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Hypertension in Patients with Type 2 Diabetes Mellitus and Diabetic Nephropathy

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ABSTRACT
The study was undertaken to investigate hypertension in patients with type 2 diabetes mellitus and type 2 diabetes with nephropathy. The study type was a case-control study. This case-control study aimed to assess the prevalence of hypertension among patients aged 40–70 years who were diagnosed with type 2 diabetes mellitus and diabetic nephropathy over the course of six months. It is estimated that the majority of individuals suffering from type 2 diabetes mellitus are also affected by hypertension. Individuals suffering from type 2 diabetes mellitus may further develop macro-vascular complications (such as diabetic nephropathy, retinopathy, and neuropathy).
KEYWORDS: Type 2 Diabetes Mellitus, Diabetic Nephropathy, Hypertension,Case-control Study.

I. INTRODUCTION

Hypertension and diabetes mellitus are prevalent illnesses that frequently coexist. Hypertension in the diabetic individual markedly increases the risk and accelerates the course of cardiac diseases, peripheral vascular disease, stroke, retinopathy, and nephropathy. Diabetic nephropathy is an essential factor involved in the development of hypertension in diabetics, particularly type I patients. However, the majority of diabetic individuals' etiologies of hypertension remain "essential" in origin and cannot be explained by underlying renal illness. Elevated peripheral vascular resistance appears to be hypertension's hallmark in type I and type II diabetes. In diabetics, elevated exchangeable sodium may also contribute to the pathophysiology of high blood pressure. A growing body of research suggests that anomalies in glucose metabolism may contribute significantly to insulin resistance/hyperinsulinemia, which is thought to be a major factor in the pathophysiology of hypertension. In individuals with coexisting diabetes, antihypertensive medication aims to both lower blood pressure and drastically reduce the high cardiovascular risk[1].

Impact of Hypertension on Diabetic Nephropathy:

The relationship between hypertension and poor vascular outcomes, including the progression of renal disease, is unequal and independent of other confounding factors. The impact of hypertension on outcomes is exponential rather than linear. A sustained reduction in blood pressure seems to be currently the most important single intervention to slow progressive nephropathy in type I and type II diabetes. Long-term follow-up studies of initially normotensive diabetic subjects without renal diseases demonstrate a blood pressure-depending decline in GFR with blood pressure levels within the reference range.Patients with a bloodpressure corresponding to <130/80 mmHg rarelydevelop microalbuminuria and show an annual declinein GFR close to the age-matched normal population. Diabetic patients with blood pressure between 130/80 and 140/90 mmHg have a greaterdecline in GFR, with 30% of patients developing associated microalbuminuria or protein urea over the subsequent 12 to 15 years[2].

MATERIALS AND METHODS

Study Site:

The purpose of this case-control study was to determine the prevalence of hypertension among patients of a certain age who had type 2 diabetes mellitus and diabetic nephropathy and sought medical advice at the Ananta Medical Hospital, Department of General Medicine and Cardiac, between December 2021 and June 2022

Study Population:

The study's population included people between the ages of 40 and 70 who had hypertension in type 2 diabetes mellitus without complications or type 2 diabetes with nephropathy.

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Sample Size:
75 patients were taken under study.
Sample and Sampling Technique
The study population consists of 75 individuals, who were further divided into the following groups:
GROUP 1 Diagnosed cases of type 2 diabetes mellitus without any complication (25)
GROUP 2 Diagnosed cases of type 2 diabetes with nephropathy (25)
GROUP 3 Age and Sex matched normal individuals as controls (25)

Eligibility Criteria
INCLUSION CRITERIA

Known cases of type 2 diabetes mellitus without any complication with age more than 40 years and less than 70 years.

Known cases of type 2 diabetes with nephropathy aged more than 40 years and less than 70 years.

EXCLUSION CRITERIA

Patient with a previous history of acute limb ischemia, deep vein thrombosis, infected tissue loss, systemic coagulopathy, or hypercoagulation disorder.

Patients with missing data or incomplete data, histories of non-diabetic renal disease, infection, acute stress state, pregnancy, or malignancies.

