

## Clinical and Biochemical Profile of Chronic Kidney Disease Patients on Maintenance Haemodialysis in a Tertiary Care Hospital

Bhavyaa Ranawat<sup>1</sup>, Nupur Dhande<sup>2</sup>, Neha Dash<sup>3</sup>, Digvi Pandit<sup>4</sup>, Akshata Sakhare<sup>5</sup>, Nita Gangurde<sup>6</sup>

<sup>1</sup>PHASE III MBBS, Dr. Vasant Rao Pawar Medical College, Hospital and Research Centre, Adgaon, Nashik 422003, India

<sup>2</sup>PHASE III MBBS, Dr. Vasant Rao Pawar Medical College, Hospital and Research Centre, Adgaon, Nashik 422003, India

<sup>3</sup>PHASE III MBBS, Dr. Vasant Rao Pawar Medical College, Hospital and Research Centre, Adgaon, Nashik 422003, India

<sup>4</sup>PHASE III MBBS, Dr. Vasant Rao Pawar Medical College, Hospital and Research Centre, Adgaon, Nashik 422003, India

<sup>5</sup>JR-III, Dept. of Medicine, Dr. Vasant Rao Pawar Medical College, Hospital and Research Centre, Adgaon, Nashik 422003, India

<sup>6</sup>Professor, Department of Microbiology, Dr. Vasant Rao Pawar Medical College, Hospital and Research Centre, Adgaon, Nashik 422003, India

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Corresponding author: Dr. Nita Gangurde

Conflict of interest: Nil

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### Abstract

**Background:** Chronic kidney disease is associated with markedly increased risk for morbidity and mortality. If kidney dysfunctions for more than three months or long, it is identified by structural or functional disorders of the kidney that reduces glomerular filtration rate to less than 60 mL/min/1.73 m<sup>2</sup>. It presents as either clinical abnormalities or indicators of kidney injury, such as changes in the blood or urine composition or abnormalities in imaging studies.

Nearly every system in the body is impacted by CKD, which leads to a number of structural and functional problems. Since CKD leads to disturbances in vital functioning of every organ system of the body including disorders of fluid electrolyte, acid base balance, hematologic, gastrointestinal and metabolic abnormalities, it was planned to assess the demographic and other biochemical parameters in cases of CKD patients to appreciate various clinical presentations along with biochemical investigation reports of CKD patients in a tertiary care hospital and to study various biochemical parameters which are associated with the course of CKD.

**Aims and Objectives:** To study various demographic patterns and other biochemical clinical parameters in patients with CKD on maintenance hemodialysis.

**Methodology:** It was a prospective observational clinical study. The study was done in the department of medicine in a tertiary care centre.

**Sample Size:** 121 patients

**Inclusion Criteria:** Both sexes and all age groups on haemodialysis.

**Exclusion Criteria:** Patients not willing to give informed consent.

In the present study, clinical profile, biochemical parameters such as Complete blood count, Serum electrolytes, Renal function test, Liver function test, C reactive protein level, Lipid

profile, S proteins, Serum calcium and phosphorus and Serum uric acid was done. Patient evaluation was done on the day of admission, during each dialysis and at time of discharge.

**Discussion and Conclusion:** Higher age patients with male predominance were observed in CKD patients. Weight, height, and BMI are the important demographic parameters in CKD patients. Hypertension was the common comorbidity in the current study of CKD patients. Creatinine level, urea level and urea protein parameters were abnormal in the CKD patients. The present study observed a high prevalence of biochemical abnormalities in CKD patients. In view of the above findings, the present study recommends periodic biochemical examination for diagnosis and early treatment of abnormalities in patients with CKD at regular intervals, which may prevent renal complications in the longer run.

**Keywords:** Chronic Kidney Disease, Hemodialysis, Biochemical Parameters.

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## Introduction

Chronic kidney disease is associated with markedly increased risk for morbidity and mortality. If kidney dysfunctions for more than three months or long, it is identified by structural or functional disorders of the kidney, that reduces glomerular filtration rate to less than 60 mL/min/1.73 m<sup>2</sup>. [1] It presents as either clinical abnormalities or indicators of kidney injury, such as changes in the blood or urine's composition or abnormalities in imaging studies. [2]

According to statistics from 2017, chronic kidney disease was the 12th leading cause of mortality worldwide. According to Lancet [3], the number of individuals needing dialysis increased by nearly 40% in 2020. 1.23 million deaths from CKD were thought to have occurred, the majority of which were brought on by cardiovascular diseases (CVD) brought on by a reduction in renal function.

### Aetiology of CKD

There are many reasons for CKD, and the commonest causes incorporate diabetes, hypertension and maturing of the kidneys.

1. Diabetes Mellitus
2. Glomerulonephritis
3. Hypertension
4. Autosomal dominant polycystic kidney disease
5. Cystic and tubulointerstitial diseases.

The pathophysiology of the uremic syndrome as a complication of CKD is divided into in three domains of dysfunction [4]

- Those due to accumulation of toxins that normally undergo renal excretion;
- Those as a result of the loss of other kidney functions, such as fluid and electrolyte homeostasis and hormone regulation; and
- Consequent to progressive systemic inflammation and its vascular dysfunction.

Nearly every system in the body is impacted by CKD, which leads to a number of structural and functional problems. Since CKD leads to disturbances in vital functioning of every organ system of the body including disorders of fluid electrolyte, acid base balance, hematologic, gastrointestinal and metabolic abnormalities, it was planned to assess the demographic and other biochemical parameters in cases of CKD patients to appreciate various clinical presentations along with biochemical investigation reports of CKD patients in a tertiary care hospital.

### Aims and Objectives:

To study various demographic patterns and biochemical clinical parameters in patients with CKD on maintenance hemodialysis.

