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Clinical Status of Patients with Type 2 Diabetes Patients at the Time of the Diagnosis

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Abstract **Original Research Article**

***Background*:** Since patients with type 2diabetes are frequently misdiagnosed, provided inappropriate management, or poorly controlled, it is important to comprehend the wide range of clinical signs and symptoms associated with diabetes. Therefore, this study evaluated the overall clinical manifestations of patients with type 2 diabetes patients at the time of the diagnosis. ***Methods*:** This cross-sectional analytical study, conducted from January 2019 to December 2019, was a collaborative effort between the Department of Physiology at Rajshahi Medical College and Diabetic Association Hospital in Rajshahi. The primary aim was to investigate diabetes mellitus (DM) among patients presenting clinical symptoms suggestive of DM at the hospital's outpatient department (OPD). Following initial assessment, patients underwent an oral glucose tolerance test (OGTT) for definitive diagnosis. Once DM was confirmed, subjects were meticulously screened based on specific inclusion and exclusion criteria. Study group A comprised 80 diabetic subjects, while study group B included an equal number of age- and sex-matched non-diabetic subjects, drawn from hospital staff, patients' relatives, and volunteers, resulting in 80 participants in each group. ***Results*:** The study findings showed that overall mean age of the respondents were 52.61±7.70 years and majority were female. In DM2 group among all, a little higher of 4/5th (85%) of the respondents were non smoker and 4/5th (80%) were non tobacco user. Among the respondents only 4 of them were alcoholic. In DM group, the mean SBP was 128.88 mm HG with SD of 10.93 and the mean DBP was 78.25 with SD of 10.70. Plus, according to the measured systolic blood pressure 39 of the respondents belonged to normal, 95 showed prehypertensive and 26 showed hypertensive systolic blood pressure were found DM2 group. Besides that, high level of serum creatinine and serum uric level are seen in DM2 group comparing healthy group. ***Conclusion*:** This study concluded that women are mostly affected with type 2 DM. The presence of comorbidities such as abnormal level of fasting blood sugar & impaired fasting sugar, high mean serum urea level and serum creatinine significantly increased the probability of developing type 2 diabetes in both genders.

Keywords: comorbidities, gender, frequent urination, type 2 diabetes.

INTRODUCTION

Over the last few decades, there has been a significant global increase in both the burden and prevalence of diabetes mellitus (DM). According to current reports, it is projected that by the year 2045, more than 629 million individuals between the ages of 20 and 79 will be afflicted with diabetes [1]. Shockingly, every 8 seconds, a person succumbs to diabetes, resulting in an estimated four million worldwide deaths in 2017 [1]. Remarkably, a staggering 80 percent of diabetics call lower- and middle-income nations their home. In these populations, the incidence and prevalence of DM, once considered a rarity in Africa, are skyrocketing. Among these patients, Type 2 diabetes holds the highest prevalence [2]. It was originally anticipated that by 2025, the majority of the world's diabetic population would reside in developing countries due to rising life expectancy, an aging populace, and urbanization on the rise. Consequently, the long-term ramifications associated with diabetes will continue to impact both individual and community health in these regions [3].

Diabetes does not discriminate based on age or socioeconomic status. It is characterized by hyperglycemia resulting from an absolute or relative

insulin deficiency. There are two distinct subtypes: type 1, also known as insulin-dependent diabetes (IDDM), and type 2, referred to as non-insulin-dependent diabetes (NIDDM). In 2000, the global incidence of type 2 diabetes stood at 171 million, with projections suggesting this number will swell to 366 million by 2030 [4].

Overall, men are more predisposed to diabetes than women, although women are more prone to type 2 diabetes [5]. The gender disparity in diabetes incidence shifts according to the reproductive stage: more men develop diabetes before puberty, whereas women are more likely to develop it after menopause and later in life. In this study our main goal was to evaluate the clinical status of type-2 diabetes in at the time diagnosis in Bangladesh.

OBJECTIVE

To assess the clinical status of type-2 diabetes in at the time diagnosis in Bangladesh.