Study Material:
After obtaining the patient data profile, the required patient details were noted.
Patient height, weight, waist circumference, and hip circumference were recorded.
Using height, weight, waist circumference, and hip circumference; body mass index and waist-hip ratio were calculated.
Patient information leaflet.

Study Procedure:
The patients who fit the inclusion criteria were approached and asked to be part of the study; their consent was taken.
The history of the patient was taken. A comprehensive list of the patient's data was compiled under counseling. Blood glucose measurement and blood pressure measurement were done on a daily basis at specific intervals of time.

Parameters that were included in the study were noted with increasing and decreasing factors after the blood sample was taken, and data was noted according to patient report outcomes.

After the completion of data collection, charts were prepared on the basis of inclusion criteria to differentiate patients into three groups: type 2 diabetes without any complications, type 2 diabetes with nephropathy, and controls under the age of 40 to 70 years.

Ethics:
The protocol was approved by the Institutional Ethics Committee, Ananta Institute of Medical Sciences and Research Center Rajsamand –313002, Rajasthan (AIMS/IEC/2022/015).

II. RESULTS AND DISCUSSION

The total number of patients screened was 108. The total number of patients enrolled in the study based on inclusion and exclusion criteria was 75.

Patient demographic details were collected and included Age, gender, HbA1C, hypertension, blood samples, serum concentrations (serum urea, serum creatinine, and serum albumin), and body mass index.

During their admission to the hospital, patients were counseled regarding lifestyle modification, non-pharmacological therapy, habitual changes, and precautions to avoid risk factors.

The pre and post - interventions were made based on health, quality of life, and medication adherence. People who adhered to the medication show significant improvement in their quality of life.

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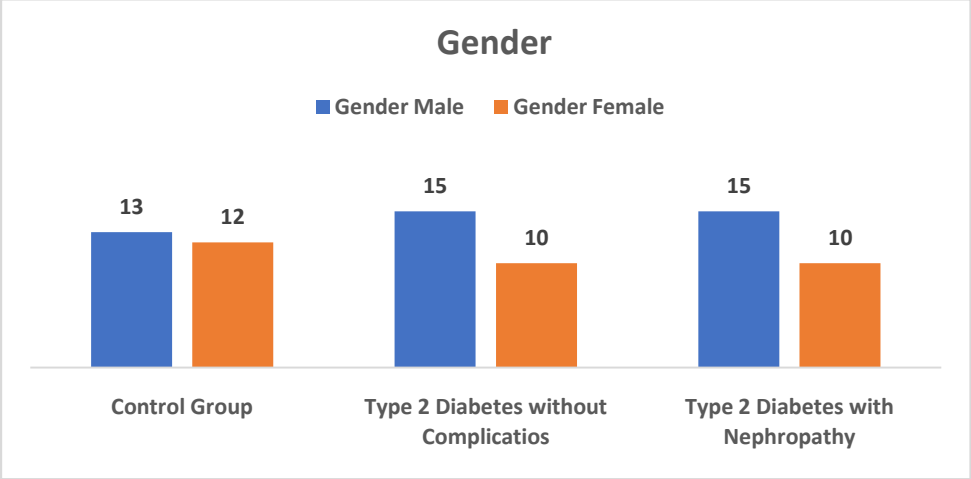

Figure 1: Gender

Among the total number of patients, the sample collection of males was 43 out of 75 which is 57.33% and female was 32 out of 75 which is 42.66%, and were aged between 40-70. These 75 patients belong to three different subgroups 25 patients are healthy control, 25 patients are of type 2 diabetes mellitus without any complications and 25 patients are of type 2 diabetes with nephropathy.