**Methodology:**

**Study Type/Design:** Prospective observational clinical study.

**Study Setting:** The study was done in the department of medicine in a tertiary care centre.

**Sample Size:** 121 patients

**Inclusion Criteria:** Both sexes and all age groups on haemodialysis.

**Exclusion Criteria:** Patients not willing to give informed consent.

In the present study, clinical profile, biochemical parameters as Complete blood count, Serum electrolytes, Renal function test, Liver function test, C reactive protein level, Lipid profile, S proteins, Serum calcium and phosphorus and Serum uric acid was done. Patient evaluation was done on the day of admission, during each dialysis and at time of discharge.

Informed consent was taken from every patient.

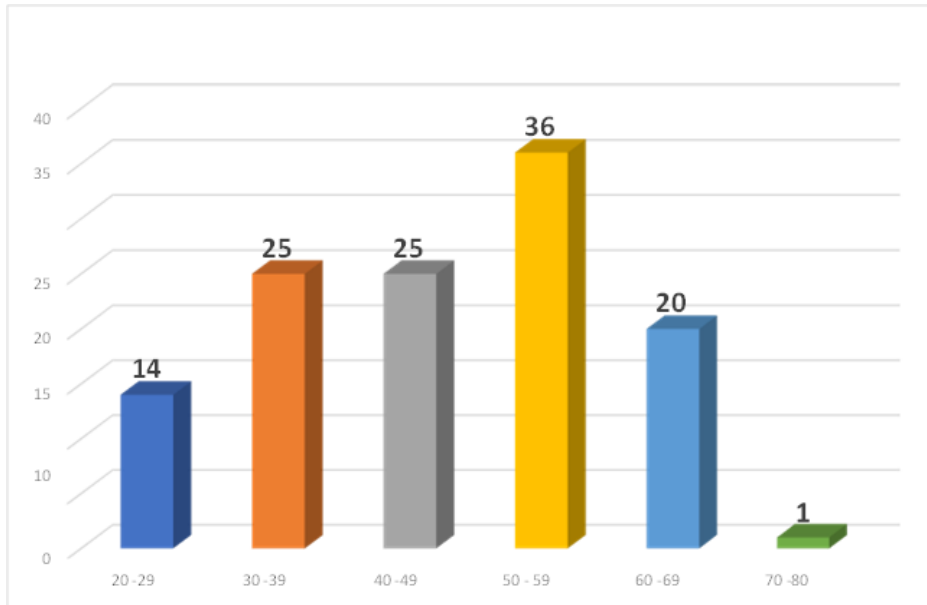
**Result and Observations:** This was a prospective observational clinical study conducted in the department of medicine in a tertiary care centre. 121 patients satisfying the inclusion criteria are selected in the study. In this study, clinical profile, biochemical testing, course in hospital and outcome of patients diagnosed to have chronic kidney disease was studied. Patient evaluation was done on the day of admission, during each dialysis and at the time of discharge.

All the findings are noted in the excel spreadsheet. The obtained data is analysed by SPSS 25 software & the frequency, mean, percentage & p – value is calculated and presented in a proper tabular form & with graphical format. The p-value < 0.05 was considered as statistically significant.

**Table 1: Study of age distribution in CKD cases**

Age in years	Frequency (N)	Percentage (%)
20 -29	14	12
30 -39	25	20.66
40 -49	25	20.66
50 - 59	36	29.74
60 -69	20	16.53
70 -80	1	0.83
<b>Total</b>	<b>121</b>	<b>100</b>
<b>Mean</b>	<b>46.78</b>	
<b>SD</b>	<b>12.68</b>	

**Table 1** represents the age distribution of CKD patients. Out of 121 patients the maximum of 36 ( 29.74 %) cases were in the age group of 50 -59 years. The mean age is 46.78 years with a SD of 12.68.

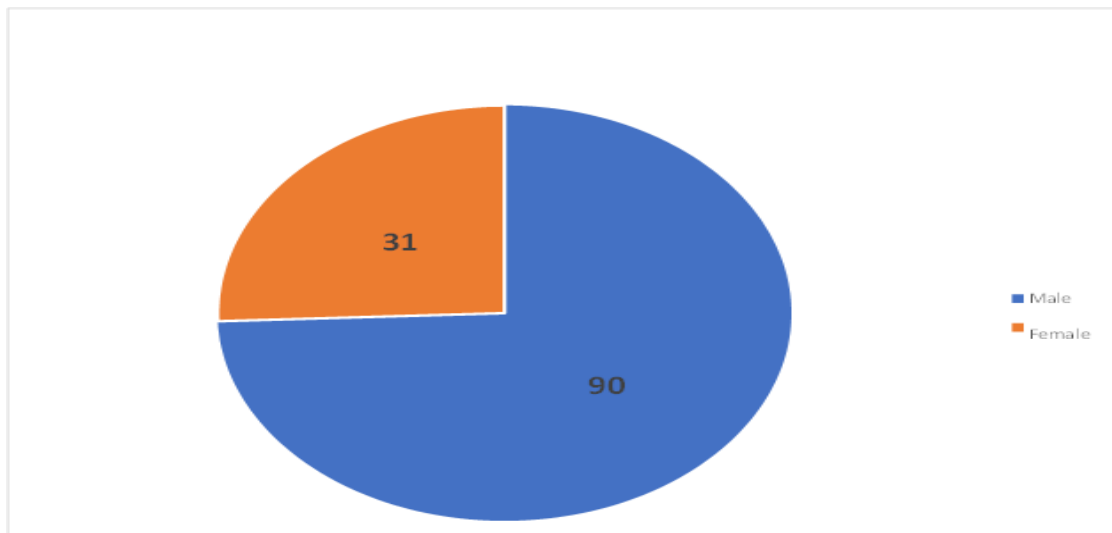


**Figure 1: Study of Age distribution in CKD patients**

**Table 2: Study of Gender Distribution in CKD patients**

Gender	Frequency (N)	Percentage (%)
Male	90	74.38
Female	31	25.62
<b>Total</b>	<b>121</b>	<b>100</b>

**Table 2** represents the gender distribution in CKD patients. Out of 121 patients 90 ( 74.38 %) were male and 31 ( 25.62 %) were female. The male: female ratio is 2.90: 1.

