(International Print/Online Journal)

SJIF IMPACT FACTOR: 6.829
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 9, Issue 4, Page No: 239-249
July-August 2026

IJMSCR

Clinical Study of COPD with special reference to Renal Function Tests to assess severity of GOLD Stages

[1]Dr. RamashasthriAkhila, [2]Dr. Mamatha B.Patil,[2]Dr. Ratna Rohith, [2]Dr. Vanama Lahari,[2]Dr. Divya Sankeerthi Pithalla, [2]Dr. Vemuri Venkata Surya

[1,2,]Department of General Medicine ,
Rajarajeswari Medical College and Hospital,Bengaluru, Karnataka, India

***Corresponding Author:**
Dr. Mamatha B.Patil
Professor, Department of General Medicine,
Rajarajeswari Medical College and Hospital, Bengaluru

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Background :

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder with important systemic manifestations, including renal dysfunction. Chronic hypoxia, systemic inflammation, and shared risk factors such as smoking may contribute to the development of chronic kidney disease (CKD) in COPD patients. However, the association between COPD severity and renal impairment remains variable across studies.

Objectives:

To assess the frequency of renal dysfunction among COPD patients and to evaluate its association with clinical parameters.

Methods:

A hospital-based cross-sectional study was conducted among 100 patients with COPD. Clinical history, risk factors, anthropometric measurements, and laboratory investigations were recorded. Pulmonary function was assessed using spirometry, and disease severity was classified according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria. Renal function was evaluated using serum creatinine, estimated glomerular filtration rate (eGFR), and urine protein analysis. Statistical methods were used to assess associations between COPD severity and renal dysfunction.

Results:

Most participants were elderly males with significant smoking exposure. CKD was identified in 58% of patients, with Stage 3 disease being the most common. Proteinuria was present in 66% of participants, suggesting early renal involvement. Mean eGFR decreased significantly with increasing COPD severity ($p < 0.001$). Higher GOLD stages showed a strong association with the presence of CKD ($p < 0.001$), and advanced COPD was predominantly associated with moderate renal impairment.

Conclusion:

Renal dysfunction is highly prevalent among COPD patients and shows a significant association with disease severity. COPD should be recognized as a systemic disease with important renal involvement. Early screening and integrated management are essential to prevent progression and improve patient outcomes.

Keywords: COPD, Chronic Kidney Disease, eGFR, GOLD stage, Renal dysfunction

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and treatable respiratory condition characterized by persistent airflow limitation and progressive destruction of lung tissue.Over time, repeated exposure leads to structural abnormalities including airway narrowing, loss of alveolar attachments, and reduced elastic recoil, resulting in compromised ventilation and gas exchange capacity 1.

The global burden of COPD is substantial and growing. According to the World Health Organization (WHO), COPD is projected to become the third leading cause of death worldwide by 2030 2 In 2019 alone, there were approximately 212.3 million prevalent cases globally, resulting in 3.3 million deaths 3. The impact is particularly severe in India, where COPD is currently the second leading cause of mortality and disability-adjusted life years (DALYs) 4

Common symptoms include chronic cough, sputum production, and dyspnea, which may worsen with physical activity.Exacerbations are associated with accelerated lung function decline, diminished quality of life, frequent healthcare utilization, and increased mortality risk 5-7

Beyond its respiratory impact, COPD is now widely recognized as a systemic disease with broad extrapulmonary manifestations. Chronic low-grade systemic inflammation in COPD contributes to the development of multiple comorbidities, including cardiovascular disease, osteoporosis, skeletal muscle wasting, diabetes, cognitive dysfunction, depression, and chronic kidney disease (CKD)8-10

advancing age—commonly shared between CKD and COPD—has been identified as a key risk factor for their coexistence11

Emerging evidence suggests a strong bidirectional relationship between COPD and CKD, underpinned by overlapping risk factors such as smoking, older age, oxidative stress, and systemic inflammation 12. Cigarette smoking, the most important etiological factor for COPD, also directly contributes to renal damage. Nicotine promotes oxidative stress, mesangial cell proliferation, and extracellular matrix accumulation, leading to progressive renal and pulmonary fibrosis. Both diseases share features of premature aging and elevated pro-inflammatory markers 13.

Among large study populations, estimated glomerular filtration rate (eGFR) variability is widely accepted as a prognostic marker for CKD progression and has also been linked to higher exacerbation risk in COPD 14.

Given the shared risk factors, common inflammatory pathways, mutual organ vulnerability, and substantial global burden of both COPD and CKD, their interaction represents a critical area for clinical research.Understanding the association helps in integrated therapeutic approaches that target both respiratory and renal outcomes—ultimately reducing morbidity, healthcare utilization, and mortality.