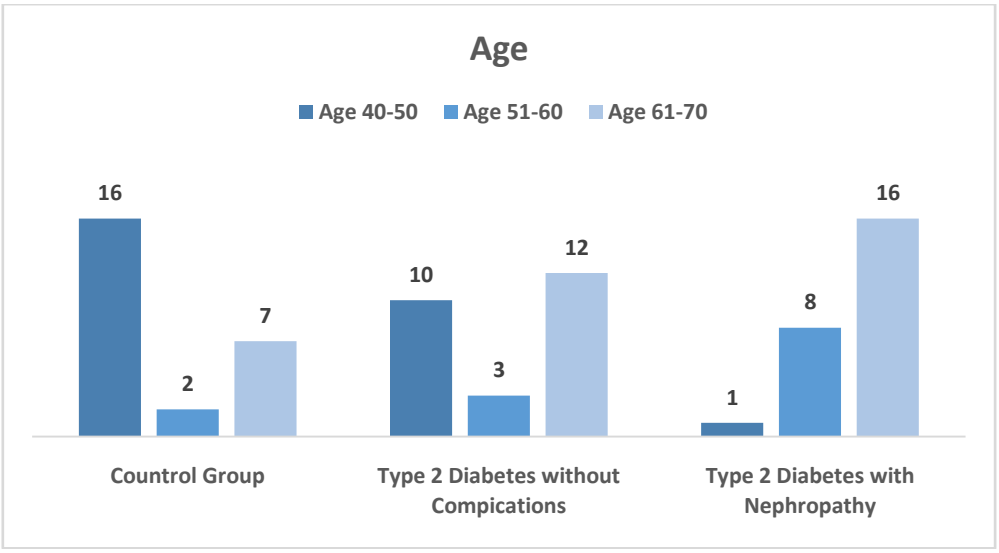

Figure 2: Age

Age is one of the most common factors involved in diagnosing disease and with the increase in age risk factors increases. However, in our study, the mean age of type 2 diabetes patients without any complication was 56.4, in type 2 diabetes with nephropathy was 61.52, and 56.56 in control patients. During the study conducted, we included patients of age between 40-70.

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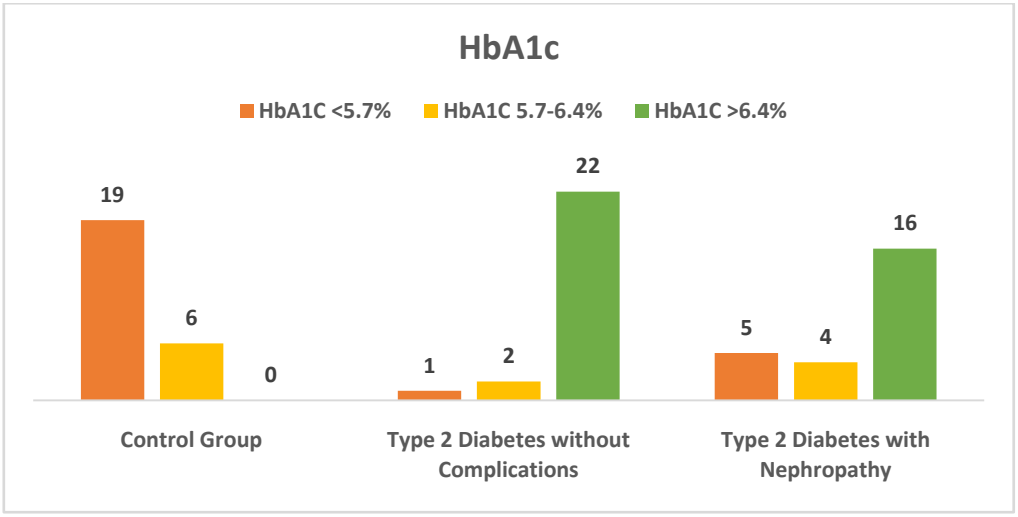

Figure 3: HbA1C

It is also known as glycated hemoglobin. The HbA1C test is used to measure the average level of blood sugar over the past 2 to 3 months. The normal range for the HbA1C level is between 4% to 5.6%. HbA1C levels between 5.7% to 6.4% mean you have pre-diabetes and a higher chance of getting diabetes. Levels of 6.5% or higher mean you have diabetes.