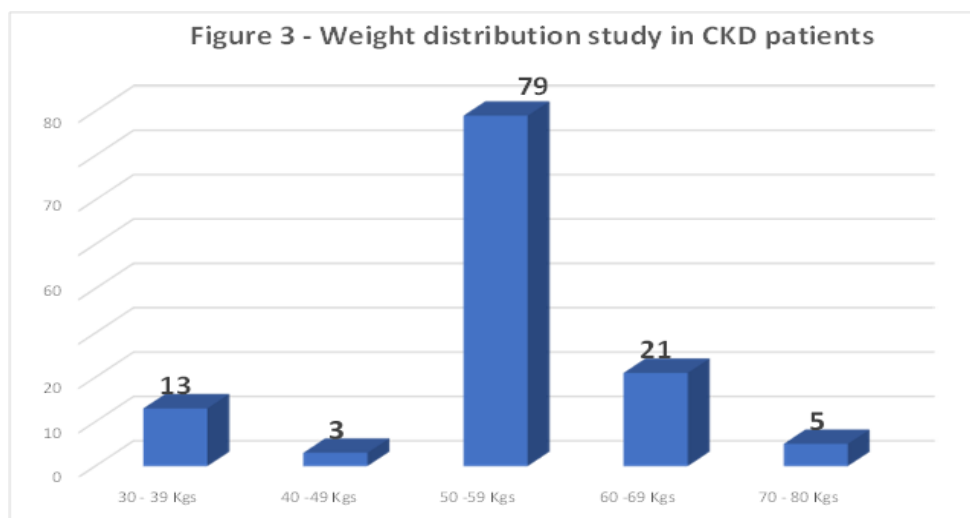


**Figure 2: Study of gender distribution in CKD Patients**

**Table 3: Study of Weight distribution in CKD patients**

Weight in Kgs	Frequency ( N )	Percentage (%)
30 - 39	13	10.74
40 -49	3	2.48
50 -59	79	65.29
60 -69	21	17.36
70 - 80	5	4.13
<b>Total</b>	<b>121</b>	<b>100</b>
<b>Mean</b>	<b>54.20 years</b>	
<b>SD</b>	<b>7.91</b>	

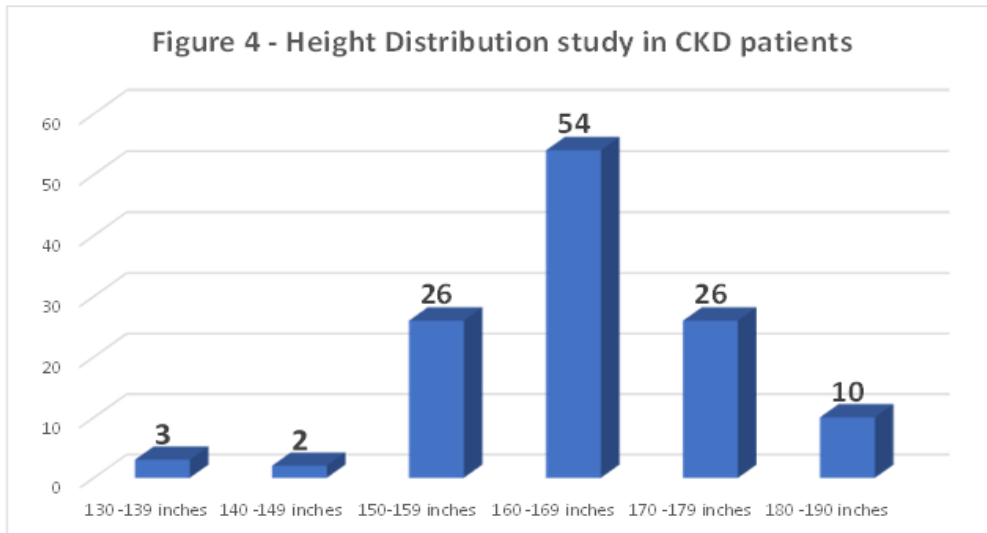
**Table 3** represents the weight distribution in CKD patients. Out of 121 patients maximum 79 (65.29 %) patients had a weight between 50 -59 kgs. The mean weight of CKD patients in the study is 54.20 Kgs with a SD of 7.91.



**Table 4: Study of Height distribution in CKD patients**

Height in (inches)	Frequency( N )	Percentage (%)
130 -139 inches	3	2.48
140 -149 inches	2	1.65
150-159 inches	26	21.49
160 -169 inches	54	44.63
170 -179 inches	26	21.49
180 -190 inches	10	8.26
<b>Total</b>	<b>121</b>	<b>100</b>
<b>Mean</b>	<b>164.12 inches</b>	
<b>SD</b>	<b>10.12</b>	

