

# Prevalence and Risk Factors of Anemia in Chronic Kidney Disease Patients with Diabetes: A Cross-Sectional Study

Risk Factors of Anemia in Chronic Kidney Disease with Diabetes

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## ABSTRACT

**Objective:** To assess the prevalence of anemia in patients of chronic kidney disease secondary to diabetes.

**Study Design:** A Cross-Sectional Study

**Place and Duration of Study:** This study was conducted at the Department of Nephrology and Hemodialysis, Central Park Teaching Hospital, Lahore from December 2022 to May 2023.

**Methods:** Non-random convenient sampling technique was employed and patients with age of 18 to 64 who are diagnosed cases of CKD stage 3 or above with GFR < 60 ml/min/1.73 m<sup>2</sup> were recruited in the study. Post stratification chi-square test was applied and p-values < 0.05 was considered statistically significant.

**Results:** A total of 323 patients were recruited with the mean age of 42.76 ± 11.54 years with age range of 21 to 60 years. Anemia was assessed in all the study participants; it showed the prevalence of anemia in chronic kidney diseased patients secondary to diabetes was noted as 31.3% showing that 101 patients out of 312 had anemia. Females are more prone to develop anemia in diabetic chronic kidney diseased patients when compared to males with p value of 0.039.

**Conclusion:** Customized therapy and individualized interventions can be designed that are in tune with the causes of anemia in this category of patient thus enhancing clinical outcomes.

**Key Words:** Chronic Kidney Disease; Diabetes; Anemia

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## INTRODUCTION

A major fraction of the clinical and intricate nature of the uremic syndrome with regards to the treatment of CKD is mostly but not eventually derived from anemia, a significant consequence of CKD<sup>1</sup>. This condition is a very common hematological illness within the general population with prevalence estimated at 7.6%, which is compatible with serum hemoglobin levels below 130 g/L for males and 120 g/L women. However those with renal disease has a much higher prevalence reaching 15%. As eGFR and hemoglobin serum level are subject to virtually linear connection, anemia is usually associated with the degree of the renal worthlessness<sup>2,3</sup>.

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Patients with Chronic Kidney Disease Stage 3 Anemia is noticeably common, rising from 5% in CKD Stage 1 to about 75% to 80% in Pre Dialysis Stage CKD<sup>4,5</sup>. As for the kidney, decrease of erythropoietin secretion is the first mechanism that leads to anemia in the chronic kidney diseases<sup>6</sup>. Furthermore, anemia might be caused by lowered iron or unavailability of iron due to higher hepcidin levels caused by the localized inflammation in the chronic uremia is responsible for the occurrence<sup>7</sup>. In addition, different factors such as malnutrition and each state of chronic inflammation can bring about a decrease in folates and vitamin B12 and an increase in the reticules formation (erythroblasts) and immature cells death<sup>6</sup>. Anemia has been traced to some poor quality life, more hospital admissions, renal disease progression, as well as high mortality rate apart from comparative CKD patients<sup>8</sup>. DM has been identified as the primary cause of CKD and ESRD; what's more, DM is also thought to be associated with renal development, even without renal impairment.

About 10% of DM patients with normal renal function have been reported to have anemia<sup>9</sup>. Hemoglobin levels in a population of almost 9000 people without renal impairment were independently influenced by diabetes<sup>10</sup>. Numerous factors have been proposed as contributing to the pathogenesis of anemia in these patients, including the use of renin-angiotensin-aldosterone system (RAAS) blockers, which are

essential in the treatment of proteinuric diabetic nephropathy, erythropoietin deficiency caused by efferent sympathetic denervation of the kidney in the context of diabetic neuropathy, and chronic inflammatory reaction leading to functional iron deficiency. Anemia may be more prevalent and manifest at an earlier stage of chronic kidney disease (CKD) in individuals with diabetes<sup>11</sup>. On this context, the aim of this study was to examine in comparison the prevalence of anemia in matched CKD patients with DM and not on dialysis.

