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## Original Research Article

## A study to compare hemoglobin levels and body mass index in normal and diagnosed diabetic stages of CKD patients visiting a tertiary care hospital

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## ABSTRACT

Chronic kidney disease (CKD) has become a worldwide community health problem in people with type, 2 diabetes obesity and long-term hyperglycemia may cause renal vascular complications. The aim of this study was to see if there was any connection between BMI, haemoglobin and CKD in DM patients. This case study was conducted in department of Medicine, Era's Lucknow Medical College and Hospital, ERA University, Lucknow. The analysis was performed for 18 months.

When compared to CKD patients, the non-CKD group's mean BMI was marginally higher. Older age, female sex, hypertension, and diet plant were all linked to the involvement of CKD in multivariable study. There was same connection between CKD and haemoglobin in this study. The negative relationship between BMI, Hb and CKD could indicate reverse causality. While a diabetic patient's BMI does not cause them to develop CKD, it is possible that CKD causes them to have a lower BMI and Hb level.

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## 1. Introduction

In the twenty-first century, diabetes mellitus (DM) has become a global pandemic.<sup>1</sup> Diabetic patients also develop chronic kidney disease (CKD), which is a common microvascular complication.<sup>2</sup> End-stage renal disease (ESRD) is most often caused by chronic kidney disease (CKD) and are extremely common in T2DM patients in both developed and developing countries.<sup>3</sup> Renal failure is a common diabetic microvascular complication in Asia, with a high prevalence of renal failure.<sup>4</sup> Kidney disease as a consequence of T2DM is expected to overtake diabetes as

the primary cause of global disease burden by 2030.<sup>5</sup>

India, as an Asian region, has been affected by the epidemiological transformation in recent years, with the prevalence of non-communicable diseases on the rise.<sup>6</sup> Behavioural factors such as lack of physical activity and the growing trend of junk food intake are amongst the factors that contribute to over nutrition, which can lead to microvascular complications in diabetic patients (DM).<sup>7</sup> Though it is not clear that all diabetic patients would develop CKD, minor kidney damage is common as a result of uncontrolled diabetes.<sup>8</sup> Another study showed that CKD is affected by age, sex, race, supportive family background, high blood pressure, and dietary habits.<sup>9</sup> Furthermore, long-

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term hyperglycemia caused by uncontrolled diabetes may play a key role in the onset of renal vascular disease.<sup>10</sup> As a result, it is often preferable to hold the glycaemic condition under control in diabetic patients to avoid kidney disease.<sup>11</sup>

A high BMI is linked to metabolic disorders, which may increase the risk of microvascular complications. When compared to patients with a typical BMI, obese patients are more likely to experience diabetic micro vascular kidney complications.<sup>12</sup> However, a previous study reported that the connection between BMI and CKD in T2DM patients is not straightforward.<sup>13</sup> Overweight and obesity have been shown to be protective for some ESRD patients in some epidemiological studies.<sup>14</sup> Furthermore, patients with a high BMI may have a better prognosis during the dialysis stage of CKD.<sup>15</sup> Patients with a large BMI can endure well, according to a new terminology called survival paradox<sup>16</sup> which is very controversial. By investigating the above relationship in the Indian community, this study will provide us with useful details. To the best of our knowledge, the connection between obesity and CKD has not been thoroughly investigated in India. As a result, the aim of this study is to look into the relation between BMI and CKD in diabetic patients in India.

## 2. Materials and Methods

This case study was conducted in department of Medicine, Era's Lucknow Medical College and Hospital, ERA University, Lucknow. The analysis was performed for 18 months.

### 2.1. Study participants & Inclusion criteria

Participants aged 18 years and above with chronic kidney disease (any stage), was recruited after informed consent. Patients with chronic kidney disease attending the medicine OPD, dialysis unit, casualty ward and indoor patients fulfilled the inclusion criteria.

Participants those were normotensive, without chronic kidney disease or without any disease that causes hypertension like primary hypertension, secondary hypertension cvd, stroke, diabetes, autonomic neuropathy were recruited as control.

### 2.2. Exclusion criteria

Adults with cancer, Acute myocardial infarction in the previous 6 months, Hepatic failure, Thyroid disease, Previous large vessel stroke and Moderate to severe cognitive decline were in exclusion criteria.