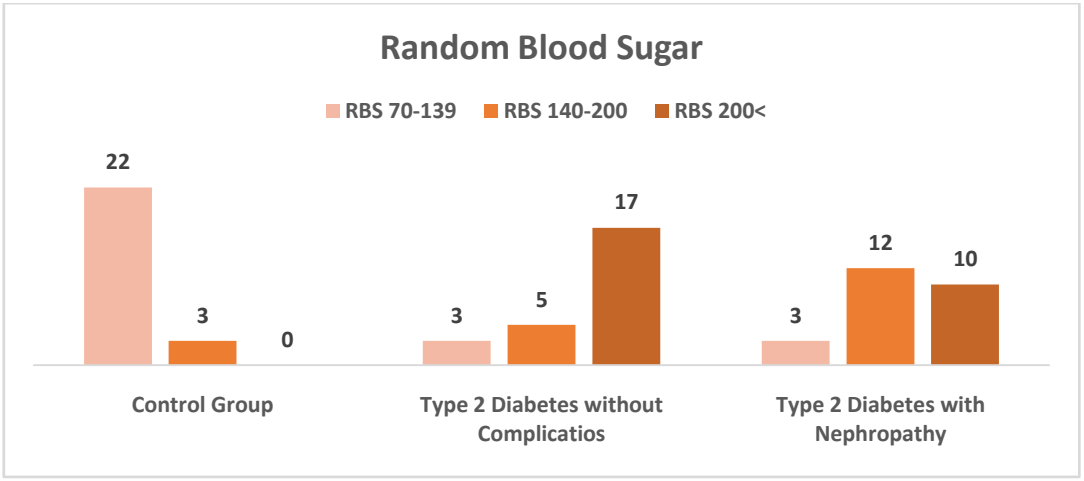

Figure 4: Random Blood Sugar

A random blood glucose test is one method for measuring the amount of glucose or sugar circulating in a person's blood. The expected values for normal fasting blood glucose concentration are between 70mg/dL (3.9mmol/L) and 100mg/dL (5.6mmol/L). when fasting blood glucose is between 100 to 125mg/dL (5.6 to 6.9 mmol/L) changes in lifestyle and monitoring glycemia are recommended. For a random glucose test, a result of 200mg/dL or above indicates that a person may have diabetes. In our study, the random blood sugar mean was found to be increased in type 2 diabetes mellitus without any complication (264.28) as compared to type 2 diabetes with nephropathy (201.28) and controls (105.92) individuals.

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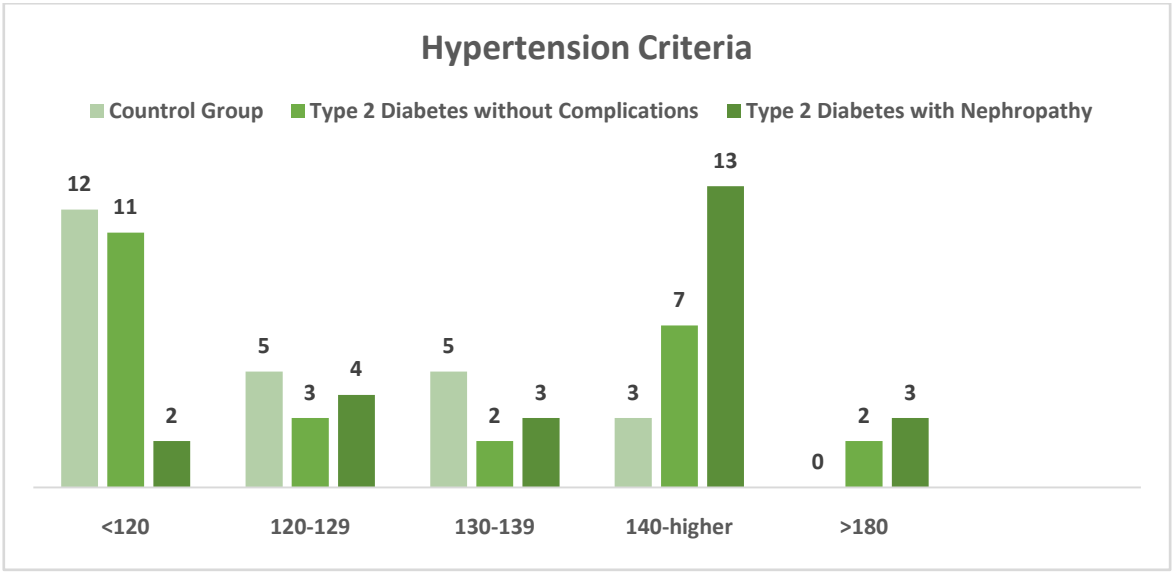

Figure 5: Diagnosing criteria for hypertension

A condition in which the force of the blood against the artery walls is too high. Usually, hypertension is defined as a blood pressure above 140/90, and is considered severe if the pressure is above 180/120. Elevated levels of blood pressure are found in diseased patients as compared to control individuals. Type 2 diabetes patients without any complication are exposed more likely in the range of 140 to higher as compared to others.