METHODOLOGY

This cross-sectional analytical study was conducted between January 2019 and December 2019 in collaboration between the Department of Physiology at Rajshahi Medical College and Diabetic Association Hospital in Rajshahi. The primary objective was to investigate diabetes mellitus (DM) among patients attending the hospital's outpatient department (OPD) with clinical symptoms suggestive of DM. Patients were then subjected to an oral glucose tolerance test (OGTT) for definitive diagnosis. After confirmation of DM, subjects were screened based on specific inclusion and exclusion criteria. A total of 80 diabetic subjects were included in study group A, and an equal number of age- and sex-matched non- diabetic subjects (comprising hospital staff, patients' relatives, and volunteers) were recruited as study group B, resulting in a sample size of 80 in each group. Consecutive purposive sampling was employed during sample selection. Prior to inclusion in the study, formal informed written consent was obtained from all participants after explaining the study's title, objectives, procedures, potential benefits, and risks. Participants were assured that their participation would not yield financial benefits and would not hinder their ongoing treatment. They were also informed of their right to withdraw from the study at any time. Confidentiality of their data was emphasized, and it was clarified that data would only be used for research and educational purposes.

During interviews with the participants, various demographic and medical information, including age, sex, disease duration, social status, economic status, educational background, medical history, and treatment regimen, were collected. Blood samples were collected to measure blood sugar, serum urea, and serum creatinine levels. Blood sugar was quantified using the GOD–POD method, while creatinine and urea levels were determined using the modified Jaffe's method and Urease-Berthelot's method, respectively. Data were recorded in a pre-designed case record form by the researcher. After data collection, statistical analysis was performed using SPSS software.

Data were checked for consistency, and normality was assessed using the Kolmogorov–Smirnov test. Continuous variables were presented as mean ± standard deviation, while qualitative variables were expressed as frequencies and proportions. For normally distributed data, Student's t-test was used to compare means between two groups, while the Mann–Whitney test was applied for skewed data. Proportions were compared using the Chi-square or Fisher's exact test, as appropriate. All statistical tests were two-sided, and a significance level of $p < 0.05$ was considered for statistical significance.

RESULTS

Table-1 shows age distribution of the patients where among diabetic patients 2/5th (38.75%) were in 40-49 years, 2/5th (41.25%) were 50-59 years old and only one fifth (20.00) of them were in ≥ 60 years age group. Almost similar pattern of age distributions found among healthy adults group. Mean age of the newly diagnosed DM patients were 53.05±8.14 years and healthy adult group the mean age were 52.16±7.25 years. The overall mean age of the respondents were 52.61±7.70 years. There were no significant age difference between the groups (P >.05) and mean age difference were also not significant (P>0.05).

Table 1: Age of the patients (n=160)

Age (In years)	DM (n=80) No. (%)	Healthy adults (n=80) No. (%)	Total (n=160) No. (%)	p-value
40-49	31 (38.75)	32 (40.00)	63 (39.40)	0.921
50-59	33 (41.25)	34(42.50)	67 (41.90)	
>60	16 (20.00)	14 (17.50)	30 (18.80)	
Mean	53.05±8.14	52.16±7.25	52.61±7.70	0.468

Figure-1 showed gender distribution of the respondents. It reveals that, in both newly diagnosed DM patients and healthy adult group female (63.8% & 56.3% respectively) were predominant than male (36.3% & 44.7% respectively).

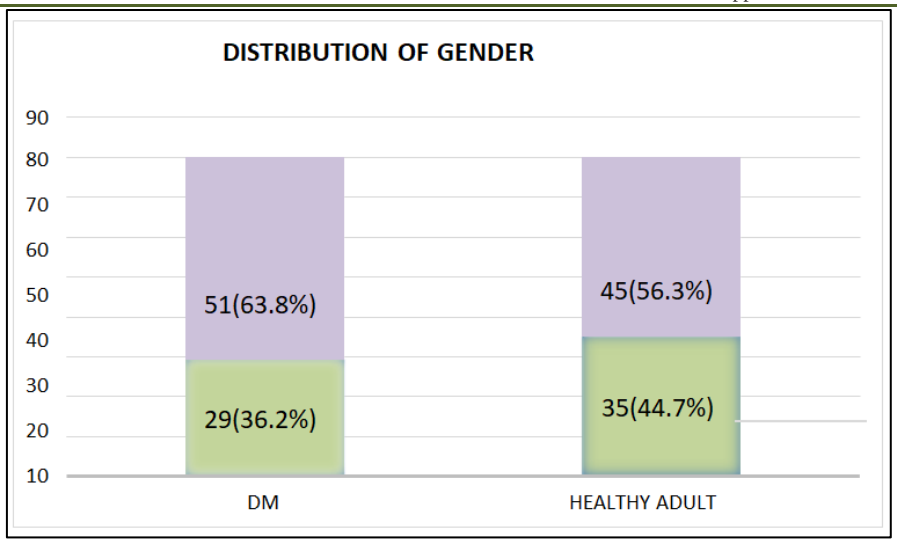

Figure I: Gender distribution of the respondents.