Materialsand Methods

Study Design and Population:

This was a hospital-based, descriptive cross-sectional study conducted at the Department of General Medicine, Rajarajeswari Medical College and Hospital, Bengaluru, over 18 months following ethical clearance and written informed consent from all participants.100 patients aged above 40 years attending the outpatient and inpatient departments of General Medicine with clinical features suggestive of chronic obstructive pulmonary disease (COPD).

Inclusion and Exclusion Criteria

Patients included were chronic smokers with a smoking history of more than 5 years and individuals with a history of biofuel exposure.Patients were excluded if Known case of Diabetes Mellitus,Hypertension,CKD,COPD patients presenting with Acute Kidney Injury (AKI) and sepsis,Patients currently on nephrotoxic drugs, including but not limited to aminoglycosides, ACE inhibitors, or ARBs,Presence of cardiovascular diseases,Family history of renal disease.Critically ill patients requiring intensive care.The sample size was calculated using the Yamane formula for a known population size:n=N/1+N(e)2 yielding around 96 patients; 100 were recruited to improve precision.

Method of Data Collection

After Institutional Ethics Committee approval and informed consent, 100 eligible patients were enrolled from the Medical wards of General Medicine. Clinical history, smoking and biofuel exposure, physical and systemic examinations were recorded. Investigations included PFT, CBC, urine analysis, urine protein,

Volume 9, Issue 4; July-August 2026; Page No 239-249

chest X-ray, blood urea, serum creatinine, BUN, LFT, and eGFR (MDRD method). Data were systematically documented for analysis.

StatisticalAnalysis

Data were entered into Microsoft Excel and analyzed using SPSS Version 23. Results were expressed as frequencies, percentages, means, and standard deviations. Appropriate inferential tests were applied, with a 95% confidence interval and significance set at $p < 0.05$.

Results

Age and sex distribution of study participants

Out of 100 participants,male were (77%), while 23% were female.Most participants were clustered between 60–79 years, accounting for 66% of the total population, with the highest proportion in the 70–79-year subgroup. Individuals aged 50–59 years constituted 20%, while younger participants aged 40–49 years represented only 10%. A very small fraction (4%) were aged 80 years and above. This distribution highlights that advancing age is a significant factor in the occurrence of COPD and its complications, including renal impairment(fig 1&2).

Duration of smoking and biomass exposure in study participants

majority of the study participants were smokers (79%), while 21% reported no history of smoking but had presence of biomass exposure among 79 individuals most participants had prolonged exposure, with 84% reporting 21–40 years of smoking history. A smaller proportion (13%) had 11–20 years of exposure, while only 3% reported more than 40years. (fig 3).

Renal Parameters

Derangement of renal parameters were observed in study population.The mean serum creatinine was 1.52 + 4.71 mg/dL, while the mean eGFR was 76.5 ‡ 258 ml/min/1.73 m', indicating reduced renal function in a subset of participants. The mean UPCR was 0.90 ‡ 0.55, suggesting proteinuria in some patients.The distribution of CKD stages reveals that 42% of participants were in

Stage 1, indicating normal or near-normal kidney function, while 14% were in Stage 2.A significant proportion (34%) were in Stage 3a and 10% in Stage 3b, reflecting moderate renal impairment. The absence of advanced stages (Stage 4 or 5) suggests that most renal dysfunction in this cohort was in the carly to moderate stages. (Table 1).

Distribution of GOLD classification

The distribution of participants according to GOLD classification demonstrates that the majority of patients were in the moderate to severe stages of COPD. Stage 2 constituted the largest proportion, accounting for 38% of the study population, indicating that most patients had moderate airflow limitation. This was followed by Stage 3, which included 34% of participants, reflecting a substantial number of individuals with severe disease. Stage 1, representing mild COPD, comprised 19% of the population, suggesting that fewer patients were diagnosed at an early stage. The least proportion was observed in Stage 4 (9%), indicating very severe disease.(Table2).

Distribution of urine protein among study participants

Proteinuria was observed in a substantial proportion of participants. 1+ proteinuria was the most common finding (44%), followed by absence of proteinuria (34%). Higher-grade proteinuria (2+) was present in 10% of participants, suggesting possible underlying renal involvement in a subset of patients.(fig 4).

Renal parenchymal changes on imaging

Renal parenchymal changes were present in 58% of participants, while 42% had normal renal imaging, indicating that more than half of the study population had evidence of renal structural abnormalities.Hence CKD was present in 58% of the study participants, while 42% had no evidence of CKD, indicating a high burden of renal disease in the study population.