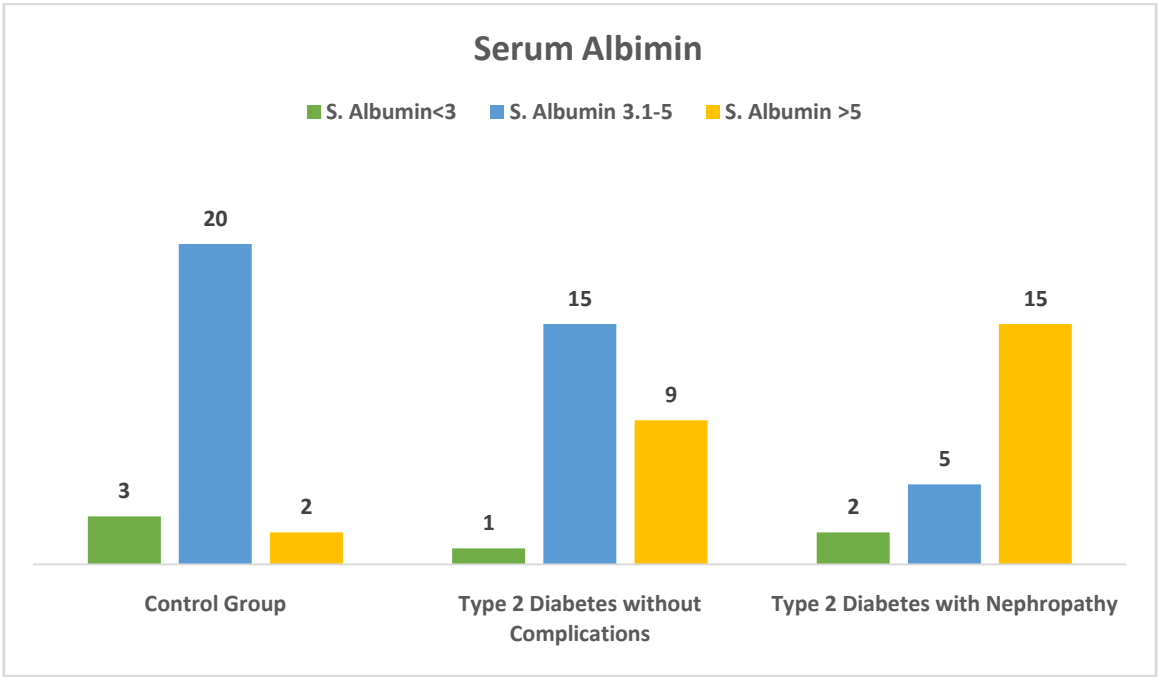

Figure 6: Serum Albumin Concentration

A serum albumin test measures the amount of protein in the clear liquid portion of the blood. Albumin can also be measured in the urine. Blood is drawn from a vein (venipuncture), usually from the inside of the elbow or the back of the hand. The normal range is 3.1 to 5.0g/dL (31 to 50 g/L). The normal value ranges can differ slightly between laboratories. Serum albumin level in type

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2 diabetes without any complication was 4.62, in type 2 diabetes with nephropathy was 5.31, and in control was 3.87.