**METHODS**

A descriptive cross-sectional study was conducted at department of nephrology and hemodialysis central park teaching hospital for the assessment of anemia at various levels of diabetic non-dialysis dependent patients from December 2022 to May 2023 after obtaining ethical approval from institutional review board of Central Park Medical College and Teaching Hospital (CPMC/IRB-No/2238). Sample size of 323 was calculated by using WHO sample size calculator with confidence interval of 95 percent and anticipated population proportion of 30 percent<sup>12</sup>. Non-random convenient sampling technique was employed and patients with age of 18 to 64 who are diagnosed cases of CKD stage 3 or above with GFR < 60 ml/min/1.73m<sup>2</sup> were recruited in the study. While patients undergoing kidney transplant, and have anemia due metabolic and other causes like carcinomas were excluded from the study.

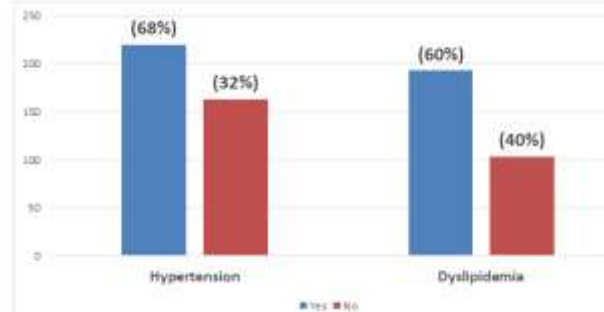
After obtaining written informed consent, detailed demographic information like gender, age, height, weight, BMI background were recorded. Body-mass index was calculated through dividing the weight with the height squared; it was considered to be a risk factor for hypertension, hyperlipidemia, diabetes mellitus, and coronary artery disease. A 3cc venous blood was also collected in EDTA/clot vials for the assessment of blood glucose, serum urea and creatinine levels and were immediately centrifuged at 4000 rpm for 30 minutes and serum was separated and parameters were assessed using commercially available ELISA kits.

**Statistical analysis:** Statistical analysis was performed with Statistical Package for Social Sciences 26.0 (SPSS Inc, Chicago, IL). Continuous variables like age were presented as mean ± 1 SD and categorical variables like gender, HTN, dyslipidemia etc. were described as number or percentage (n, %). Data was stratified for age, gender, duration of DM, Stage of CKD (3-5), HTN, Dyslipidemia. Post stratification chi-square test was applied and p-values < 0.05 was considered statistically significant.

**RESULTS**

A total of 323 patients were recruited with the mean age of 42.76 ± 11.54 years with age range of 21 to 60 years.

On the assessment of gender, 46 percent (n=149) were males and rest of 54% (n=174) were females. Body mass index (BMI) was assessed it was to be 24.76 ± 3.07 kg/m<sup>2</sup> and mean duration of diabetes was also assessed which turned out to be 9.01 ± 5.96 years. Frequency of hypertension was also assessed; it showed 68 percent (n=220) were hypertensive as well while rest 32% (n=103) were non-hypertensive as explained in figure 1. All the patients were also screened for dyslipidemias and it showed 60% of study population (n=193) were having dyslipidemia while rest 40 percent (n=130) were not having any dyslipidemia as explained in figure 1.



**Figure No.1: Assessment of Frequency of Hypertension and Dyslipidemia in Study Population.**

Age stratification was done for the assessment of age as risk factor in the development of anemia in diabetic chronic kidney disease patients and it showed only 49 out of 101 below 40 years of age developed anemia while 93 out of 222 developed anemia showing no impact of age in development of anemia in patients of diabetic CKD with p value of 0.266. Similarly gender stratification was done for the assessment of gender as risk factor in development of anemia in study population as explained in table 1. It showed that females are more prone to develop anemia in diabetic chronic kidney diseased patients when compared to males with p value of 0.039 as explained in table 1.

**Table No.1: Assessment of Anemia in Study Population based on Gender.**

Presence of Anemia	Male	Female	Total	p-value
Yes	38	63	101	0.039*
No	111	111	222	
Total	149	174	323	

Anemia was assessed in all the study participants; it showed the prevalence of anemia in chronic kidney disease patients secondary to diabetes was noted as 31.3% showing that 101 patients out of 312 had anemia. Impact of duration of diabetes was assessed using chi-square test by setting the cut off at 5 years as explained in table 2. Surprisingly it was noted that duration of diabetes has no association with anemia in chronic kidney disease patients secondary to diabetes as narrated in table 2 with p-value of 0.473.