Figure II showed the distribution of the respondents according to the occupation. It revealed that, more than 1/3rd of both the groups were housewife (37.2% in diabetic vs 34.2% in healthy adult). Among both the diabetic and healthy adult group more than 1/3rd were service holders (35% and 40% respectively). In both diabetic and healthy adults group there was similarity that 13 respondents were businessman and 5 respondents were farmers in each groups.

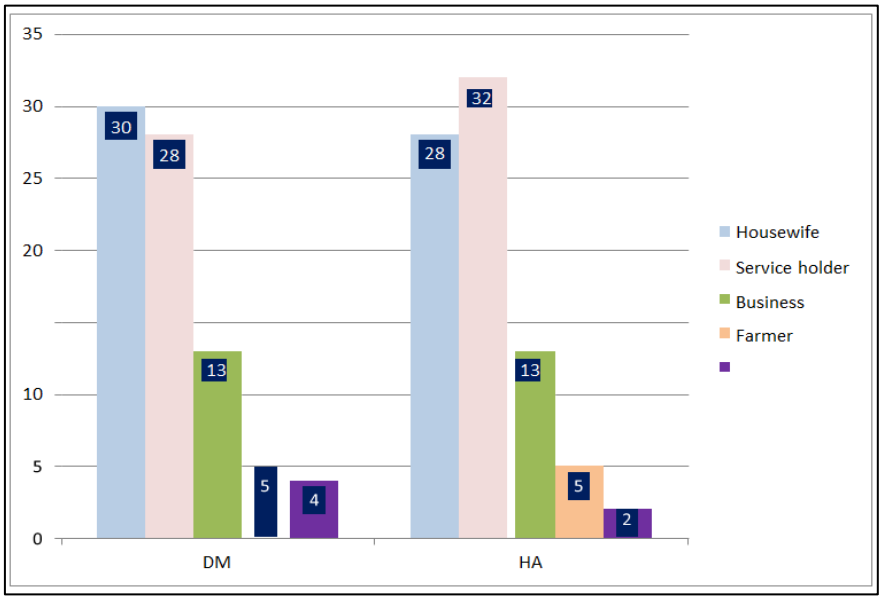

Figure II: Distribution of the respondents according to the occupation.

This table II showed the presence or absence of single or multiple of risk behaviours among the respondents. It revealed that, smoking was the commonest risk behavior among the respondents in both groups (46) whereas alcoholism is the least common (only 5). Among the respondents who had only smoking habit 12 were diabetic and 11 belonged to heathy adult group. 16 diabetic patient and 13 healthy adult had only tobacco chewing habit. Among the alcoholics, 2 of are diabetic and 3 belonged to healthy adult group. There were 3 respondents who had the history of only alcohol consumption as risk behavior, among them 1 respondent is diabetic, 2 were healthy adults. 1 diabetic respondent had habit of both smoking and tobacco chewing. Among the respondents 2 had the habit of both smoking and alcohol consumption, one of them belonged to diabetic and another one in healthy adult group. 53 of the diabetic respondents and 54 of the respondents had no smoking, alcohol, tobacco chewing habit.

Table II: Distribution of the respondents according to presence or absence of single or multiple risk factors (n=160)

Variables		**DM (%)**	**Healthy adult** (%)	**Total (%)**
Presence of risk factors	Only smoking habit	12(52.2)	11(47.8)	23(100)
	Only Tobacco chewing habit	16(55.2)	13(44.8)	29(100)
	Only Alcohol consumption	1(33.3)	2(66.7)	3(100)
	Smoking and Tobacco chewing habit	1(100)	0(0)	1(100)
	Smoking and Alcohol consumption	1(50)	1(50)	2(100)
	Smoking + alcohol + no exercise	1(50)	1(50)	2(100)
	Smoking + tobacco chewing + no exercise	1(100)	0(0)	1(100)
Absence of risk factors	Only Exercise habit	5(27.7)	13(72.3)	18(100)
	Non smoking habit	68(50.7)	66(49.3)	134(100)
	No smoking, alcohol, tobacco chewing habit	53(49.5)	54(50.5)	107(100)
	No (smoking + tobacco chewing) + exercise	4(44.5)	5(55.5)	9(100)