Comparison of mean eGFR across GOLD Classification

Patients with Grade 0 dyspnea had the highest mean eGFR (93.1 ml/min/1.73 m²), followed by Grade 1 (89.1 ml/min/1.73 m²). In contrast, patients with Grade 2 and Grade 3 dyspnea had substantially lower mean eGFR values (58.1 and 57.4 ml/min/1.73 m² respectively). This demonstrates that worsening dyspnea severity is associated with declining renal function.(Fig 5).

Association between Gold stage and renal parenchymal changes

Volume 9, Issue 4; July-August 2026; Page No 239-249

Early stages (Stage 1 and 2) showed a higher proportion of normal kidneys, whereas advanced stages (Stage 3 and 4) were strongly associated with renal abnormalities, with nearly all patients in these stages showing parenchymal changes. This indicates that worsening COPD severity is closely linked with structural kidney damage.(Fig 6)

Association between Gold stage and EGFR and CKD

A highly significant association was observed between GOLD stage and the presence of CKD ($p < 0.001$). CKD prevalence increased with COPD severity, with all patients in Stage 3 and Stage 4 having CKD. In contrast, early stages showed a higher proportion of patients without CKD. This finding strongly supports the relationship

between disease progression in COPD and the development of renal dysfunction.The mean eGFR progressively decreased with increasing GOLD stage. Patients with Stage 1 had the highest mean eGFR(93.1ml/min/1.73m²), followed by Stage 2(89.1ml/min/1.73m²). Incontrast, patients with Stage 3 and 4 GOLD had substantially lower mean eGFR values (58.1 and 57.4 ml/min/1.73 m² respectively). This demonstrates that worsening GOLD stage is associated withdecliningrenal function.(Table 3).

AssociationbetweenMMRCGradeandeGFR(CKD Stages) :

The association between GOLD stage and CKD stages based on eGFR demonstrates a clear and statistically significant relationship between the severity of COPD and the degree of renal dysfunction ($\chi^2 = 57.98$, df = 10, $p < 0.001$). In patients with GOLD Stage 1, the majority (73.7%) were in CKD Stage 1, indicating preserved renal function, while smaller proportions were in CKD Stage 2 (10.5%) and Stage 3 (15.8%). Similarly, in GOLD Stage 2, most patients (60.5%) remained in CKD Stage 1, though there was a noticeable increase in CKD Stage 2 (28.9%), suggesting early renal impairment withmoderateCOPDseverity.

Patients in GOLD Stage 3 showed a marked shift toward worse renal function, with the majority (67.6%) classified under CKD Stage 3, while only 5.9% remained in CKD Stage 1. This indicates a strong association between severe airflow limitation and significant renal impairment. Among those in GOLD Stage 4, none were in CKD Stage 1, and most were distributed between CKD Stage 2 (55.6%) and Stage 3 (44.4%), further highlighting the progression of renal dysfunction with increasing COPD severity,suggesting that renal assessment should be an integral part of the clinical evaluationinCOPDpatients.(Fig7).

Discussion

Chronic obstructive pulmonary disease (COPD) is increasingly recognized as a systemic disease with significant extrapulmonary manifestations, including renal dysfunction. The association between COPD and chronic kidney disease (CKD) is multifactorial, involving chronic hypoxia, systemic inflammation, oxidative stress, endothelial dysfunction, aging, and smoking. Persistent hypoxemia in COPD reduces renal perfusion and activates neurohormonal pathways, while chronic inflammation contributes to vascular and glomerular injury, leading to progressive decline in kidney function. Recurrent exacerbations and associated comorbidities may further worsen renal impairment.

The present study evaluated the burden of renal dysfunction among COPD patients and its relationship with disease severity. Our findings revealed a considerable prevalence of CKD, with renal function progressively deteriorating as COPD severity increased. Higher GOLD stages were significantly associated with CKD, and a corresponding decline in estimated glomerular filtration rate (eGFR) was observed across advanced stages of disease. These results indicate that renal dysfunction is an important systemic manifestation of COPD rather than a coincidental comorbidity.

Comparison with previous studies demonstrates variability in the reported association between COPD severity and renal dysfunction. While some studies have shown a strong correlation, others suggest an independent relationship. Nevertheless, the evidence underscores the importance of routine renal assessment in COPD patients. Understanding the COPD–CKD interaction may facilitate early detection, risk stratification, and integrated management strategies, ultimately improving clinical outcomes.

