

# Effect of Diabetes on the Onset of Various Complications in Adult Type 2 Diabetic Population

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**Abstract:** *The aim of the study was to check the biochemical parameters as indicators of the onset of various complications in the body, to correlate these complications with adult type 2 diabetic population and to associate the duration of diabetes mellitus with other complications. A cross-sectional study was conducted on 109 diabetic subjects out of which 47.7% (n=52) were males and 52.29% (n=57) were females. Baseline data showed that the mean HbA1c of males was 11.94% and that of females was 7.27%. Hypertension was the most common complication (90.8%) followed by cardiovascular diseases (38.5%), eye diseases (34.86%), renal disorders (29.35%) and foot complications (28.44%). The prevalence of liver disease was just 8.25%. Majority of patients (38.53%) had two complications, followed by three complications in 25.68%, only one complication in 22.01% and four complications in 13.76% subjects along with diabetes. Pearson's coefficient of correlation proved a positive association ( $r=0.904$  in males and  $r=0.833$  in females) of these complications with diabetes. In people with type 2 diabetes, the risk of developing different complications is inversely proportional to glycemic control. This emphasises the fact that effective control of type 2 diabetes is needed to prevent or reduce the risk of these complications.*

**Keywords:** Diabetes, Macrovascular, microvascular, Renal-Retinal Association

## 1. Introduction

Diabetes mellitus is a group of chronic metabolic conditions, all of which are characterized by elevated blood glucose levels resulting from the body's inability to produce insulin or resistance to insulin action, or both. [1] A total of 415 million adults were estimated to live with diabetes in 2015 and the number is expected to reach to 640 million by the year 2040 worldwide. [4]

There are two major forms of diabetes, type 1 and type 2; although diabetes may also manifest during pregnancy and other conditions including drug and chemical toxicity, genetic disorders, endocrinopathies, insulin receptor disorders and in association with pancreatic exocrine disease. [2]

The complications related to diabetes pose a significant health care burden and a deterrent to overall quality of life. [5] Increased blood glucose is a usual manifestation of uncontrolled diabetes, through time leading to serious damage to different organs and systems. [3] Complications from diabetes can be classified as microvascular (neuropathy, nephropathy and retinopathy) or macrovascular (cardiovascular disease, stroke, peripheral vascular disease). [1] Chronic Kidney Disease (CKD) is an emerging public health problem associated with adverse cardiovascular and renal outcomes as well as premature deaths. [6] Interestingly, Diabetic Retinopathy and CKD are closely associated with age and metabolic and cardiovascular risk factors, such as hypertension, diabetes, obesity and hyperlipidaemia. [7]

The aim of the present study was to investigate the association of diabetes with these complications.

## 2. Method

### 2.1 Study Design

The study was conducted in medical in-patient wards of Yashoda Hospitals, Malakpet and Premier Hospital, Mehdiapatnam with the purpose to assess the effect of diabetes on the onset of various complications in adult type 2 diabetic population.

### 2.2 Sample Selection

A total of 109 subjects were selected and prior consent was obtained to conduct the study by the hospital authorities. Prior permission was taken from the patients too.

### 2.3 Data Collection

A questionnaire was framed to collect the general and specific information by formulating structured questions relevant to the study. It was categorized into five sections and a general diabetic questionnaire was also framed related to the different diabetic complications. Data was collected by interview method and analysed.

## 3. Result and Discussion

From the total sample of 109 subjects, 5-10 years of the duration of diabetes was observed in majority (33.02 percent) of the subjects of which 15.59 percent were males and 17.43 percent were females, followed by >15 years (29.35 percent; Males-12.84 percent, Females-16.51 percent), <5 years (20.1 percent; Males-10.09 percent, Females-10.09 percent) and 10-15 years (17.43 percent; Males-9.17 percent, Females-8.25 percent).