### 2.3. Statistical analysis

The results were analysed using descriptive statistics and making comparisons among various groups. Discrete (categorical) data were summarized as proportions and

percentages (%). All the associations were tested by using chi square test. Unpaired t tests were used for making comparisons between cases & control while one way ANOVA was used to compare parameters with various grades of cases.

Statistical analyses were performed using SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). A value of  $p < 0.05$  was considered statistically significant.

## 3. Observations & Results

A total 130 male and 54 female volunteers were taken for study, volunteers were divided in control and case. In male total 64 volunteers were control and 66 volunteers were CKD patients with DM, similarly in female 28 volunteers were control and 26 female volunteers were CKD patients with DM. Baseline demographic, clinical and biochemical characteristics are presented in Table 1.

Individual for case and control were taken based on age and sex to analyze, No significant difference in proportion of age and gender was found between case & control ( $p > 0.05$ ).

Volunteers were selected for analysis based on smoking, alcohol and tobacco consumption and their diet. Results Elaborated that Diet showed significant association with cases ( $p = 0.015$ ).

The significant difference was found in mean BMI between case & control group.

The significant difference was found in mean Hb, TLC & Fasting sugar between case & control group.

## 4. Discussion

A important negative relationship between higher BMI and CKD was discovered in this study of diabetic patients. In contrast to expectations, the BMI of CKD patients was found to be lower than that of non-CKD patients. The fact that CKD patients typically lose weight supports our finding of a negative relationship between CKD and BMI. Furthermore, there is a high probability of reverse causation, which can be clarified by the fact that CKD patients can receive special attention and treatment from the health-care system, and their adherence to a balanced diet and lifestyle may result in a reduction in excess calories and carbohydrates. Another reason may be that patients with CKD frequently experience anaemia and their nutritional condition deteriorates.<sup>16</sup>

Obesity has been shown to be a risk factor for CKD in several studies. According to the results of the Framingham study cohort, a high BMI will predict reduced kidney function on its own.<sup>17</sup> As a result, our findings contradict the Framingham cohort report. However, using BMI to determine CKD status in T2DM patients can be difficult. These people with diabetes not only lose muscle mass, but also have an increase in body fat. Since BMI does not distinguish between body muscle and body fat, it should not

**Table 1:** Baseline characteristics of subjects

Variable	Control		Case		Total		chi sq	p-value	
	No.	%	No.	%	No.	%			
Age	20 - 29 yr	12	13.0%	9	9.8%	21	11.4%	2.35	0.672
	30 - 39 yr	7	7.6%	4	4.3%	11	6.0%		
	40 - 49 yr	17	18.5%	23	25.0%	40	21.7%		
	50 - 59 yr	44	47.8%	42	45.7%	86	46.7%		
	>= 60 yr	12	13.0%	14	15.2%	26	14.1%		
Sex	Male	64	69.6%	66	71.7%	130	70.7%	0.11	0.746
	Female	28	30.4%	26	28.3%	54	29.3%		

**Table 2:** list of diet volunteers were used.

Variable	Control		Case		Total		chi sq	p-value	
	No.	%	No.	%	No.	%			
Smoking	No	69	75.0%	68	73.9%	137	74.5%	0.03	0.866
	Yes	23	25.0%	24	26.1%	47	25.5%		
Alcohol	No	85	92.4%	80	87.0%	165	89.7%	1.47	0.226
	Yes	7	7.6%	12	13.0%	19	10.3%		
Tobacco	No	75	81.5%	71	77.2%	146	79.3%	0.53	0.466
	Yes	17	18.5%	21	22.8%	38	20.7%		
Diet	Veg	42	45.7%	26	28.3%	68	37.0%	5.97	0.015
	Mixed	50	54.3%	66	71.7%	116	63.0%		

**Table 3:** Analysis of BMI between case and control.

Group		Mean	SD	t-value	p-value
BMI	Case	21.32	3.77	-9.42	<0.001
	Control	26.27	3.35		