Figure III showed the history of physical exercise among the respondents. It reveals that, in both diabetic and healthy group, habit of physical exercise was scarce (6.25% and 16.25% respectively). Only 18 respondents had history of physical exercise among them diabetic respondents are less than that of healthy adults (DM vs HA = 5 vs 13)). Only one of the respondents had history of frequent physical exercise who belonged to DM group. The respondents who never had exercise were more in number in diabetic group.

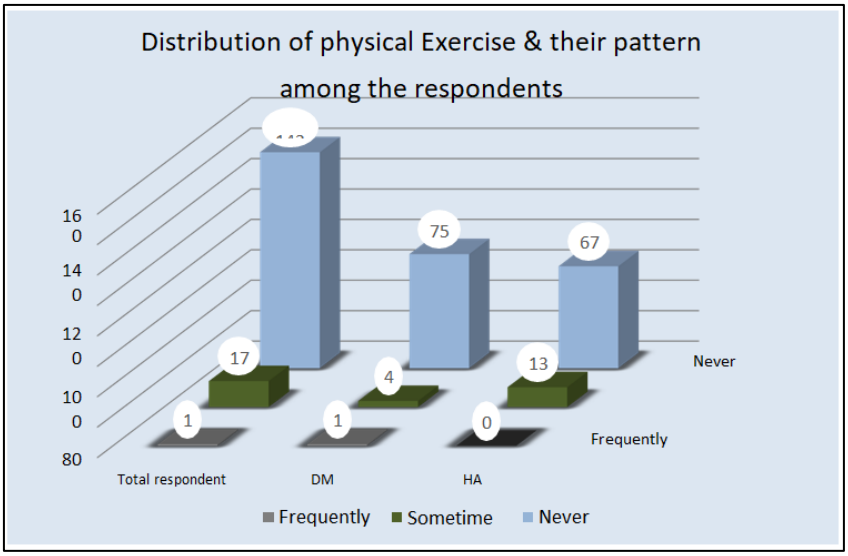

Figure III: Physical exercise and their pattern among the respondents (n=160)

Table-III showed the distribution of the mean blood pressure among the respondents. It reveals that, in DM group, the mean SBP was 128.88 mm HG with SD of 10.93 and the mean DBP was 78.25 with SD of 10.70. In healthy adult group, mean SBP was 119 mm Hg with SD of 9.98 and mean DBP was 75.19 mm Hg with SD of 7.97. Among the total respondents (n=160), the mean SBP was 123.94 mm Hg with SD 11.55 and the mean DBP was 76.72 mm HG with SD of 9.53.

Table III: Mean Blood pressure of the respondents (n=160)

Group	**DM (n = 80)**	**HA (n =80)**	**Total (n =160)**
	Mean±SD (Hg mm)	**Mean±SD (Hg mm)**	**Mean±SD (Hg mm)**
SBP	128.88 ±10.936	119 ± 9.98	123.94±11.55
DBP	78.25±10.706	75.19 ± 7.97	76.72±9.53

Table IVshowed the BMI of the respondents. It showed that in diabetic group more than 50% of the respondents were of normal BMI and others were overweight. In case of healthy adult group, only 1 person

was underweight, 2 pesron were obese, ½ of the respondents were of normal group and rest were obese. A chi square test for independence with α=0.05 was used to assess whether BMI between diabetic and healthy adult groups the relation between the two groups were not statistically significant ($\chi2$=3.204, df=3, p>0.05).

Table IV: Distribution of the respondents according to BMI

BMI classification	TYPE 2 DM PATIENTS (n=80) No. (%)	HEALTHY ADULT (n=80) No. (%)	TOTAL (n=160) No. (%)	p-value
Under weight	0(0)	1 (100)	1(100)	0.361
Normal	44(52.4)	40(47.8))	84(100)	
Over weight	36(45)	37(46.25)	73(100)	
Obese	0(0)	2(2.5)	2(100)	
Total	80(100)	80(100)	160(100)	

Pearson $\chi2$= 3.204, df=3, p= 0.361

Table V shows the fasting blood sugar distribution between the two groups. It reveals that, in healthy adult group most of the respondents (85%) had normal fasting blood sugar & 15% had IFG (impaired fasting sugar). None of the respondents in DM group had normal FBS or IFG. A chi square test for independence with α=0.05 was used to assess fasting blood sugar level between the two groups. The relation between the two groups was statistically significant (p=0.00).