Volume 9, Issue 4; July-August 2026; Page No 239-249

In our study, the majority of participants were elderly (66% aged 60–79 years) with a clear male predominance (77%), indicating that COPD with renal dysfunction is more common in older males.

Similar observations were reported by Elmahallawy II et al15. where the mean age was 65.28 ± 6.32 years,supporting the observation that COPD with associated renal dysfunction is more frequent in elderly males. S. Balasubramaniyan et al16. also found a higher incidence of chronic kidney disease among males (53%) and predominantly in the 60–70 years age group, highlighting the combined influence of age and gender on renal involvement.

In our study, smoking was highly prevalent (79%), with the majority having prolonged exposure of 21–40 years (84%), clearly identifying it as the most significant risk factor.Similarly, Yoshizawa T et al.17found that nearly all COPD patients had a history of smoking (over 90%), highlighting the strong etiological link between smoking and COPD.S. Balasubramaniyan et al16. extended this observation by demonstrating that chronic kidney disease was more prevalent among individuals with heavy smoking exposure (>40 pack-years), suggesting that prolonged smoking not only contributes to COPD but also accelerates renal dysfunction.

Pulmonary Function and Disease Severity

In our study, spirometry demonstrated an obstructive pattern with reduced FEV_1 (1.16 L) and FEV_1 /FVC ratio (0.57), and the majority of patients were in GOLD Stage 2 (38%) and Stage 3 (34%), indicating a predominance of moderate to severe COPD.Similar findings were reported by Elmahallawy II et al.,15 where the mean FEV_1 was 48.14% ± 14.24, with a large proportion of patients (72%) in GOLD Stage IV, indicating more severe disease compared to our study.In the study by Laha S et al.,18median FEV_1 was 46.79%, with most patients in GOLD Stage 3 (43.7%) and Stage 2 (37.5%), closely mirroring our study.

CKD Staging

In our study, CKD Stage 1 was present in 42% of participants, Stage 2 in 14%, and Stage 3 in 44%, indicating that a substantial proportion had moderate renal dysfunction Similarly, Elmahallawy II et al. 15reported that 54% had normal renal function, while 26% had concealed renal failure and 20% had overt renal failure, indicating both subclinical and overt kidney involvement.

Proteinuria Distribution

In our study, proteinuria was present in 66% of participants, with 1+ proteinuria being the most common (44%), indicating early renal involvement even before marked decline in eGFR. Proteinuria serves as an important marker of glomerular damage and systemic endothelial dysfunction.Similarly, Laha S et al.18demonstrated that urine ACR increased significantly with advancing age and COPD severity ($p < 0.001$), indicating progressive albuminuria with worsening disease. This supports the concept that proteinuria may act as an early indicator of renal involvement in COPD Prevalence of CKD

In our study, chronic kidney disease was present in 58% of participants, indicating a high burden of renal dysfunction among COPD patients.Comparable findings were reported by Elmahallawy II et al15., who observed a CKD prevalence of 46% in COPD patients compared to 22% in controls ($p < 0.001$), clearly demonstrating a higher burden of renal dysfunction in COPD.

S. Balasubramaniyan et al.16and Harsha Narilla et al.19reported lower prevalence rates of 26% and 25%, respectively, suggesting variability across studies,M. Saravanan et al.20demonstrated a markedly higher prevalence, with renal dysfunction present in 83.6% of patients, suggesting extensive renal involvement in their study population.Overall, despite variations in prevalence across studies, there is consistent evidence that CKD is significantly more common in COPD patients than in the general population.

Association Between COPD Severity and CKD Stages

In our study, early GOLD stages were predominantly associated with CKD Stage 1 (73.7%), whereas advanced stages were mainly associated with CKD Stage 3 (67.6%), demonstrating a significant shift toward more severe renal impairment with disease progression ($p < 0.001$). This indicates that as COPD advances, there is a parallel progression in the severity of kidney dysfunction.

Supporting this observation, Elmahallawy II et al.15reported that patients with overt renal failure had more severe airflow limitation, higher smoking index, and greater comorbidity burden, suggesting

Volume 9, Issue 4; July-August 2026; Page No 239-249

progression toward advanced CKD stages with worsening COPD. Similarly, M. Saravanan et al.122 found that advanced COPD stages were predominantly associated with higher CKD stages ($p < 0.005$), further reinforcing the relationship between disease severity and renal deterioration.