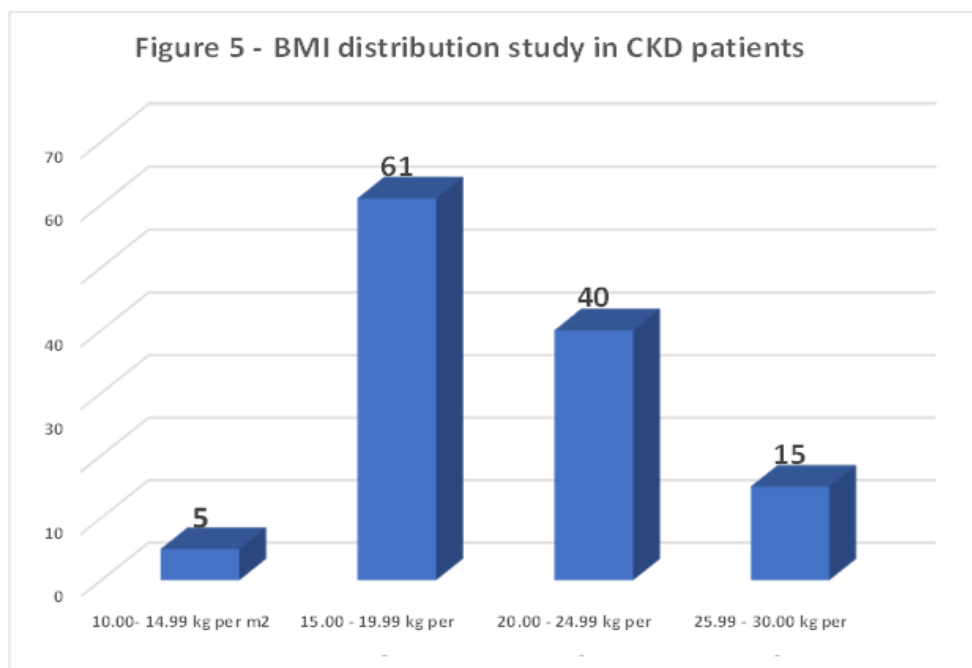
**Table 4** represents the height distribution in CKD patients. Out of 121 patients maximum 54 (44.63 %) patients had height between 160 -169 inches. The mean height of CKD patients in the study is 164.12 inches with a SD of 10.12



**Table 5: Study of Body mass Index distribution in CKD patients**

BMI (kg per m2)	Frequency( N)	Percentage (%)
10.00- 14.99	5	4.13
15.00 - 19.99	61	50.41
20.00 - 24.99	40	33.06
25.99 - 30.00	15	12.40
<b>Total</b>	<b>121</b>	<b>100</b>
<b>Mean</b>	<b>20.30 kg/m<sup>2</sup></b>	
<b>SD</b>	<b>3.37</b>	

**Table 5** represents the body mass index distribution in CKD patients. Out of 121 patients maximum 61 ( 50.41 %) patients had BMI between 15 – 19.99 kg/m<sup>2</sup>. The mean BMI of CKD patients in the study is 20.30 Kg/m<sup>2</sup> with a SD of 3.37.

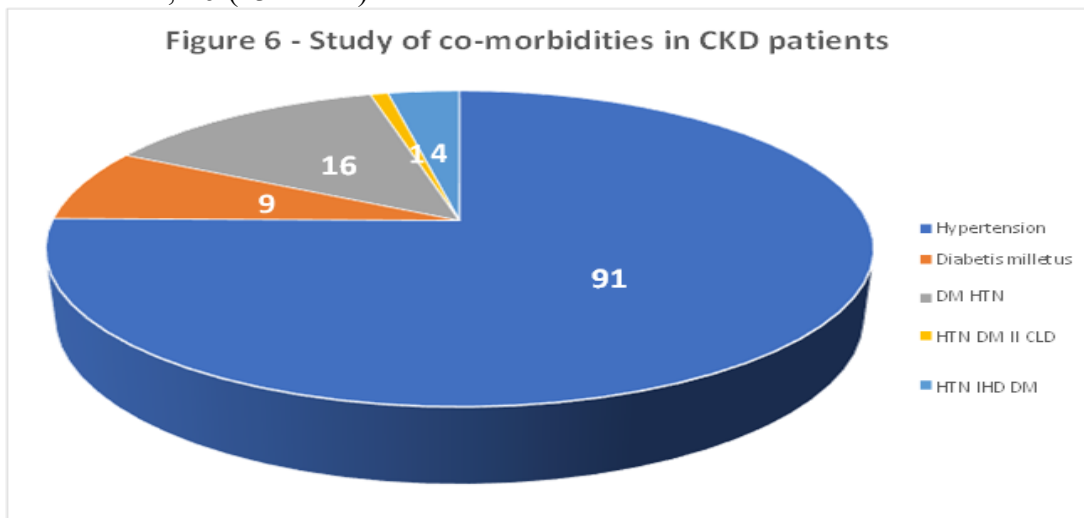


**Table 6: Distribution of associated co-morbidities in CKD patients**

Cause of CKD	Frequency ( N )	Percentage (%)
Hypertension	91	75.21
Diabetes Miletus	9	7.44
DM + HTN	16	13.22
HTN + DM II + CLD	1	0.83
HTN + IHD + DM	4	3.31
<b>Total</b>	<b>121</b>	<b>100</b>

**Table 6** represents the associated co-morbidities in CKD patients. Out of 121 patients 91 (75.21 %) cases suffered from hypertension, 9 ( 7.44 %) patients had diabetes mellitus, 16 (13.22 %) cases had