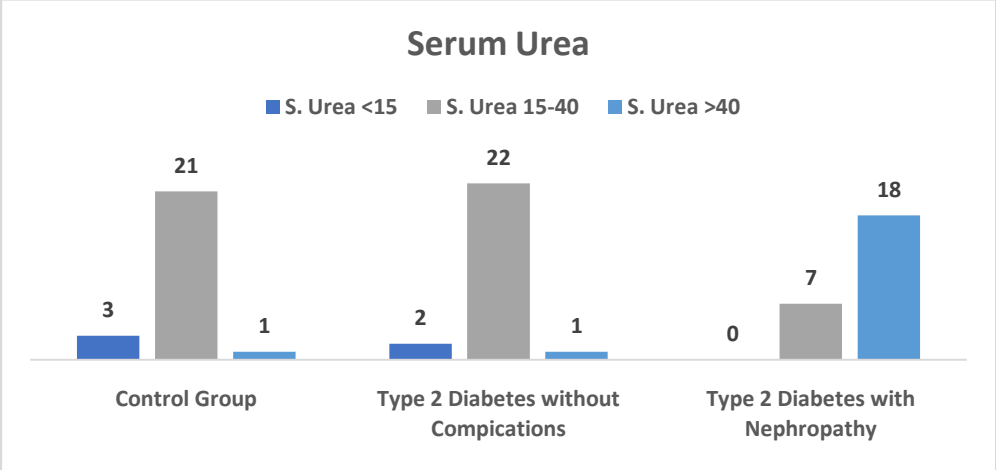

Figure 7: Serum Urea Concentration

Serum/ plasma urea concentration reflects the balance between urea production in the liver and urea elimination by the kidneys, in urine; so increased plasma or serum urea can be caused by increased urea production, decreased urea elimination, or a combination of the two. The normal range for serum urea is 15 to 40mg/dL. Serum urea levels are found morein patients with type 2 diabetes with nephropathy as compared to type 2 diabetes without any complication and control patients. The increased level of serum urea in type 2 diabetes with nephropathy was 67.73.

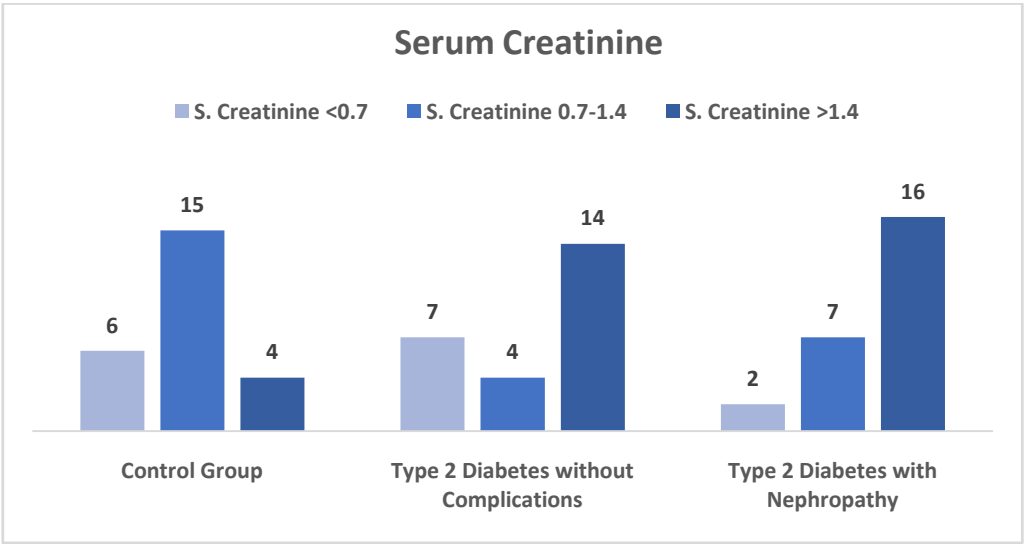

Figure 8: Serum Creatinine

A creatinine test is a measure of how well our kidneys are performing their job of filtering waste from our blood. Creatinine is a chemical compound left over from energy-producing processes in our muscles. Healthy kidneys filter creatinine out of the blood. Creatinine exists in the Body as a waste product in urine. The typical range for serum creatinine is: for adult men, 0.7 to 1.4mg/dL (65.4 to 119.3micromoles/Litre) for adult women, 0.59 to 1.04mg/dL (52.2 to 91.9micromoles/Litre). Here serum creatinine levels are found to be increased in type 2 diabetes with nephropathy and type 2 diabetes without any complication when compared to controls. The mean

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serum creatinine of type 2 diabetes without any complication was 1.98, type 2 diabetes with nephropathy was 4.21, and in healthy control was 0.89.