Overall, the findings indicate that although variability exists, there is a general trend toward worsening CKD stages with increasing COPD severity. This underscores the importance of early detection and monitoring of renal function, particularly in patients with advanced COPD, to prevent progression to severe kidney disease

Conclusion: This study demonstrates a significant association between chronic obstructive pulmonary disease and renal dysfunction.Aconsiderable proportion of COPD patients were found to have impaired renal function, as evidenced by reduced eGFR, presence of proteinuria, and structural renal changes. The severity of renal dysfunction was observed to increase with advancing GOLD stage and worsening clinical status, indicating a strong correlation between pulmonary and renal involvement. These findings highlight that COPD is not merely a respiratory disorder but a systemic disease with multisystem involvement, including the kidneys. Early detection and integrated management of renal dysfunction in COPD patients are essential to improve overall prognosis, reduce complications, and enhance quality of life.

Limitations Of The Study

The present study has certain limitations that should be considered while interpreting the findings. Firstly, the study was conducted with a relatively small sample size of 100 participants, which may limit the generalizability of the results to the broader population. Secondly, as this was a cross-sectional study, it only provides a snapshot of the association between COPD and renal dysfunction and does not establish a causal relationship. Longitudinal follow-up would be required to assess disease progression and temporal relationships. Thirdly, the study was conducted at a single center, which may introduce selection bias and limit external validity. Recommendations

Based on the findings of this study, several recommendations can be proposed. Routine screening for renal dysfunction using parameters such as eGFR and urine protein should be incorporated into the standard management protocol for patients with COPD, especially those in advanced GOLD stages. Early identification of renal impairment can help in timely intervention and prevention of further deterioration.

References :

1. Singh D, Agusti A, Anzueto A, Barnes PJ, Bourbeau J, Celli BR, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive lung disease: the GOLD Science Committee Report 2019. Eur Respir J. 2019;53(5):1900164. Available from: https://erj.ersjournals.com/content/53/5/1900164
2. World Health Organization. World health statistics 2022: monitoring health for the SDGs, sustainable development goals [Internet]. Geneva: World Health Organization; 2022[cited 2022Sep 28].Available from: https://apps.who.int/iris/handle/10665/356584
3. Safiri S, Carson-Chahhoud K, Noori M, Nejadghaderi SA, Sullman MJM, Heris JA, et al. Burden of chronic obstructive pulmonary disease and its attributable risk factors in 204 countries and territories, 1990–2019: results from the Global Burden of Disease Study 2019. BMJ. 2022;378. Available from: https://www.bmj.com/content/378/bmj-2021-069679
4. India State-Level Disease Burden Initiative CRD Collaborators. The burden of chronic respiratory diseases and their heterogeneity across the states of India: the Global Burden of Disease Study 1990–2016. Lancet Glob Health. 2018;6(12):e1363–74. 5. Seemungal TA, Donaldson GC, Paul EA, Bestall JC, Jeffries DJ, Wedzicha JA. Effect of exacerbation on quality of life in patients with chronic obstructive pulmonary disease.Am J Respir Crit Care Med. 1998;157(5):1418–22.
5. Kanner RE, Anthonisen NR, Connett JE. Lower respiratory illnesses promote FEV1 decline in current smokers but not ex-smokers with mild chronic obstructive pulmonary disease: results from the Lung Health Study. Am J Respir Crit Care Med. 2001;164(3):358–64.
6. Donaldson GC, Seemungal TA, Bhowmik A, Wedzicha JA. Relationship between exacerbation