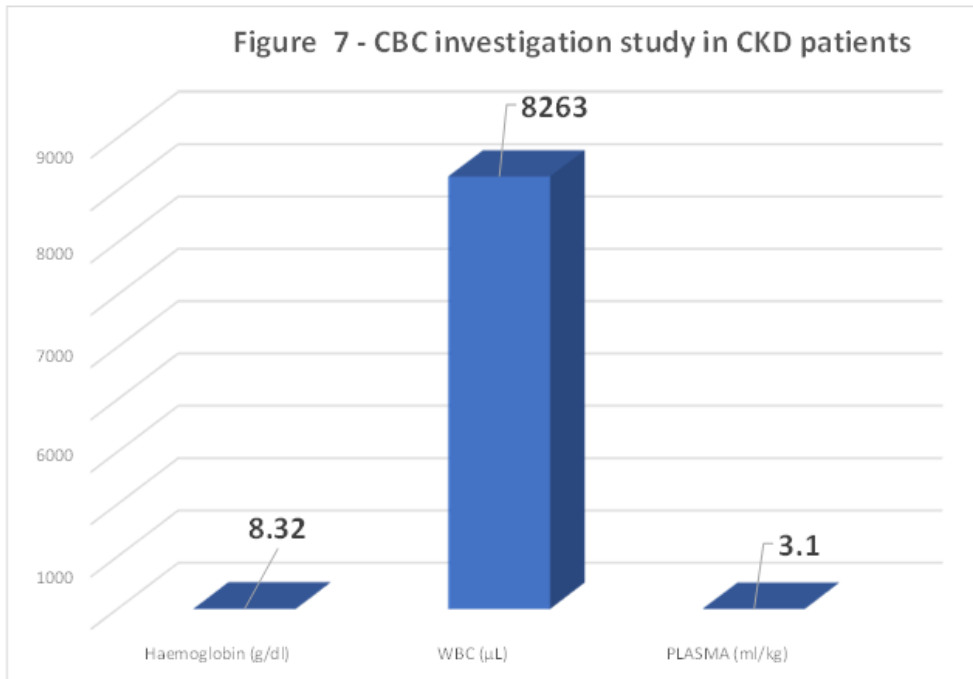
both diabetes mellitus & hypertension, 1 ( 0.83 %) patient had hypertension, DM & chronic liver disease, and 4 ( 3.31 %) cases had hypertension, ischemic heart disease & DM.



**Table 7: Total blood count Investigation in CKD patients**

CBC Investigations	Mean	Median	SD	Minimum	Maximum
Haemoglobin (g/dl)	8.32	8.4	1.29	5.5	11.4
WBC (µL)	8263	7802	4917	1308	27222
PLASMA (ml/kg)	3.1	2.1	8.48	1.17	82

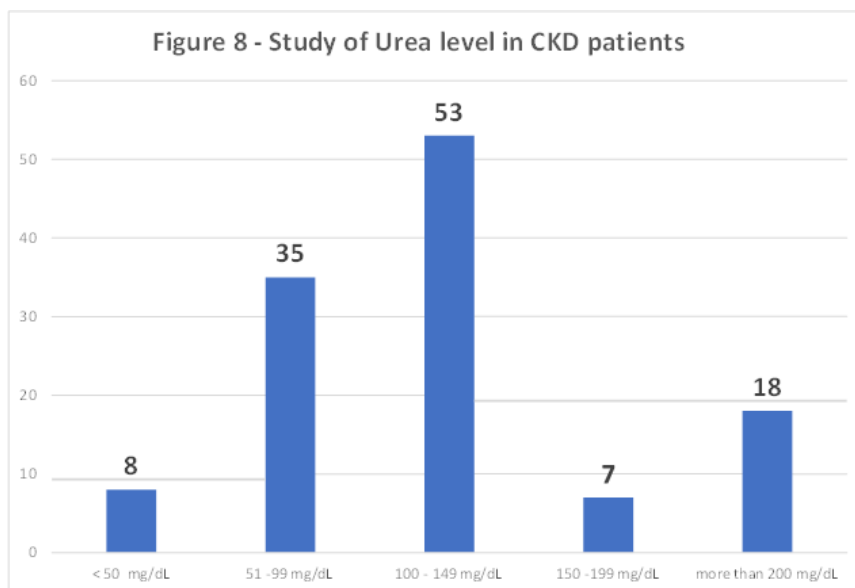
**Table 7** represents the total blood count investigation in CKD patients. The mean hemoglobin level of 121 patients is 8.32 g/dl with a SD of 1.29. The mean WBC is 8263 µL with SD of 4917. The mean plasma level is 3.1 ml/kg with a SD of 8.48.



**Table 8: Study of Urea level in CKD patients**

Urea (mg/dL)	Frequency (N)	Percentage (%)
< 50 mg/dL	8	6.61
51 -99 mg/dL	35	28.93
100 - 149 mg/dL	53	43.80
150 -199 mg/dL	7	5.79
more than 200 mg/dL	18	14.88
<b>Total</b>	<b>121</b>	<b>100</b>
<b>Mean</b>	<b>130.07 mg/Dl</b>	
<b>SD</b>	<b>74.72</b>	

**Table 8** represents the urea level in CKD patients. Out of 121 maximum of 53 ( 43.80 %) patients had the urea level between 100 -149 mg/dL. The mean urea level is 130.07 mg/dL with a SD of 74.72.





**Table 9: Study of Creatinine level in CKD patients**

Creatinine (mg/dL)	Frequency ( N)	Percentage (%)
2.1 - 4.0	15	12.40
4.1 - 6.0	15	12.40
6.1 - 7.9	53	43.80
> 8	38	31.40
<b>Total</b>	<b>121</b>	<b>100</b>
<b>Mean</b>	<b>8.01 mg/dL</b>	
<b>SD</b>	<b>4.46</b>	