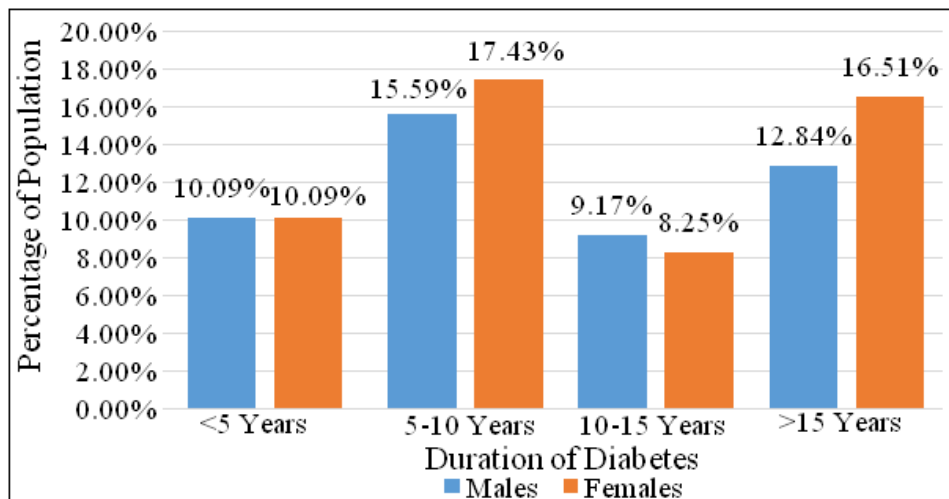


Figure 1: Distribution of male and female subjects according to the duration of diabetes

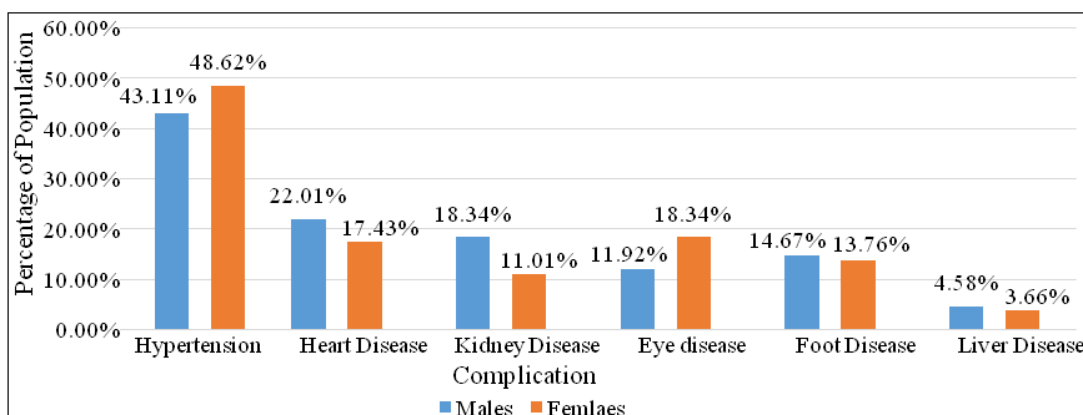


Figure 2: Distribution of male and female subjects according to the type of complication

Out of the 52 male subjects, 47 (90.38 percent) had hypertension, 24 (46.15 percent) had heart complications, 20 (38.46 percent) had kidney diseases, 13 (25 percent) had eye complications, 16 (30.76 percent) had foot complications and 5 (9.61 percent) had liver problems. Out of the 57 female subjects, 53 (92.98 percent) had hypertension, 18 (31.57 percent) had heart complications, 12 (21.05 percent) had kidney diseases, 20 (35.08 percent) had eye complications, 15 (26.31 percent) had foot complications and 4 (7.01

percent) had liver problems. The most common complication was found to be hypertension, followed by heart, eye and kidney diseases. Of the total population, the 38.53% of the subjects were found to have two complications, followed by three complications in 25.68% of the subjects, one complication in 22.01% of the subjects and four complications in 13.76% of the subjects, along with diabetes.