Volume 9, Issue 4; July-August 2026; Page No 239-249

frequency and lung function decline in chronic obstructive pulmonary disease. Thorax. 2002;57(10):847–52.
7. Donaldson GC, Seemungal TAR, Patel IS, Bhowmik A, Wilkinson TMA, Hurst JR, et al. Airway and systemic inflammation and decline in lung function in patients with COPD. Chest. 2005;128(4):1995–2004.Availablefrom: https://linkinghub.elsevier.com/retrieve/pii/S0012369215525956
8. Gan WQ, Man SF, Senthilselvan A, Sin DD. Association between chronic obstructive pulmonary disease and systemic inflammation: a systematic review and a meta-analysis. Thorax. 2004;59(7):574–80. Available from: https://thorax.bmj.com/lookup/doi/10.1136/thx.2003.019588
9. Garrod R, Marshall J, Barley E, Fredericks S, Hagan G. The relationship between inflammatory markers and disability in chronic obstructive pulmonary disease (COPD). Prim Care Respir J. 2007;16(4):236–40. Available from: http://www.nature.com/articles/pcrj200747
10. Trudzinski FC, Alqudrah M, Omlor A, Zewinger S, Fliser D, Speer T, et al. Consequences of chronic kidney disease in chronic obstructive pulmonary disease. Respir Res. 2019;20:151.
11. Haroun MK, Jaar BG, Hoffman SC, Comstock GW, Klag MJ, Coresh J. Risk factors for chronic kidney disease: a prospective study of 23,534 men and women in Washington County, Maryland. JAm Soc Nephrol. 2003;14:2934–2941.
12. Okyay GU, Er RE, Tekbudak MY, Paşaoğlu Ö, Inal S, Öneç K, et al. Novel inflammatory marker in dialysis patients: YKL-40. TherApher Dial. 2013;17:193–201 14. Suzuki A, Obi Y, Hayashi T, Kotani N, Uemura Y, Imai E, et al. Visit-to-visit variability in estimated glomerular filtration rate predicts hospitalization and death due to cardiovascular events. Clin Exp Nephrol. 2019;23:661–668.
13. Elmahallawy II, Qora MA. Prevalence of chronic renal failure in COPD patients. Egypt J Chest Dis Tuberc. 2013;62:221–227.
14. Balasubramaniyan S. Chronic kidney disease: a forgotten comorbidity in COPD. J Med Sci Clin Res. 2020;8(11). doi:10.18535/jmscr/v8i11.78
15. Yoshizawa T, Okada K, Furuichi S, Ishiguro T, Yoshizawa A, Akahoshi T, et al. Prevalence of chronic kidney disease in patients with chronic obstructive pulmonary disease: assessment based on glomerular filtration rate estimated from creatinine and cystatin C levels. Int J Chron Obstruct Pulmon Dis. 2015;10:1283–1289.
16. Laha S, Mohapatra A, Sarangi R, Sahoo JP, Subhankar S. Urine albumin-creatinine ratio (ACR) of patients with chronic obstructive pulmonary disease(COPD): a cross-sectional study. Cureus. 2025;17(6):e86974. doi:10.7759/cureus.86974
17. Narilla H, Bandi VK, Nalabothula S. Renal dysfunction in COPD: a cross-sectional study on prevalence and predictors. Int J Adv Res. 2025;29–31. doi:10.36106/ijar/9401098
18. Saravanan M, Vignesshkanth R, Arulkumaran P. Prevalence of renal function defects among COPD patients attending a respiratory disease hospital in South India. Int JAcad Med Pharm. 2023;5(1):295–299.