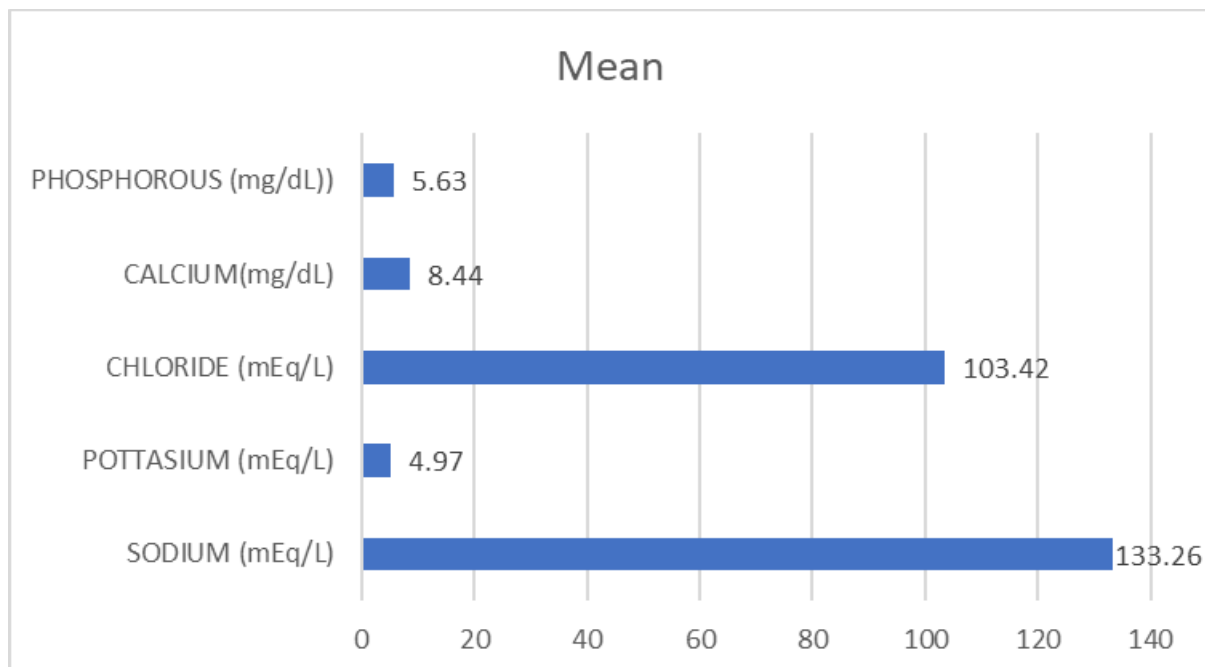
**Table 9** represents the study of Creatinine level in CKD patients. Out of 121 patients maximum of 53 (43.80%) patients had Creatinine level between 6.1 -7.9 mg/dL. The mean Creatinine level is 8.01 mg/dL with a SD of 4.46.

**Table 10: Study of Electrolyte level in CKD patients**

Electrolyte level	Mean	Median	SD	Minimum	Maximum
<b>Sodium (mEq/L)</b>	133.26	133	6.69	116	147
<b>Potassium (mEq/L)</b>	4.97	4.9	0.9	2.9	6.6
<b>Chloride (mEq/L)</b>	103.42	102	6.28	87	120
<b>Calcium (mg/dL)</b>	8.44	8.4	0.95	6.7	10.6
<b>Phosphorous (mg/dL)</b>	5.63	4.7	2.6	1.8	12

**Table 10** represents the electrolyte level in CKD patients. The mean sodium level of 121 patients is 133.26 mEq/L with a SD of 6.69. The mean potassium level is 4.97 mEq/L with a SD of 0.9. The mean

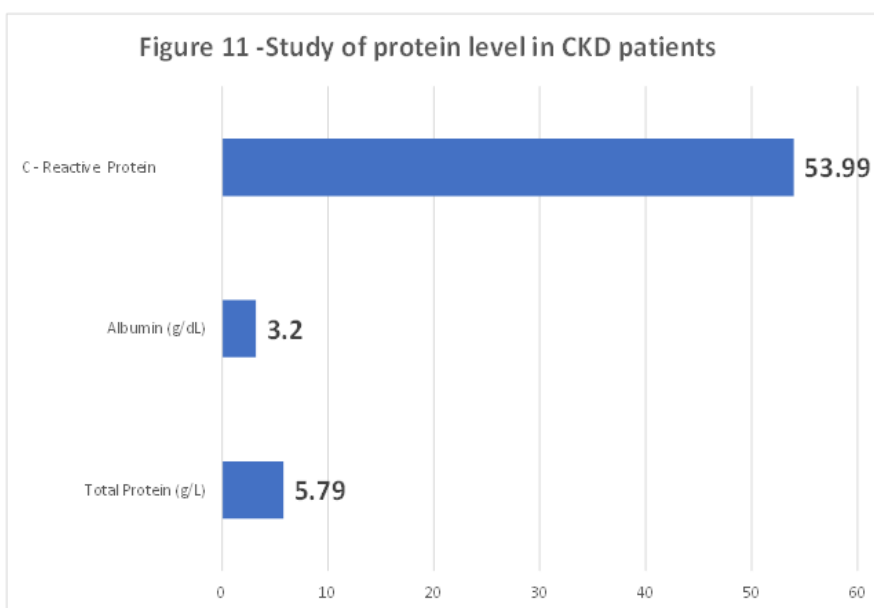
chloride level is 103.42 mEq/L with a SD of 6.28. The mean calcium level is 8.44 mg/dL with a SD of 0.95 and mean phosphorus level is 5.63 mg/dL with a SD of 2.6.



**Table 11: Study of protein level in CKD patients**

Protein level	Mean	Median	SD	Minimum	Maximum
Total protein (g/dL)	5.79	5.8	1.31	3.4	7.6
Albumin (g/dL)	3.2	3.2	0.62	1.6	4.3
C - reactive Protein (mg/dL)	53.99	56	31.47	1.9	123