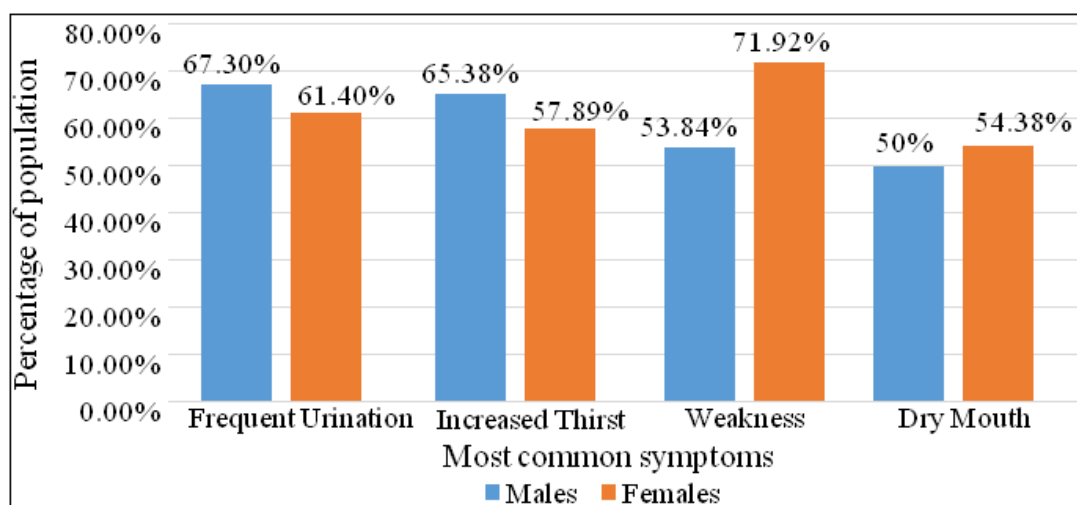


Figure 3: Distribution of male and female subjects according to the most common symptoms they have

Among the 52 male subjects, the most common symptoms were found to be frequent urination (67.3% of the subjects), increased thirst (65.38%), weakness (53.84%) and dry mouth (50%). Less common symptoms were night sweats (13.46% of the subjects), followed by intense hunger and nausea or vomiting (15.38%). Among the 57 female subjects,

the most common symptoms were found to be weakness (71.92% of the subjects), frequent urination (61.4%), increased thirst (57.89%) and dry mouth (54.38%). Less common symptoms were intense hunger (14.03% of the subjects), followed by night sweats (17.54%) and abdominal pain (21.05%).

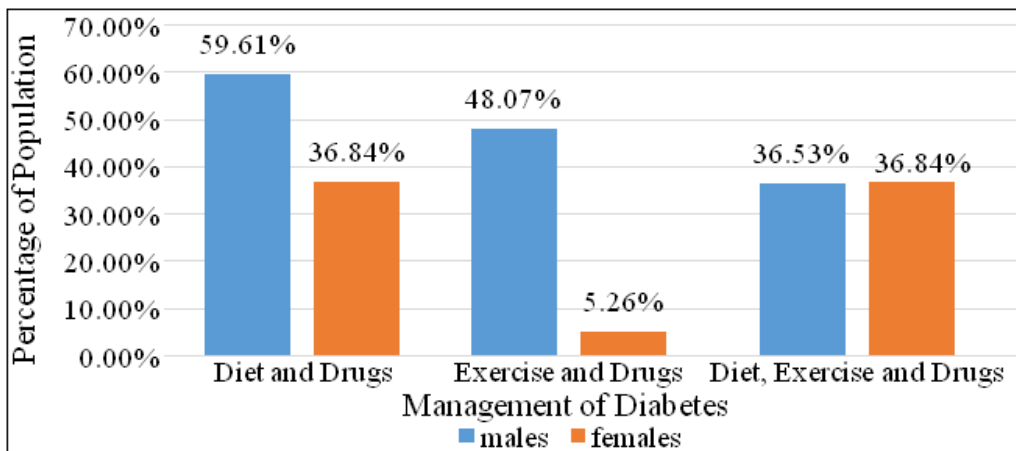


Figure 4: Distribution of male and female subjects according to the management of diabetes

31 male subjects (59.61%) managed diabetes through diet and drugs followed by 25 subjects (48.07%) who managed it through physical activity and drugs, 19 subjects (36.53%) who managed it through diet, physical activity and drugs. 21 female subjects (36.84%) managed diabetes through diet and drugs and another 21 subjects (36.84%) who managed diabetes through diet, physical activity and drugs. It was also found that not many female subjects (5.26% of the subjects) tried managing diabetes through all the three routes.

Out of all the diabetic subjects who were aware of the necessary dietary modification related to diabetes, 75.84% of the subjects followed the diet properly. Among subjects with diabetes and hypertension, who were aware of the necessary dietary modifications, 91.76% followed the diet while all the subjects who were aware of the necessary dietary modifications related to heart, kidney and liver diseases, followed the diet properly.

Almost all the subjects complained of having more than one symptom. Headache in people suffering from hypertension and chest pain and heart burn in people suffering from heart diseases were the most common symptoms found.

Only 47.7% of the population engaged in physical activity of which, 43.11% did walking. The majority of male subjects did physical activity for 1 hour while majority of female subjects did it for 15-30 minutes.

Back pain, micturition, oedema and nausea or vomiting in people suffering from kidney diseases and loss of appetite, jaundice and abdominal pain in people suffering from liver diseases were the most common symptoms found.

