# Elevated serum uric acid and triglycerides level in the patients with Type II Diabetes Mellitus- a Nepalese case control study

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**Abstract**

BACKGROUND

Hyperuricemia is associated with type 2 diabetes, which is a metabolic disorder of multiple etiologies resulting from defects in insulin action. The present study wascarried out to look for any association between uric acid and Type II Diabetes Mellitus and also status of triacylglycerol level among those patients.

METHODS

The blood samples were collected 100 diabetic and 100 non-diabetic individuals in the department of biochemistry and then analyzed for estimation of blood glucose, Uric Acid and Triacylglycerol level.

RESULTS

The average level of serum uric acid in diabetic patients was higher (5.706±1.617) in comparison to non diabetic subjects (4.322±0.784) with statistically significant difference ($p \leq 0.05$). For female the result indicate there was a positive correlation between (FBS and triglycerides) and (triglycerides and uric acids) which was statistically significant ($r$ =-0.465, $n$ = 41, $p$ = 0.002) and($r$ =-0.370, $n$ = 41, $p$ = 0.017) respectively.

CONCLUSIONS

This study documents that hyperuricemia is associated with type 2 diabetes mellitus. Furthermore, the serum triacylglycerol and serum uric acid is also found to be associated risk factors for diabetic complications. Hence, timely diagnosis and management of diabetes is vital to control the complications related to diabetes.

**Key words:** Hyperuricemia, Hypertriglyceridemia, Type 2 Diabetes Mellitus

## Introduction

Diabetes mellitus is one of the most common metabolic disorders affecting a large proportion of population worldwide (1). The term diabetes mellitus describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. The decreased uptake of glucose into muscle and adipose tissue leads to chronic extracellular hyperglycemia which results in tissue damage and various vascular complications (2) including nephropathy, diabetic foot, and micro and macro vascular disease as a consequence of atherogenesis (3).

Uric Acid (UA) is the final oxidation product of purine metabolism generated during enzymatic degradation hypoxanthine and xanthine (4). Hyperuricemia is arbitrarily defined as a serum UA concentration in excess of 7.0 mg/dl in men and 6.0 mg/dl in women. Hyperuricemia may occur from excessive production of urate (overproduction) or decreased elimination (under excretion), and frequently a combination of both processes occur in the same patient (5).Hyperuricemia, the precursor of gout, is strongly associated with insulin resistance syndrome, an established risk factor for Type II diabetes (6), cardiovascular disease and also play a role in the development of renal and metabolic diseases in diabetic patients (7).

Type II diabetes mellitus is one of the most frequent metabolic disorder globally. According to recent data of IDF for Nepal in 2014, 4.6% of the total adult populations are diabetic, i.e7, 00,000 people are affected by diabetes. Hyperuricemia is a common finding in Type II diabetes mellitus adding to the morbidity and mortality of these patients (3). It has also been hypothesized that hyperuricemia might be a risk factor for the development of Type II diabetes, but the casual association between hyperuricemia and Type II diabetes remains controversial. The major objective of this study was to find out the association of serum uric acid level with Type II diabetes mellitus in individuals attending a tertiary care community hospital in central Kathmandu.

## Materials and Methods

A descriptive cross sectional study was carried out among 200 patients in department of biochemistry MMCH from Feb 2015 to July 2015. The blood samples were collected by asceptic technique with avoidance of hemolysis as far as possible from diabetic patients by standard venipuncture method. The methods for the collection and analysis were followed as described by Standard Operating Procedure (SOP) provided. Blood samples were allowed to clot for 15 minutes and then centrifuged for 10 minutes at 3000 rpm. The separated serum was then processed for estimation of blood glucose by GOD-POD method, Uric Acid by Uricase-PAP method, Triacylglycerol by GPO-PAP method and Creatinine by Jaffe's method in a semi-automated analyzer (Statfax 3300).

### Statistical analysis

The study data was analyzed by using SPSS program to compute descriptive parameters including mean and frequencies, and inferential statistics was used including student's t test to test the significance of the differences between the mean values of two continuous variables and Chi-squire test ($X^2$) test the difference in proportions categorical variables between two groups. The level of confidence ($P$<0.05) was considered as cutoff value for significance.

## Results

Diabetic (study group) and non diabetic (Control group) were enrolled in this study. For each group 100 subject (59 male and 41 female) were selected. The mean age of the study subjects was 54 ±13 years (range 25-78) and 54 ±12 years for control group with no statistical significant difference, P= 0.837. FBS, PPS, Uric acid and Triglycerides were studied to assess the association of uric acid and triglycerides level with the blood glucose concentration in diabetic patients.