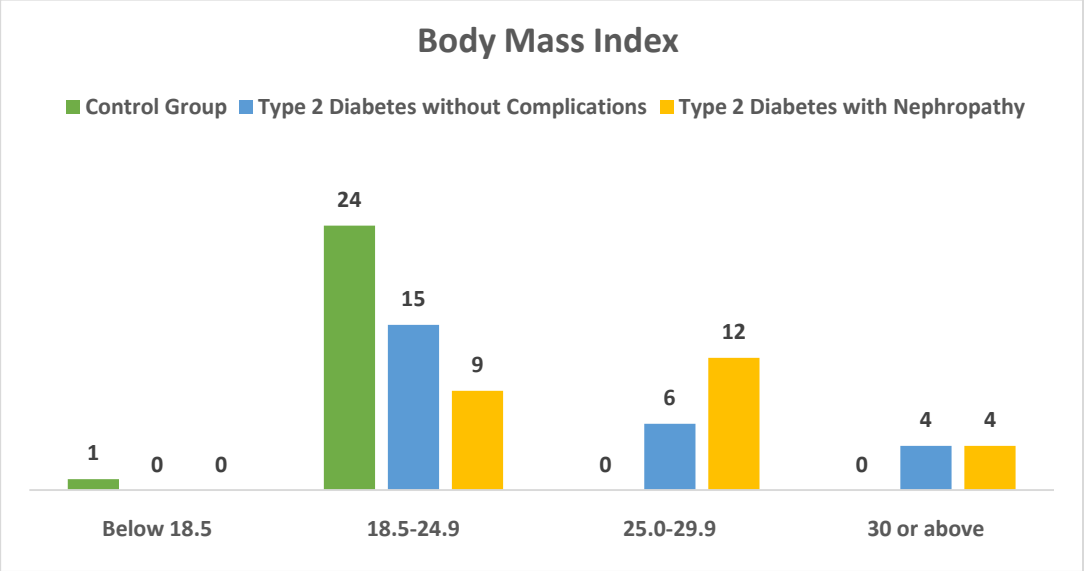

Figure 9: Body Mass Index

The body mass index is a measure that uses our height and weight to work out if our weight is healthy. The BMI calculation divides an adult's weight in kg by their height in meters squared. The normal range of body mass index is between 18.5 to 24.9 then we are in the healthy weight range. If it is between 25 to 29.9 then we are in the overweight range and if it comes between 30 to 39.9 the new is in the obese range. So according to our study, BMI was found to be increased in type 2 diabetes without any complication and type 2 diabetes with nephropathy when compared to controls. This means obesity can lead to complications.

III. CONCLUSION

The present study was undertaken to evaluate the levels of gender, age, HbA1C, random blood sugar, blood pressure, serum albumin, urea and creatinine, and BMI in type 2 diabetes mellitus without any complications and type 2 diabetes with nephropathy.

The study showed that HbA1C and random blood sugar levels are increased in type 2 diabetes mellitus without any complication and decreased in type 2 diabetes with nephropathy.

Serum albumin, serum urea, and serum creatinine levels were increased in type 2 diabetes with nephropathy when compared to type 2 diabetes mellitus without any complications and controls.

Body mass index is high in type 2 diabetes mellitus without any complication and type 2 diabetes with nephropathy when compared to controls.

The correlation of hypertension in type 2 diabetes mellitus without any complication, type 2 diabetes with nephropathy, and controls stated that there is an increased level of hypertension in type 2 diabetes with nephropathy.

After completion of the study, we conclude that hypertension plays a very significant role in increasing cases of type 2 diabetes and diabetic nephropathy in the hospital. Hypertension in patients with type 2 diabetes mellitus without any complication and type 2 diabetes with nephropathy, mostly affects males more than females, under the age of 40- 70 years.

Therefore, the routine assay of blood pressure and sugar levels in type 2 diabetes mellitus without any complication and diabetic nephropathy to improve quality of life and reduce morbidity.

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