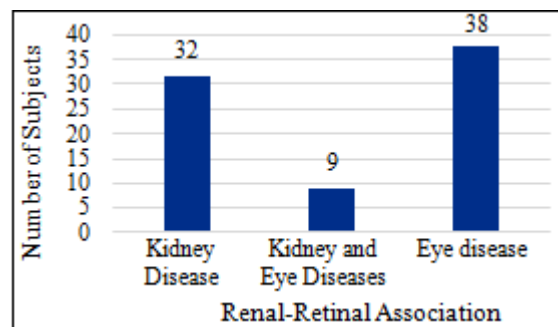


Figure 6: Graphical representation of the association of renal and retinal disorders in renal diabetic subjects.

Blurred vision and sensitivity to light in people suffering from eye complications, sore and blisters, redness and swelling in people suffering from foot complications were the most common symptoms found in the population.

There was also an association of renal and eye disorders found in the population. Of the total population, 32 patients had kidney disease. Of the 32 subjects, 9 subjects have shown eye complications. Similar results were found in a few studies<sup>8,9</sup>. Although the study had a limited population size, the renal-retinal association was seen.

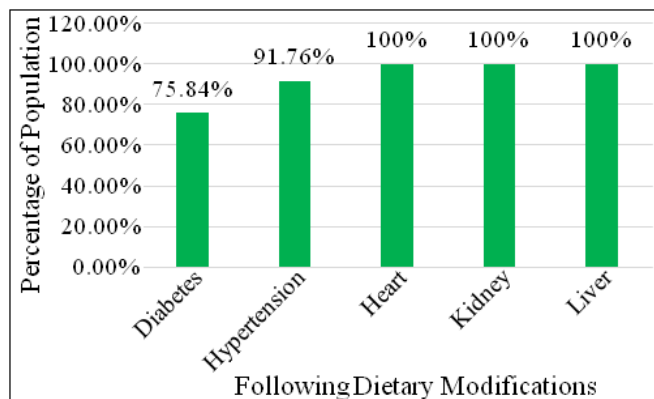


Figure 5: Distribution of population based on how many follow the necessary dietary modifications.

**Table 1:** Correlation between HbA1c values and parameters of different diabetic complications

	<5 years		5-10 years		10-15 years		>15 years	
	Males	Females	Males	Females	Males	Females	Males	Females
<b>S. Na+</b>	0.327	-0.266	-0.214	-0.242	-0.038	<b>0.645*</b>	-0.965*	0.181
<b>S. K+</b>	-0.252	0.014	0.063	0.110	<b>-0.549*</b>	0.254	<b>0.890*</b>	0.324
<b>Blood Urea</b>	-0.223	-0.215	<b>0.553*</b>	0.345	<b>0.476</b>	0.476	-0.544	0.009
<b>S. Creatinine</b>	-0.364	0.201	<b>0.559*</b>	0.403	<b>0.598*</b>	<b>0.702*</b>	<b>0.904*</b>	<b>0.689*</b>
<b>T. Cholesterol</b>	-0.247	-0.209	-0.082	0.157	-0.040	<b>0.833*</b>	0.220	-0.325
<b>LDL</b>	0.121	-0.033	0.457	0.217	0.799*	<b>0.822*</b>	0.051	-0.334
<b>HDL</b>	-0.435	-0.139	<b>-0.500*</b>	-0.217	<b>-0.580*</b>	<b>-0.766*</b>	-0.350	0.381
<b>Albumin</b>	0.302	0.327	-0.015	0.093	-0.211	0.168	-0.088	-0.402
<b>Bilirubin</b>	0.500	-0.438	-0.145	0.393	-0.217	0.186	0.007	0.289
<b>Systolic BP</b>	0.352	-0.386	-0.089	0.031	0.042	-0.315	0.262	-0.454
<b>Diastolic BP</b>	-0.047	-0.109	-0.228	-0.284	0.266	-0.386	0.312	<b>-0.515*</b>

\*Indicates moderate, high and very high strength correlations found between diabetes and different diabetic complications

Pearson's coefficient of correlation was done between HbA1c values and the parameters of heart, kidney and liver disorders and blood pressure. The results revealed a steady increase in the risk of acquiring complications with an increase in the duration of diabetes. The highest degree correlation was observed to be 0.904 in males with >15 years of diabetes and 0.833 in females with 10-15 years of diabetes.

#### 4. Conclusion

In spite of a small sample size, considering the problems associated with diabetes, the present study could conclude that, with increasing years of diabetes, the risk of developing complications increases and therefore, proper management of diabetes since diagnosis through diet, drugs and physical activity becomes a major concern.

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