Table1 shows the statistics of biochemical parameters computed for study and control groups which point out that (FBS, PPS, Uric acid and Triglycerides) results were found to be (133.2±44.9 and 84.0±12.4,), (184.3±61.9 and 106±11.4) and (5.7±1.6 and 4.3±0.8) , (163±75.4 and 117±25.6) respectively with statistical significance P< 0.001 for all parameters.

Table 2 shows that male and female mean age was (55±11, 53±14) with no statistical significance difference, P= 0.308. In addition, the results of studied biochemical parameter were compared between male and female which found to be FBG (125.8±38.7and 143.8.0±51.2, P=0.054), PPS (176.6±55.2and 175.4±69.6, P= 0.193), uric acid (6.0±1.5and 5.3±1.7, P=0.049) and triglycerides (174.0±84.3and 147±57.8, P=0.091) respectively, with statistical significant difference in uric acid comparison result.

Table 3: shows that percentage of abnormal result within study group for male and female was found to be FBS (71% and85%, P=0.097), PPS (83% and76%, P=0.360), uric acid (20% and22%, P=0.842), triglycerides (47% and44%, P=0.725) respectively, with no statistical significance difference.

Table 4: shows that percentage of abnormal result within study group for male and female base on the age category (< 40 year and > 40 year). For the less than 40 years the result shows that there is no statistical significance difference between male and female except in PPS as it was found to be FBS (10% and17%, P=0.322), PPS (6% and23%, P=0.030), uric acid (17% and0%, P=0.197), triglycerides (14% and22%, P=0.488) respectively. The association between less and more than 40 years between gender types was depicted in (figure 1,2).

Correlation was run to determine the relationship between uric acid, triglyceride and gender type's age. For male the result indicate there was only a negative correlation between age of diabetic male and triglycerides, which was statistically significant ($r$ =-0.259, $n$ = 59, $p$ = 0.048). This correlation is depicted in (figure 3).

For female the result indicate there was a positive correlation between (FBS and triglycerides) and (triglycerides and uric acids) which was statistically significant ($r$ =-0.465, $n$ = 41, $p$ = 0.002) and($r$ =-0.370, $n$ = 41, $p$ = 0.017) respectively. These correlations are depicted in (figure 4 and 5) respectively.

**Table 1:** Statistics of studied parameters in the study and control groups

| Parameters | Study group (n=100) | Control group(n= 100 ) | P- value |
|---|---|---|---|
| *Age, years* | | | |
| Means ± SD | 54±13 | 54±12 | 0.837 |
| Range | 25-78 | 26-77 | |
| *FBS* | | | |
| Means ± SD | 133.2±44.9 | 84.0±12.4 | <0.001 |
| Range | 60-306 | 61-110 | |
| *PPS* | | | |
| Means ± SD | 184.3±61.9 | 106±11.4 | <0.001 |
| Range | 90-356 | 74-130 | |
| *Uric Acid* | | | |
| Means ± SD | 5.7±1.6 | 4.3±0.8 | <0.001 |
| Range | 2.8-10.7 | 2.2-5.9 | |
| *Triglycerides* | | | |
| Means ± SD | 163±75.4 | 117±25.6 | <0.001 |
| Range | 79-455 | 76-200 | |

P value based on Student's t-test: significant at (p< 0.05)

**Table2:** Comparison of studied parameters between gender types within study group

| Parameters | Male (n=59) | Female(n= 41 ) | P- value |
|---|---|---|---|
| *Age, years* | | | |
| Means ± SD | 55±11 | 53±14 | 0.308 |
| Range | 25-78 | 25-77 | |
| *FBS* | | | |
| Means ± SD | 125.8±38.7 | 143.8.0±51.2 | 0.054 |
| Range | 70-287 | 60-306 | |
| *PPS* | | | |
| Means ± SD | 176.6±55.2 | 175.4±69.6 | 0.193 |
| Range | 90-319 | 95-356 | |
| *Uric Acid* | | | |
| Means ± SD | 6.0±1.5 | 5.3±1.7 | 0.049 |
| Range | 2.9-10.4 | 2.8-10.7 | |
| *Triglycerides* | | | |
| Means ± SD | 174.0±84.3 | 147±57.8 | 0.091 |
| Range | 82-455 | 79-288 | |

P value based on Student's t-test: significant at ($p< 0.05$)