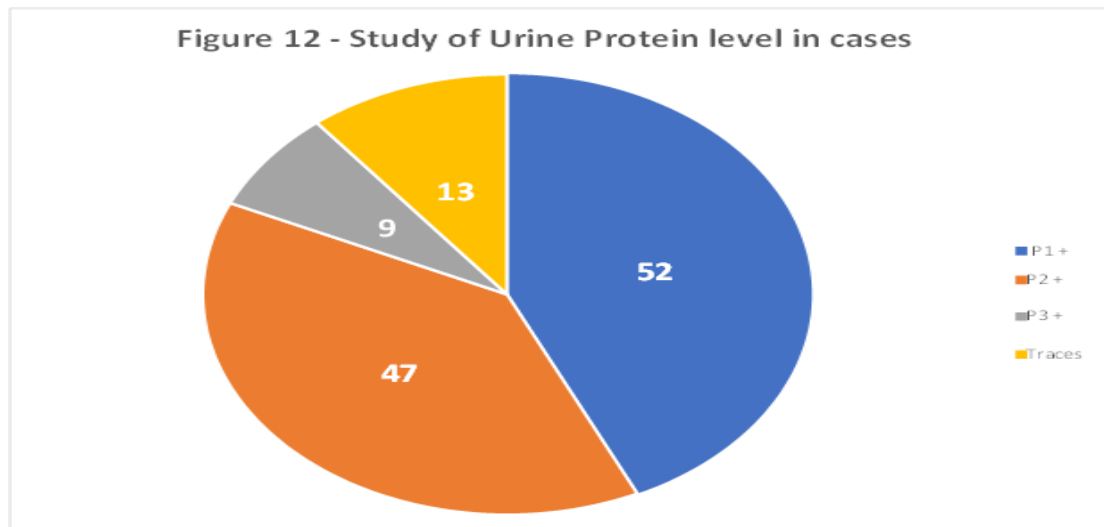
**Table 11** represents the protein level in CKD patients. The mean total protein in 121 patients is 5.79 g/dL with a SD of 1.31. The mean albumin level is 3.2 g/dL with a SD of 0.62. The mean C-reactive protein is 53.99 mg/dL with a SD of 31.47.



**Table 12: Study of urine protein level in CKD patients**

Protein level in Urine	Frequency( N)	Percentage (%)
<b>P1 +</b>	52	42.98
<b>P2 +</b>	47	38.84
<b>P3 +</b>	9	7.44
<b>Traces</b>	13	10.74
<b>Total</b>	121	100

**Table 12** represents the urine protein level in CKD patients. In the study out of 121 patients maximum 52 ( 42.98 %) of the patients had P1+ level, 47 ( 38.84 %) patients had P2 + level, 9 ( 7.44 %) patients had P3 + level of urine protein and in 13 ( 10.74 %) patients traces of urine protein was observed.



## Discussion

The current prospective observational clinical study of 121 cases on patients of CKD on maintenance hemodialysis was conducted. All the cases satisfying the inclusion criteria were selected for the study. The patient evaluation was done on the day of admission, during each dialysis, and at the time of discharge.

Recent studies have shown that CKD is linked to high rates of cardiovascular mortality and morbidity because CKD's harmful consequences start to manifest in its early stages, preventive measures must be taken as soon as possible. However, renal failure's asymptomatic character and early, unsuccessful detection costs patients important time and proper consultation is hindered. [5]

The data was analysed by SPSS – 25 software and the results obtained are discussed as under.

## Demographic Parameters

### Study of age distribution in CKD cases

In the current study of the age distribution of CKD patients out of 121 patients, the maximum of 36 ( 29.74 %) cases were in the age group of 50 -59 years. The mean age is 46.78 years and an SD of 12.68.

An identical study conducted by Mehul Kaliya [6] et al had mentioned a maximum

of 40 % of patients in the age group of 41 - 60 years. Another comparable study by Lahariya D [7] et al observed that the majority of patients were in the age group of 51–60 years (23%). The mean age of patients was  $47 \pm 16$  years (range 14–81 years). Both the study results were in concordance with the current study, thus stating that the incidence of CKD increases with age as the risk factors for CKD also increase. [8]

### Study of Gender Distribution in CKD patients

In the current study out of 121 patients, 90 ( 74.38 %) were male and 31 ( 25.62 %) were female. The male: female ratio was 2.90: 1. The current study has male predominance.

Another comparable study conducted by Satish Sachdeva [9] et al reported 75 % male cases and 25 % female cases. Another identical study by R.B. Ramegowda [10] et al observed that out of the total 175 study participants, 119 (68.0%) were males and 56 (32.0%) were females, sex ratio being 2.1:1. Both the comparable studies have similar findings as the current study with male predominance. It suggests that the risk of CKD is more in males compared to females.

### Study of Weight distribution in CKD patients

In the current study of weight distribution in CKD patients out of 121 patients, a maximum of 79 ( 65.29 %) patients weighed 50 - 59 kgs. The mean weight of CKD patients in the study was 54.20 kg with a SD of 7.91. No comparable study reporting weight was found.

#### **Study of Height distribution in CKD patients**

In the current study with regards to the height distribution in CKD patients out of 121 patients, a maximum of 54 ( 44.63 %) patients had a height between 160 -169 inches. The mean height of CKD patients in the study is 164.12 inches with an SD of 10.12. No comparable study studying height was found.

#### **Study of Body mass Index distribution in CKD patients**

In the current study of the body mass index distribution in CKD patients out of 121 patients, a maximum of 61 ( 50.41 %) patients had a BMI between 15 – 19.99 kg/m<sup>2</sup>. The mean BMI of CKD patients in the study is 20.30 Kg/m<sup>2</sup> with an SD of 3.37.

#### **Distribution of associated co-morbidities in CKD patients**

In the current study of the associated co-morbidities in CKD patients, out of 121 patients 91 ( 75.21 %) cases suffered from hypertension, 9 ( 7.44 %) patients had diabetes mellitus, 16 (13.22 %) cases had both diabetes mellitus & hypertension, 1 ( 0.83 %) patient had hypertension, DM & chronic liver disease and 4 ( 3.31 %) cases had hypertension, ischemic heart disease & DM.

Similar to the current study, the SEEK-India project conducted by Singh AK et al [11] found that individuals with risk factors for CKD were more likely to be overweight or obese and to have diabetes, hypertension, and cardiovascular disease than those without CKD.