Table V: Distribution of the respondents according to fasting blood sugar among the respondents (n=160)

FBS category		Group		Total
		DM	HA	
Normal or abnormal FBS	Normal	0(0.0%)	68(85.0%)	68(42.50%)
	IFG	0(0.0%)	12(15.0%)	12(7.50%)
	DM	80(100%)	0(0%)	80 (50.0%)
Total		80 (100.0%)	80 (100.0%)	160(100.0%)

Table VI showed mean serum urea, serum creatinine, urine microalbumin and eGFR of newly diagnosed type 2 diabetic cases (n=80). Mean serum urea level of the diabetic cases was 24.28±8.45 mg/dl, mean serum creatinine level of the diabetic cases was 0.91±.36 mg/dl, mean urine microalbumin level of the diabetic cases was 24.63±14.75 mg/day, and the mean eGFR was 95.63±17.84 ml/min.

Table VI: Mean serum urea, serum creatinine, urine microalbumin and eGFR of newly diagnosed type 2 diabetic cases (n=80).

Variable	Mean±SD
Serum urea (mg/dl)	24.28±8.45
Serum creatinine (mg/dl)	0.91±.36
Urine microalbumin (mg/day)	24.63±14.75
eGFR (ml/min)	95.63±17.84

Table-VII: Distribution of the respondents on the basis of serum urea level. Mean serum urea level was statistically significantly higher in case group than control group (p<0.001). In case group the mean serum urea level was 24.28±8.45 mg/dl and in control group mean serum urea level was 18.89±5.74 mg/dl. Number of subjects having increased serum urea level was also statistically significantly higher in case group than control group (p<0.05). In case group 06 (7.50) patients had serum urea level above normal range (>40mg/dl) and in control group all subjects had normal serum urea level.

Table VII: Distribution of the respondents on the basis of serum urea level

Variable		DM (n=80) No. (%)	Healthy adult (n=80) No. (%)	Total (n=160) No. (%)	P value
Serum Urea level	Normal	74 (92.50)	80 (100)	154 (97.50)	0.013
	Above normal	06 (7.50)	00 (00)	06 (2.50)	
Mean Serum Urea (mg/dl)		24.28±8.45	18.89±5.74	21.58±7.69	<0.001

Chi-squared Test ($\chi 2$) was performed to compare between two groups Pearson$\chi 2$=6.234, df=1, p=0.013
Unpaired t-test was performed to compare the mean between the groups

Table VIII shows distribution of the respondents on the basis of serum creatinine level. Mean serum creatinine level was statistically significantly higher in case group than control group (p=0.017). In case group the mean serum creatinine level was 0.91±.36 mg/dl and in control group mean serum creatinine level was 0.814±0.183 mg/dl. Number of subjects having increased serum creatinine level was also statistically significantly higher in case group than control group (p<0.05). In case group 08 (10) patients had serum creatinine level above normal range (>1.2 mg/dl) and in control group only 01 (1.25%) subjects had normal serum creatinine level above normal range.

Table VIII: Distribution of the respondents on the basis of serum creatinine level

Variable		DM (n=80) No. (%)	Healthy adult (n=80) No. (%)	Total(n=160) No. (%)	P value
Serum creatinine level	Normal	72 (90)	79 (98.75)	151 (94.38)	0.016
	Above normal	08 (10)	01 (1.25)	09 (5.62)	
Mean Serum creatinine (mg/dl)		0.91±.36	0.814±0.183	0.861±0.287	0.039

Chi-squared Test ($\chi 2$) was performed to compare between two groups Pearson $\chi 2$=5.769, df=1, p=0.016
Unpaired t-test was performed to compare the mean between the groups

DISCUSSION

Diabetes mellitus stands as a prominent global health concern, serving as a leading cause of mortality and disability on a worldwide scale. In 2011, its prevalence was estimated at approximately 8%, with projections foreseeing an alarming increase to 10% by the year 2030. This concerning trend is especially pronounced in low- and middle-income nations, where a staggering 80% of individuals afflicted with diabetes reside. The Asian and eastern Pacific regions bear a disproportionate burden, with China housing the largest number of adults grappling with diabetes in 2011, numbering a staggering 90.0 million, equivalent to 9% of its population. India followed closely with 61.3 million individuals affected, constituting 8% of its population, while Bangladesh grappled with 8.4 million cases, representing 10% of its populace. Globally, 60% of individuals contending with diabetes trace their ancestry to Asia, and remarkably, 40% of all diabetes cases in the least developed countries are concentrated in Bangladesh [6].