**Table 3:** Percentage of abnormal parameters values and association with gender within study group

| Parameters | Male (n=59) | | Female(n=41) | | X2 | P- value |
|---|---|---|---|---|---|---|
| | Normal | Abnormal | Normal | Abnormal | | |
| FBS | 17 | 42(71%) | 6 | 35(85%) | 2.74 | 0.097 |
| PPS | 10 | 49(83%) | 10 | 31(76%) | 0.84 | 0.360 |
| Uric Acid | 47 | 12(20%) | 32 | 9(22%) | 0.04 | 0.845 |
| Triglycerides | 31 | 28(47%) | 23 | 18(44%) | 0.12 | 0.725 |

*P value based on chi squire test ($p< 0.05$) significant*

**Table 4**: Percentage of abnormal parameters values and association with age within study group

| Parameters | Less than 40 year | | More than 40 year | | X2 | P- value |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | | |
| FBS | 4(10%) | 6(17%) | 38 (90%) | 29 (83%) | 0.98 | 0.322 |
| PPS | 3(6%) | 7(23%) | 46 (94%) | 24 (77%) | 4.70 | 0.030 |
| Uric Acid | 2(17%) | 0(0%) | 10 (83%) | 9 (100%) | 1,65 | 0.197 |
| Triglycerides | 4(14%) | 4(22%) | 24 (86%) | 14 (78%) | 0.48 | 0.488 |