**Table No.2: Application of Chi-square test on Anemia with Duration of Diabetes Stratification.**

Presence of Anemia	<5 years	>5 years	Total	p-value
Yes	25	76	101	0.473
No	47	175	222	
Total	72	251	323	

Chi-square was employed for the assessment of body mass index as effect modifier on the anemia in study population; out of 101 anemia patients, 55 were having normal BMI for south Asians while 46 with higher BMI had anemia which showed insignificant association of anemia with BMI with p value of 0.117. Hypertension was also assessed as effect modifier in presence of anemia it was noted that 73 out of 101 patients were hypertensive which showed a positive association with anemia with p value of 0.021 as explained in table 3. Dyslipidemias were also assessed for anemia and it was noted that no association was observed between dyslipidemias and anemia in patients of chronic kidney disease secondary to diabetes with p-value of 0.190.

**Table No.3: Application of Chi-square test on Anemia with presence of Hypertension Stratification**

Presence of Anemia	Yes	No	Total	p-value
Yes	73	28	101	0.021*
No	147	84	222	
Total	220	130	323	

## DISCUSSION

The purpose of the discussed study was to investigate the incidence of anemia in CKD patients of diabetes who do not depend on dialysis. Anemia is a widespread of the blood disorder common in CKD patients, and it is very important in the development of the disease. The analysis indicated that anemia was manifested in 31 percent while scanning 100% of the target population, this stand will emphasize that the disease weight in this group is enormous.

This finding is the same as the outcomes of other studies that showed the fact that the anaemia is highly prevalent in the CKD subjects, especially, the diabetic ones. Our findings concur with what has been previously reported: the anemia-Chronic Kidney Disease-Diabetes association is rather complex. The relationship between diabetes and anemia was shown in a number of investigations to be broad among etiologies in the diabetic kidney disease, among which are impaired erythropoiesis, erythropoietin deficiency, functional iron deficiency as well as chronic inflammatory processes<sup>13,14</sup>.

Surprisingly, the difference in distribution was in favour of females so that anemia could be more common in female diabetic CKD patients than in their male counterparts. This observation reports possible

gender-specific differences in the pathogenesis or the management of anemia in this group leading further investigation later on. Nevertheless, it should be noted that both genetic and societal factors result in women having more risks for anemia than men, further research is required to study hormonal variations and nutritional status that also influence the prevalence of anemia<sup>15</sup>.

So our study did not lead to better understanding of the relation between the time of diabetes duration and the emergence of anemia among CKD patients. On the contrary, the emergence of anemia is found to be less connected to the progression of diabetes duration which stands in accordance with some previous research that anemia prevalence increase with length of diabetes. However, mainly this no association in our study may be an indicator of a very complex interconnecting situation of different elements what lead to onset of anemia in diabetic CKD not related to diabetes duration only<sup>16,17</sup>.

BMI (body mass index) and comorbidities such as hypertension (high blood pressure) were therefore considered as possible effect modifiers for anemia. Although we have not observed a significant association between BMI and anemia, however, hypertension was seen to be associated with the presence of anemia positively<sup>18,19</sup>. This underlines the need for the inclusion of comorbidities and in the management of anemia in CKD patients especially patients with diabetes.

Besides that, the lack of a strong correlation between anemia and dyslipidemia in individuals in our study population reveals that dyslipidemia might not be the main reason for anemia in diabetic CKD patients. Nevertheless, in-depth studies should be conducted towards identifying and understanding whether dyslipidemia has a role in anemia development in this group of patients<sup>20</sup>.

On the whole, this survey is a substantial stepping stone towards an ever-expanding research field about the incidence and risk factors of anemia in non-dialysis dependents with diabetic CKD. The elucidation of the fundamental mechanisms and risk factors of anemia in this population would be crucial for the personalization of care of patients, as well as the development of some targeted interventions which would aim at the mitigation of the impact of anemia and the improvement of the clinical outcomes. Also, more longitudinal studies with large sample sizes and comprehensive analyses of potential confounders are required to validate our findings and to reveal the complicated mechanism of the development of anemia in patients with diabetic CKD.

## CONCLUSION

In the end, our study illuminates the prevalence of anemia in non-dialysis patients with DM-CKD. Another CKD complication is anemia and our findings

present a huge implication of this disease among this population. Customized therapy and individualized interventions can be designed that are in tune with the causes of anemia in this category of patient thus enhancing clinical outcomes.

#### Author's Contribution:

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Revisiting Critically: Abdulrehman Saleem, Faheem Usman Sulehri

Final Approval of version: Abdulrehman Saleem

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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