Volume 9, Issue 4; July-August 2026; Page No 239-249

Figure1. Age distribution of study participants

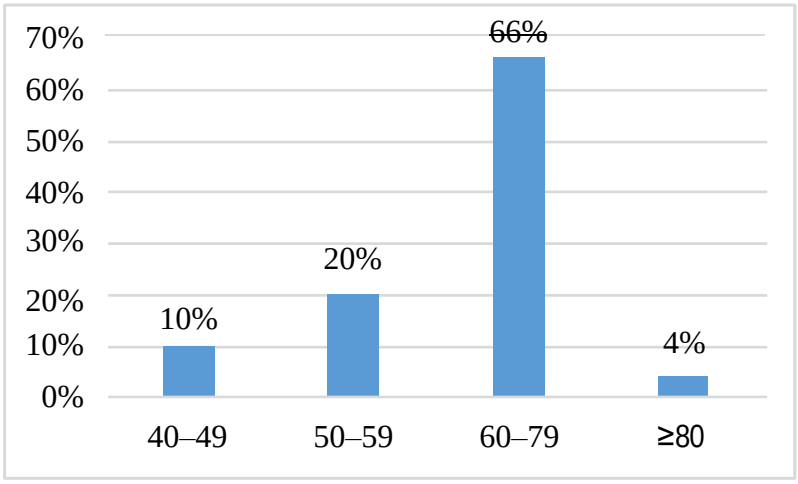


Figure2. Sex distribution of study participants

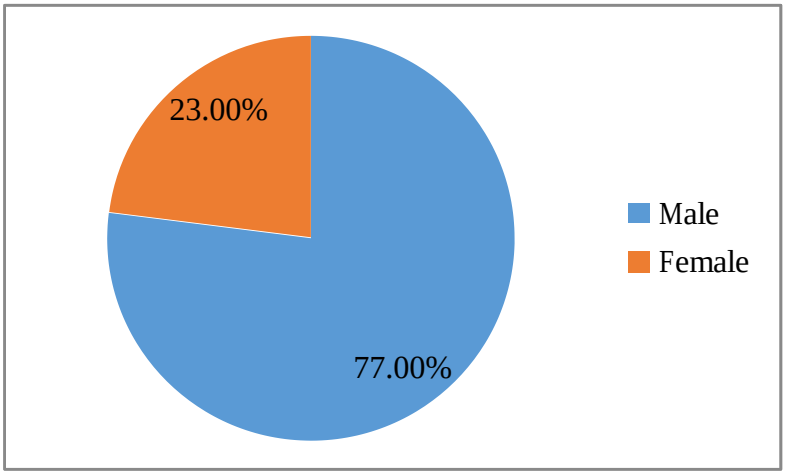
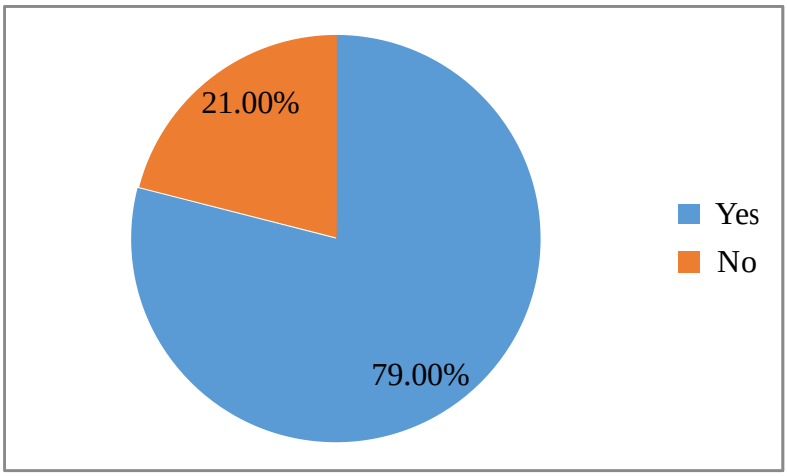


Figure3: SmokingStatus of StudyParticipants



Volume 9, Issue 4; July-August 2026; Page No 239-249

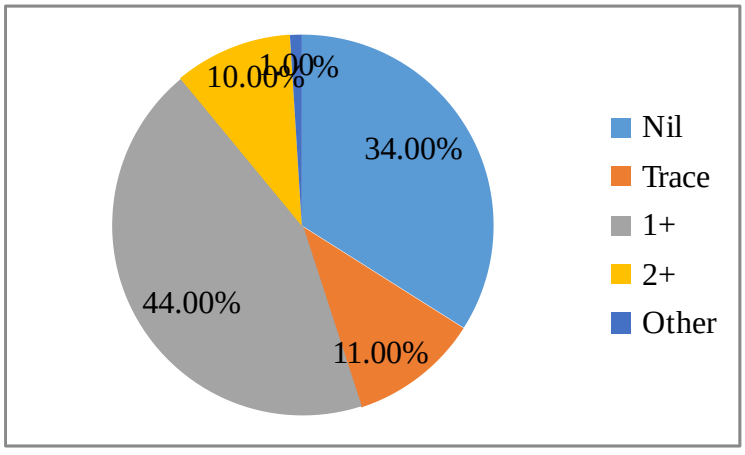
Table1: CKD Stages Based on eGFR

CKD Stage	eGFR (mL/min/1.73 m²)	Frequency	Percentage (%)
Stage 1	≥90	42	42.0
Stage 2	60–89	14	14.0
Stage 3a	45–59	34	34.0
Stage 3b	30–44	10	10.0
Total		**100**	**100.0**

Table2: Distribution of GOLD classification

GOLD classification	Frequency	Percentage
Stage 1	19	19.0%
Stage 2	38	38.0%
Stage 3	34	34.0%
Stage 4	9	9.0%
Total	**100**	**100%**

