major symptoms are polyuria, polydipsia, polyphagia, and glycosuria. Several blood and urine indicators that are affected by diabetes mellitus includes urea, creatinine, uric acid, cholesterol, and urine albumin.

For this study, a total 105 diabetic patients were recruited whose age rangingfrom20 to 75 years. It was comprised of 49.52 % women and 50.48% men. The patients were segregated in 11 groups to minimize physiological differences. The present study claims that out of 105 samples, 69% of diabetic subjects had elevated cholesterol levels. The highest elevation was observed in 41-45 year of age group. A study by Zheng et al, on 1460 diabetic participants aged 55 or above claims a high prevalence 77% of Triglycerides and cholesterol levels in diabetic patients (23). In addition, Cheng et al, found that among 10741 individuals, 27% of women and 17% of men had high triglycerides and cholesterol together with diabetes mellitus (21). The sample size and sample selection is the only variation the current study faces. Prior studies and the current study have led to the conclusion that as people get older, the effects of diabetes mellitus have a greater impact on their cholesterol levels.

In the present study, 28% of diabetic patients have shown increased uric acid level. The highest elevation was recorded in 36-40 years of age group diabetic patients. A study conducted by

Singh et al, on 50 hospitalized diabetes patients between the ages of 35 and 60 revealed that hyperuricemia was common in (46%) type 2 diabetic individuals (16). Samples size in the prior study was 50 diabetic patients while the present study recruited 105 diabetic patients.

According to our findings, 57% subjects have been found with increased serum urea levels and 36% with elevated serum creatinine levels. The highest elevation of urea and creatinine was found in 51-55 years of age group. A study conducted by Mishra et al, on 50 diagnosed cases of diabetes mellitus aged 35-65 years and claimed that serum urea and serum creatinine were significantly increased with the increasing duration of diabetes (24). Elevated Serum urea and creatinine levels are the predictors of renal impairments in diabetic patients. Effective blood glucose management can halt the development of diabetic nephropathy and significantly lower the morbidity and mortality rates linked to this chronic complication (12).

Another study conducted by Azzez et al on 30 diabetic patients, ranging in age from 40 to 72 years in General Musul Hospital, Musul, Iraq. Urea and creatinine were more common in older people, with prevalence rates of 16.6% and 33.3%, respectively(25).In this present study, the age group of (50-55) years was mostly affected. The findings in this study and earlier ones indicate that diabetes mellitus progresses to renal failure and develops diabetic nephropathy.

According to the study, out of 105 samples, (40%) of patients had raised urine albumin. The highest elevation was recorded in 51-55 years of age group patients. The study carried out by Pavkov et al, showed (42%) of microalbuminuria in 195 diabetic participants which is almost similar to our findings and endorse our findings (22). A study Shih et al, (15) reported the prevalence of albuminuria in 97% out of 460 type 2 diabetic patients whose age ranges from 65-91 years. The adult age group was more prone to diabetic nephropathy because of the impairment of renal function (15).

CONCLUSION

The findings of our study concluded that, diabetes has a substantial relationship with serum cholesterol, uric acid, urea, creatinine, and urine albumin. These parameters should be frequently evaluated to prevent any irreversible changes in the body since DM produces significant and irreversible alterations to the body that can lead to the failure of various vital bodily organs.

For individuals with DM, increased physical activity, dietary changes, stress management, and better sleeping habits are all strongly advised. Maintaining stable blood sugar levels is essential for patients to avoid developing nephropathy. This study provides an opportunity to diabetic patients to monitor these vital parameters regularly to avoid progression and complication. The study should be performed on large population to get more accurate information

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