The pursuit of glycemic control presents a multifaceted challenge. One intriguing study unveiled a paradox: individuals from less-educated, lower-income backgrounds exhibited relatively better glycemic control, while a segment of highly educated, affluent individuals showcased suboptimal diabetes management. The latter phenomenon can be attributed to unregulated dietary habits and sedentary lifestyles prevalent among this group. [7]. Which was quite similar to our study where in healthy adult group most of the respondents (85%) had normal fasting blood sugar & 15% had IFG (impaired fasting sugar). None of the respondents in DM group had normal FBS or IFG.

The relationship between educational level, socioeconomic status, and glycemic control is a subject of international variation. This study's findings align with prior observations in Bangladesh, China, and India, demonstrating associations between educational attainment, socioeconomic status, and diabetes. However, a contrasting study in China revealed that diabetes prevalence was largely unaffected by educational level but was elevated in high-income groups. Additionally, research conducted in both developing and developed nations has consistently identified inverse associations between diabetes and educational level and household socioeconomic status.

In examining the age at which diabetes manifests, one study found that the mean age of presentation was 50±11 years. A significant portion of these individuals (37%) had been living with diabetes for a decade or more, with the average duration of diabetes spanning 8.5 years. These findings resonate with previous studies, indicating that the burden of long- term diabetes profoundly impacts individuals' social and professional lives, as reflected in the age at which diabetes is diagnosed [8]. Our study aligns with these research findings, demonstrating that the average age of male patients diagnosed with diabetes was 52.61±7.70 years [9].

Moreover, another study reported a predominance of female participants, particularly within the outpatient department (OPD), where dermatological symptoms were more frequently observed among women [8]. This observation may indicate an increasing incidence of the disease and heightened health concerns among women. Which is consistent to our study where in both newly diagnosed DM patients and healthy adult group female (63.8% & 56.3% respectively) were predominant than male (36.3% & 44.7% respectively).

Moreover according to one study, smoking plays a substantial role in diabetes risk, with a notable increase in smoking prevalence among young women in recent years, potentially leading to a rise in smoking-related diabetes cases among women. Furthermore, in our study, a little higher of 4/5th (85%) of the respondents were non smoker and 4/5th (80%) were non tobacco user. Among the respondents only 4 of them were alcoholic [8].

In a separate study conducted in Nigeria, sex-specific disparities in cardio-metabolic risk, microvascular, and macrovascular consequences were observed among type 2 diabetes patients. They also revealed that obesity and hypertension were more prevalent among DM2 patients. Whereas in our study, in diabetic group more than 50% of the respondents were of normal BMI and others were overweight. In case of healthy adult group, only 1 person was underweight, 2 person were obese, ½ of the respondents were of normal group and rest were obese.

Interestingly, men were more likely than women to achieve LDL treatment targets in type 2 diabetes, contradicting previous data. However, in one study, men exhibited a higher incidence of hypertension (69.0%) and dyslipidemia (76.1%) compared to women, with significantly higher rates of dyslipidemia among females (p=0.004) [8]. Whereas in our study, it was showed that according to the measured systolic blood pressure 39 of the respondents belonged to normal, 95 showed prehypertensive and 26 showed hypertensive systolic blood pressure. According to the measured diastolic blood pressure, 71 respondents showed normal range, 63 prehypertensive and 2 showed hypertensive diastolic blood pressure.

Furthermore, one study reported that Low serum creatinine concentrations were positively associated with incident type 2 diabetes mellitus [10]. However, in our study we found quite different results then other report where in diabetic group 10% cases had increased serum creatinine level while in healthy adult group 1.25% had increased serum urea level.

CONCLUSION

This study concluded that women are mostly affected with type 2 DM. The presence of comorbidities such as abnormal level of fasting blood sugar & impaired fasting sugar, high mean serum urea level and serum creatinine significantly increased the probability of developing type 2 diabetes in both genders.

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