**Table 4:** Analysis of Hb and TLC & fasting sugar among the volunteers

Group		Mean	SD	t-value	p-value
Hb	Case	9.52	1.95	-11.75	<0.001
	Control	12.51	1.45		
TLC	Case	9041.01	2569.94	6.25	<0.001
	Control	6864.27	2133.17		
Fasting Sugar	Case	126.64	31.42	8.84	<0.001
	Control	96.25	9.96		

be used as a reliable measure of CKD in T2DM patients.<sup>18</sup>

Previous research, mostly based on longitudinal studies, has suggested that obese people, especially those with cardiovascular and/or renal disease, may have a good survival outcome.<sup>18</sup> This argument is neither fully understood nor widely accepted in the scientific community, leading to the term "obesity paradox." This obesity paradox hypothesis was discovered in a longitudinal study<sup>19</sup> theorises that a high BMI can protect a patient from a variety of metabolic diseases by allowing them to use energy stored in their bodies. As a consequence, an abrupt loss of body muscle over time can be related to a lower chance of survival in CKD patients.<sup>20</sup> A 6-month decrease in body fat content was related to a higher mortality rate in patients on maintenance haemodialysis, according to one report.<sup>21</sup> However, since our results are based on a retrospective cross-sectional analysis, it is difficult to

equate our findings to the above-mentioned obesity and CKD association. The worldwide spread of kidney disease does not follow the same epidemiological characteristic, and it differs according to geographic factors, ethnicity, and racial factors.<sup>18</sup> Increased age was linked to renal insufficiency in this study, which was also discovered in an earlier findings.<sup>19</sup> In this study, the mean of BMI was 26.27 kg/m<sup>2</sup> among the T2DM patients. After applying the WHO recommended BMI classification (overweight: BMI  $\geq$ 25.00 kg/m<sup>2</sup> and obese  $\geq$ 30.00 kg/m<sup>2</sup>). The finding was consistent and contextual, after taking consideration of another study, which found that about 50% of participants of a selected area in India were accounted as overweight and obese.<sup>19</sup>

Considering the other risk factors of CKD, degenerative changes of the renal glomerular tissue is found as frequent among the older age group.<sup>18</sup> The number of female patients with CKD was more when compared with their

male counterparts. Our findings are similar to other large-scale studies where old age and female sex were found as a risk factor of CKD.<sup>20</sup> Our study found that T2DM patients with hypertension had 1.4 times high chances to get CKD which is similar to a previous report (Peralta et al. 2005) Moreover, diabetic patients with higher micro albuminuria were 1.7 times more likely to have CKD, which corresponds to an earlier study.<sup>21</sup> To the best of our knowledge, this was the first initiative to analyse the individual relationship between BMI and diabetic CKD in the India.

However, this study has experienced certain limitations. It was a monocentric study, and this study could not collect relevant information on food habit, behaviour, duration of T2DM, first-time identification of DM, medication use like lipid-lowering drugs, and adherence to treatment. This study did not consider other comorbidities like chronic obstructive pulmonary disease, heart failure, or malignancies, which are contributory factors for weight change due to unconfirmed diagnosis. Therefore, residual confounding might influence the study findings. The results of this cross-sectional study should be interpreted with caution due to the usual cause and effect dilemma. However, this study has used a large volume of sample and high-quality data to come up with the finding.

Finally, the negative association of BMI with CKD in patients with T2DM might reflect the reverse causality. Lower BMI might not contribute to CKD, but there are probabilities that CKD can lead to the reduced BMI. Therefore, longitudinal studies are required to explore the actual relationship of BMI with the development of diabetic CKD.

The level of haemoglobin in CKD patients with Diabetes was also investigated in this study. The overall haemoglobin level in the study's control population was decent (12.51), but the prevalence of CKD patients with DM had a low haemoglobin level (9.52). Anaemia is a well-known complication of CKD that is linked to the severity of renal insufficiency, owing to decreased endogenous erythropoietin development and true deficiency or reduced serum iron availability.<sup>22</sup> Previous indirect evidence indicated that diabetic patients with CKD could have higher anaemia rates than diabetic patients without the disease. Patients with type 2 DM can develop anaemia even if they don't have nephropathy, according to a previous retrospective review, which found that 16% of people with type 2 DM but no CKD developed anaemia after a 7-year follow-up.<sup>23</sup>

In conclusion, this study has confirmed that Hb level & BMI both are very low in CKD outpatients and reduced steadily with advancing Stages of CKD. Furthermore, the prevalence of anemia is higher in diabetic patients with CKD compared to matched non-diabetic counterparts. As anemia is associated with significant morbidity and mortality, both detection and treatment of anemia in diabetic CKD patients should be performed earlier than in non-

diabetic counterparts.

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## 6. Conflict of Interest

None.

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