Figure4. Distribution of urine protein among study participants



Volume 9, Issue 4; July-August 2026; Page No 239-249

Figure5. Comparison of meaneGFRacrossGOLDClassification

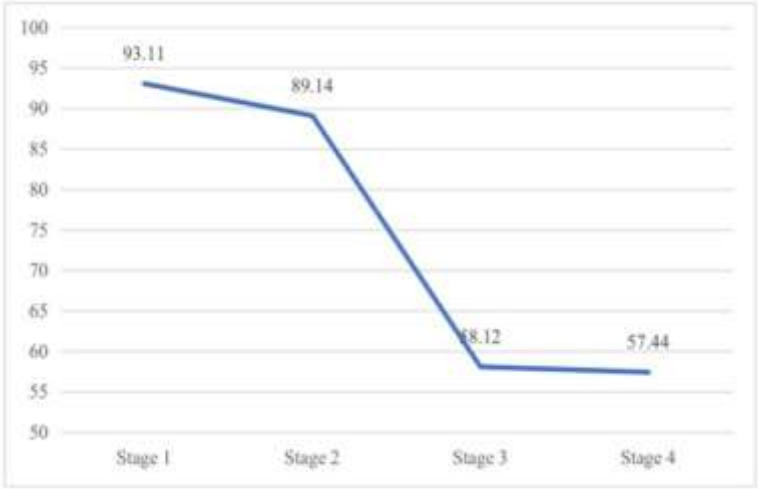


Figure6. AssociationbetweenGoldstageandrenal parenchymal changes

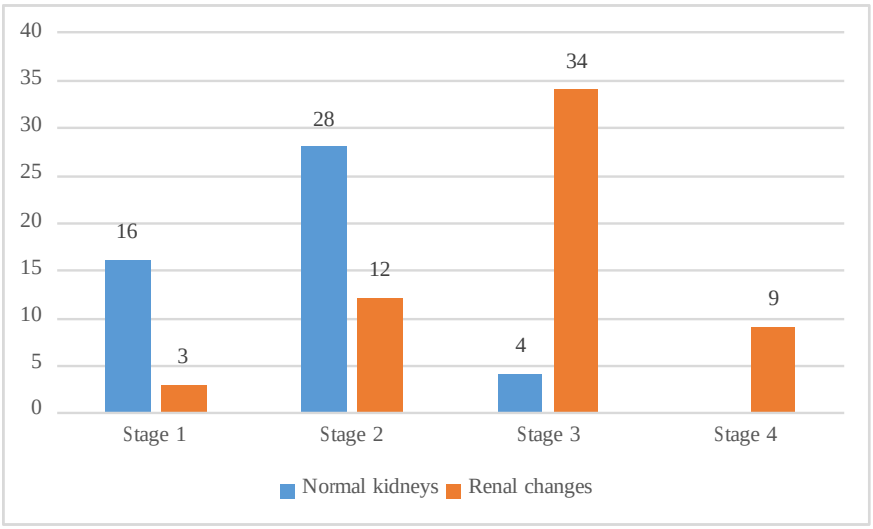
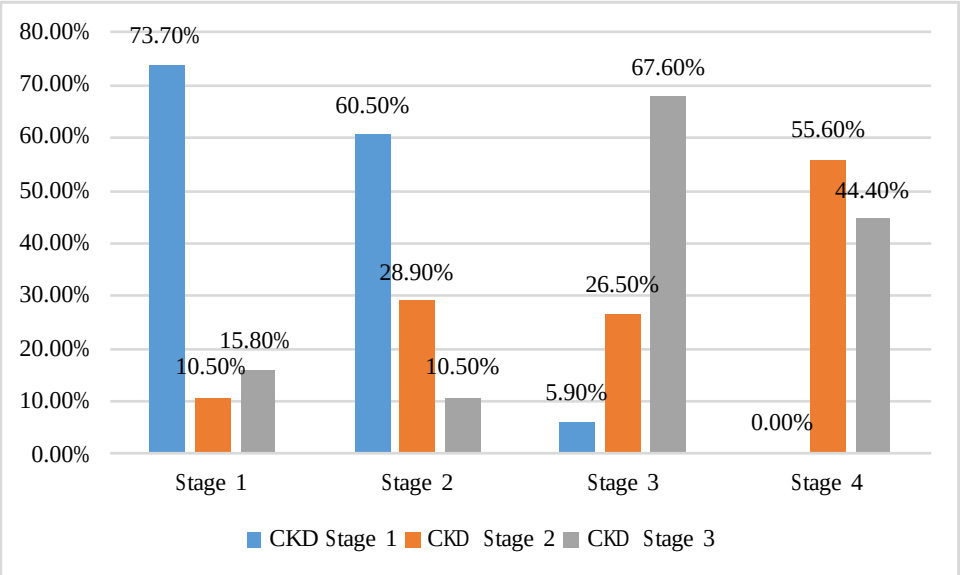


Table3 . AssociationbetweenGoldstageandMeanEGFRandCKD

Gold stage	CKD Absent n (%)	CKD Present n (%)	Mean EGFR	Total
Stage 1	16 (84.2%)	3 (15.8%)	93.11	19
Stage 2	26 (68.4%)	12 (31.6%)	89.14	38
Stage 3	0 (0%)	34 (100%)	58.12	34
Stage 4	0 (0%)	9 (100%)	57.14	9
Total	**42 (42%)**	**58 (58%)**	**76.49**	**100**

Volume 9, Issue 4; July-August 2026; Page No 239-249

Figure 7: Association between MMRC Grade and eGFR (CKD Stages)



Volume 9, Issue 4; July-August 2026; Page No 239-249