#### **Total blood count Investigation in CKD patients**

In the current study of the total blood count investigation in CKD patients, the mean hemoglobin level of 121 patients was 8.32 g/dl with an SD of 1.29. The mean WBC count was 8263  $\mu$ L with a SD of 4917. The mean plasma level was 3.1 ml/kg with a SD of 8.48.

#### **Study of Urea level in CKD patients**

In the current study of the urea level in CKD patients out of 121 maximum of 53 ( 43.80 %) patients had a urea level between 100 -149 mg/dL. The mean urea level was 130.07 mg/dL with an SD of 74.72.

A study conducted by Mehul Kaliya et al reported 14% (14) patients had normal blood urea, but 86% (43) had high blood urea of which 20% (10) patients were in 70-100 mg% range, 20% (10) patients were in 101-130 mg% range, 12% (6) patients were in 131-160 mg% range.

#### **Study of Creatinine level in CKD patients**

In the current study of Creatinine levels in CKD patients out of 121 patients a maximum of 53 (43.80 %) patients had Creatinine levels between 6.1 -7.9 mg/dL. The mean Creatinine level was 8.01 mg/dL with a SD of 4.46.

A study conducted by Mehul Kaliya et al reported that a serum creatinine level >1.2 was present in all 24 patients and for females serum creatinine level >0.9 was present in all 26 patients.

#### **Study of Electrolyte level in CKD patients**

In the current study, the electrolyte level in CKD patients with a mean sodium level of 121 patients was 133.26 mEq/L with a SD of 6.69. The mean potassium level was 4.97 mEq/L with an SD of 0.9. The mean chloride level was 103.42 mEq/L with a SD of 6.28. The mean calcium level was 8.44 mg/dL with a SD of 0.95, and the

mean phosphorous level was 5.63 mg/dL with a SD of 2.6.

### Study of protein level in CKD patients

In the current study of the protein level in CKD patients, the mean total protein in 121 patients was 5.79 g/dL with a SD of 1.31. The mean albumin level was 3.2 g/dL with a SD of 0.62. The mean C-reactive protein was 53.99 mg/dL with a SD of 31.47. The higher protein level indicated a high risk to cause damage to the glomerular structure leading to or aggravating chronic kidney disease. In the current study the mean total protein level, mean albumin level and C- reactive protein was in range.

### Study of urine protein level in CKD patients

In the current study of the urine protein level in CKD patients out of 121 patients, a maximum of 52 ( 42.98 %) of the patients had a P1+ level. 47 ( 38.84 %) patients had a P2 + level, 9 (7.44 %) patients had a P3 + level of urine protein and in 13 ( 10,74 %) patients traces of urine protein was observed. In the current study, 9 patients with P3 + level of protein were detected in urine which indicated a higher level of protein and a high risk of kidney disease.

### Summary

In the current study, 5 patients failed routine follow-ups after 12 months and 1 patient died due to severe complications in 15 months and 2 patients died in 18 months.

The results of the study are summarized as under:-

1. Out of 121 patients a maximum of 29.74 % cases were in the age group of 50 -59 years. The mean age is 46.78 years with a SD of 12.68.
2. Male predominance was seen in our study with 74.38 % being male and 25.62 % being female. The male: female ratio was 2.90: 1.
3. The mean weight of CKD patients in the study was 54.20 kg with a SD of 7.91.
4. The mean height of CKD patients in the study was 164.12 inches with a SD of 10.12.
5. The mean BMI of CKD patients in the study was 20.30 Kg/m<sup>2</sup> with a SD of 3.37.
6. In the comorbidities studied, 91 ( 75.21 %) cases suffered from hypertension, 9 ( 7.44 %) patients had diabetes mellitus, 16 ( 13.22 %) cases had both diabetes mellitus & hypertension, 1 ( 0.83 %) patients had hypertension, DM & chronic liver disease, and 4 ( 3.31 %) cases had hypertension, ischemic heart disease & DM. Hypertension was the most common comorbidity.
7. The mean hemoglobin level of 121 patients was 8.32 g/dl with a SD of 1.29. The mean WBC count was 8263  $\mu$ L with a SD of 4917. The mean plasma level was 3.1 ml/kg with a SD of 8.48.
8. 53 ( 43.80 %) patients had a urea level between 100 -149 mg/dL. The mean urea level was 130.07 mg/dL with a SD of 74.72.
9. In 53 ( 43.80 %) patients Creatinine levels were between 6.1 -7.9 mg/dL. The mean Creatinine level was 8.01 mg/dL with a SD of 4.46.
10. In the electrolyte level study the mean sodium level of 121 patients was 133.26 mEq/ L with a SD of 6.69. The mean potassium level was 4.97 m Eq/L with a SD of 0.9. The mean chloride level was 103.42 m Eq/L and the SD of 6.28. The mean calcium level was 8.44 mg/dL with a SD of 0.95 and the mean phosphorus level was 5.63 mg/dL with a SD of 2.6.
11. Total protein level in 121 patients was 5.79 g/L with a SD of 1.31 The mean albumin level was 3.2 g/dL with a SD

of 0.62. The mean C-reactive protein was 53.99 mg/dL with a SD of 31.47.

12. The protein urine level maximum of 52 ( 42.98 %) of the patients had a P1+ level. 74 (38.84 %) patients had P2 + level, 9 ( 7.44 %) patients had a P3 + level of urine protein and in 13 ( 10,74 %) patients traces of urine protein was observed.

### Conclusion

Higher age patients with male predominance were observed in CKD patients. Weight, height, and BMI are the important demographic parameters in CKD patients. Hypertension was the common comorbidity in the current study of CKD patients. Creatinine level, urea level, and urea protein parameters were abnormal in the CKD patients. The present study observed a high prevalence of biochemical abnormalities in CKD patients. In view of the above findings, the present study recommends periodic biochemical examination for diagnosis and early treatment of abnormalities in patients with CKD at regular intervals which may prevent renal complications in the longer run.

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