*P value based on chi squire test ($p< 0.05$) significant*

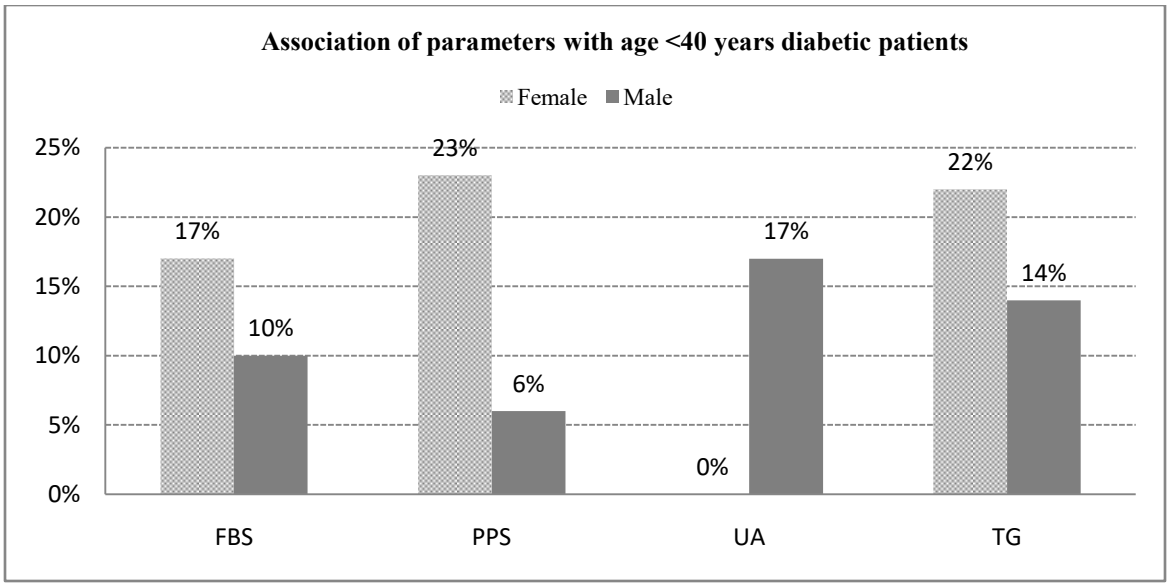


**Figure1:**Association of abnormal result with < 40 years diabetic patients' gender

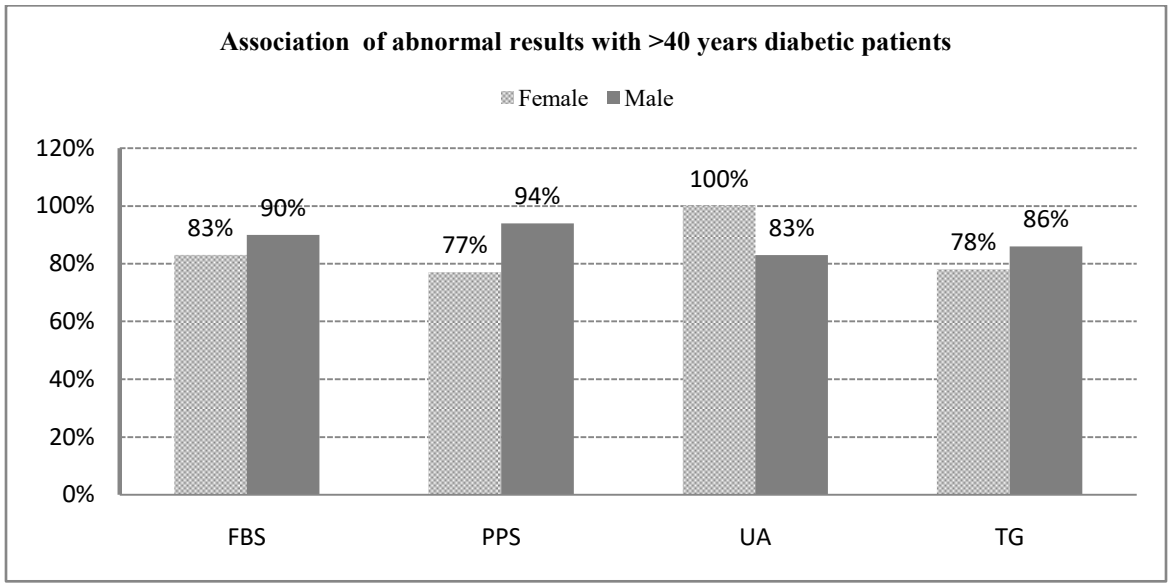


**Figure2:** Association of abnormal result with >40 years diabetic patients' gender

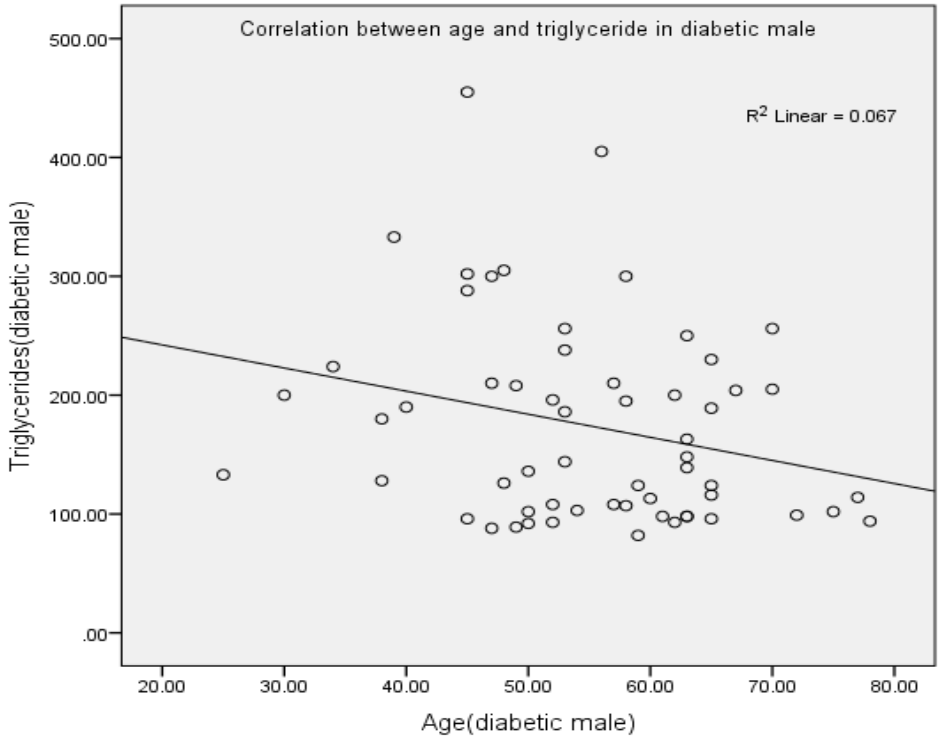


**Figure3:** Correlation between age and triglyceride in diabetic male

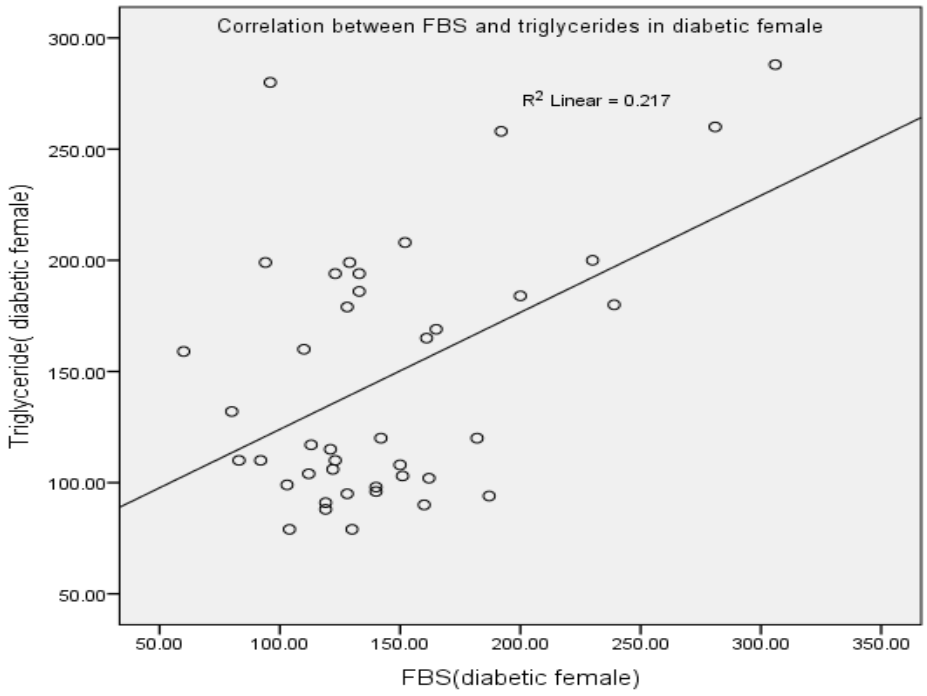


**Figure4:** Correlation between FBS and triglyceride in diabetic female

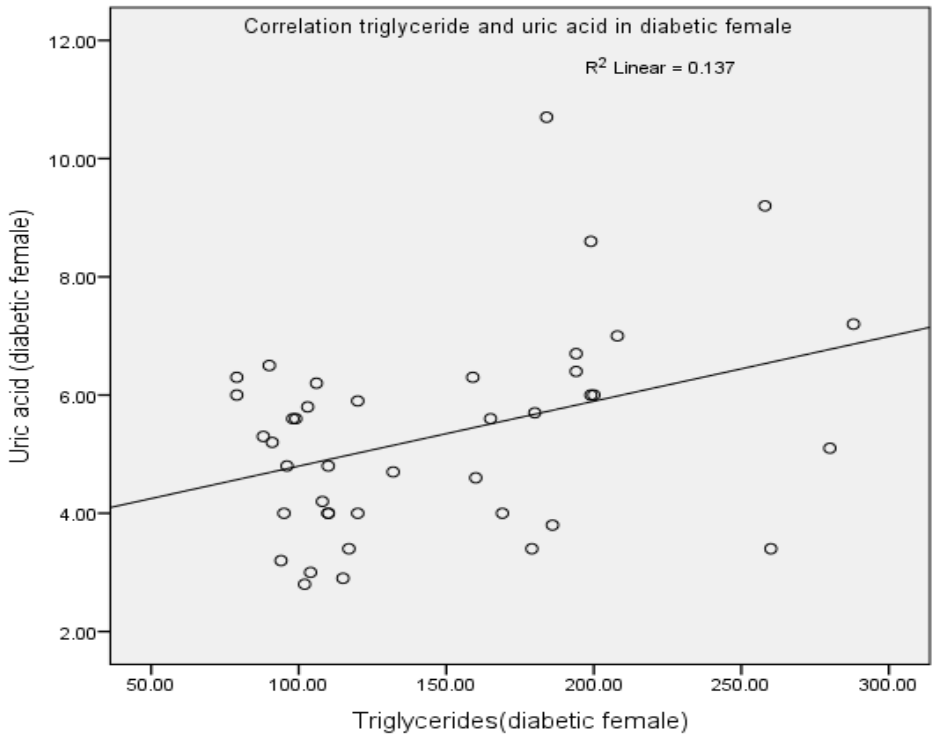


**Figure5:** Correlation between triglyceride and uric acid in diabetic female

**Discussions**

Serum uric acid is usually overlooked as a potential marker of diabetic metabolic status and insulin secretion estimation. In the medical literature, there are some studies which have proved a positive association between serum uric acid and development of type-2 diabetes. [**8,9**]. Type 2 diabetes mellitus patients have insulin resistance. Higher levels of serum insulin may decrease uric acid clearance by kidneys causing hyperuricemia, the mechanisms behind this association remains obscure. The most conceivable hypothesis is that this occurs at the renal level. Renal tubular function is influenced by hyperinsulinemia, and urinary uric acid clearance decreases with decreasing insulin mediated glucose disposal. Thus, decreased uric acid excretion leads to hyperuricemia [**10,11].**

This study was designed to evaluate the association of uric acid and triglyceride in Type-2 Diabetes patients. To achieve this aim, 100 diabetic patients and 100 controls samples wereanalyzed. The finding of this study demonstrate that FBS, PPBS, uric acid and triglyceride were statistically significant in diabetic patients than in controls, with P values of <0.001 in all cases.

However, there were no significant differencebetween groups according to the sex distribution and age. It was noticed that serum uric acid is positively associate with diabetes mellitus. The association was more relatively significant in female diabetics group. Our study noticed that there were positive correlation noticed between FBS&triglyceride ($r$ =-0.465, $n$ = 41, $p$ = 0.002) and uric acid and triglyceride ($r$ =-0.370, $n$ = 41, $p$ = 0.017) infemale diabetic group. These findings are similar to that reported by different research workers [**12,13,14**].

The age group 50-59 year had the highest frequency with 28% of total diabetic people. The distribution of male was highest in age group 50-59 with 32% of the total male population while the distribution of female was equal in age group 40-49, 50-59 and 60-69 with 22% of the female population in each group.The fasting blood glucose level was 133.160±44.914 and 83.970±12.414 and the post prandial blood glucose was 184.320±61.863 and 105.950±11.426 in diabetic and control group respectively. The mean value of uric acid was 5.706±1.617 in diabetic subjects whereas 4.322±0.784 in the non diabetic control group. The difference of mean value of uric acid in diabetic group and control is statistically significant (p<0.05)

and was found that uric acid was positively associated with Type II diabetes mellitus. The data also shows that the uric acid levels are higher in male group in both diabetic and control subjects as expected. This study shows the findings similar to the findings given by Safi *et. al.*(3) which reported the average level of serum uric acid in female patients to be 5.63 mg/dl as compared to 4.31mg/dl in female control group whereas in male, the uric acid level was reported 6.60 as compared to 5.18 mg/dl in the control group. A cohort study also reported higher uric acid level in male group than in female group, 6.2 ±1.1 mg/dL vs. 4.4 ±1.1mg/dL, respectively**[15]**.The main reason behind lower uric acid levels in female group may be due to estrogen-induced elevation in the fractional excretion of uric acid**[15]**. Hence, the variations in uric acid level may be due to gender-dependent differences in the range of uric acid.

The overall prevalence of hyperuricemia is 28% which is comparable with the results obtained by a study conducted in Nigeria who reported the prevalence rate to be 25%**[7]** and also with a study conducted by Ito H. in Japan who reported the prevalence to be 25%(9).Hyperuricemia in diabetes mellitus II is also shown by other various studies [16,17,18].In contrast to these findings, some researchers have also shown negative association between uric acid and diabetes. Cook et al explained higher mean serum uric acid values in prediabetic patients than in recently diagnosed diabetics and lower values in diabetics. The negative association could be due to the increased excretion of uric acid during hyperglycemia and glycosuria [19].

In this study, triacylglycerol was increased in 46% of the total diabetic people. The results are similar with those given by the study of A. Jalal who reported the prevalence rate to be 48.5%(3). A. Ogbera compared the prevalence of increased triacylglycerol level in normouricemic and hyperuricemia subjects and the prevalence rate was 12% and 21% respectively(7). Additionally some studies proposed that hypertriglyceridemia reduces renal excretion of UA and decrease in triglyceride levels is accompanied with increased urinary uric acid level [20, 21, 22].

**Conclusions**

This study documents that higher level of serum uric acid is associated with type II diabetic condition. It was found positively associated with the individuals who are previously diagnosed with diabetes mellitus. It was also clear from this study that serum triacylglycerol and serum uric acid are positively associated risk factors for complications associated with diabetes mellitus. It is now very important to control the diabetic related complications to manage diabetes in health care setting. Timely diagnosis of hyperuricemia in diabetic patients would be a significant benefit for the effective care for those patients. Although there are some controversial issues regarding effective treatment of hyperuricemia in diabetes, steps can be taken to manage and provide the productive life for the diabetic patients.

**Conflict of Interest**

There is no any conflict of interest.

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