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PATTERN OF MENSTRUAL IRREGULARITY IN CHRONIC KIDNEY DISEASE (CKD) PATIENTS IN TERTIARY CARE HOSPITAL

Original Research

Asmat Ullah[1]*, Muhammad Sajid Rafiq Abbasi[2], Muhammad Jawad[1], Muhammad Afnan Ullah Shah[1], Waqar Zia[1], Aqsa Rahat[1]
[1]PGR Nephrology, PIMS Hospital, Islamabad, Pakistan.
[2]Associate Professor & HOD, Nephrology Department, PIMS Hospital, Islamabad, Pakistan.
Corresponding Author: Asmat Ullah, PGR Nephrology, PIMS Hospital, Islamabad, Pakistan. asmatkhan737@gmail.com
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ABSTRACT

Background: Chronic kidney disease (CKD) profoundly affects multiple physiological systems, including the reproductive system, leading to hormonal imbalances that disrupt menstrual cycles. Women with CKD frequently experience menstrual irregularities such as amenorrhea, oligomenorrhea, and menometrorrhagia, which are exacerbated as kidney function declines. These disturbances not only impact fertility but also contribute to anemia, osteoporosis, and reduced quality of life. Understanding the prevalence and associated factors of menstrual irregularities in CKD patients is essential for improving patient management and outcomes.

Objective: To determine the prevalence and pattern of menstrual irregularities among female CKD patients and to identify associated demographic and clinical factors.

Methods: A descriptive cross-sectional study was conducted at the Department of Nephrology, PIMS Hospital, Islamabad, from August 1, 2024, to January 15, 2025. A total of 140 female patients aged 14 to 45 years with CKD, irrespective of etiology, were enrolled. Patients with a history of postmenopausal status or pre-existing gynecological disorders were excluded. Menstrual irregularities were assessed through structured interviews and medical record evaluations. Data were analyzed using SPSS version 25.0, with qualitative variables presented as frequencies and percentages, and quantitative variables expressed as mean ± standard deviation. The chi-square test was applied, considering a p-value of ≤0.05 as statistically significant.

Results: The mean age of participants was 30.64 ± 8.86 years. Only 26.4% maintained a normal menstrual cycle, while 37.1% had amenorrhea, 22.1% had oligomenorrhea, and 14.3% had menometrorrhagia. Stratification analysis showed that polycystic ovarian syndrome (p=0.015), cerebrovascular accident (p=0.006), and smoking (p=0.041) were significantly associated with menstrual irregularities, while other demographic and clinical variables, including age, dialysis status, and hypertension, were not statistically significant.

Conclusion: Menstrual irregularities are highly prevalent among female CKD patients, with amenorrhea being the most common disorder. PCOS, cerebrovascular disease, and smoking were identified as significant contributing factors. Routine reproductive health assessments and targeted interventions should be integrated into CKD management to address these concerns and improve patient outcomes.

Keywords: Amenorrhea, chronic kidney disease, dialysis, menstrual irregularities, menometrorrhagia, oligomenorrhea, reproductive health.

INTRODUCTION

Chronic kidney disease (CKD) significantly impacts multiple physiological systems, including reproductive health, yet menstrual irregularities in CKD patients remain an underexplored aspect of clinical research. A well-regulated menstrual cycle is a critical marker of overall health, governed by the hypothalamic-pituitary-ovarian (HPO) axis through intricate hormonal feedback loops. The cycle ensures ovulation and, in the absence of fertilization, results in the timely shedding of the endometrial lining. Disruptions in this cycle often signal underlying health issues, underscoring the importance of considering menstrual regularity as a "vital sign" of well-being. Women with CKD frequently experience menstrual disturbances such as amenorrhea (absence of menstruation), oligomenorrhea (infrequent periods), menorrhagia (heavy or prolonged bleeding), and dysmenorrhea (increased menstrual pain). These irregularities not only contribute to anemia but also exacerbate estrogen deficiency, leading to reduced bone density and increased fracture risk. Additionally, reproductive dysfunction and hormonal imbalances associated with CKD may impair fertility, hasten menopause, and contribute to psychological stress, anxiety, and diminished quality of life (1,2).

CKD-induced hypoestrogenism results from the disease itself as well as its treatments, leading to significant reproductive health concerns. Atypical menstruation, poor sexual health, and suboptimal fertility outcomes are frequently reported among this patient population. Studies indicate that menstrual abnormalities occur in 19–47% of patients undergoing hemodialysis and as many as 75% of those receiving peritoneal dialysis. These statistics highlight the extent of menstrual dysfunction in CKD and reinforce the need to understand its implications on overall health (REFERENCE). Alterations in hormonal regulation driven by renal dysfunction further contribute to menstrual disruptions, warranting targeted management strategies. Despite these known associations, research on the specific mechanisms underlying menstrual disturbances in CKD remains limited, necessitating further investigation to optimize patient care (3,4). Given the systemic impact of CKD on female reproductive health, this study aims to examine the pattern of menstrual irregularities among CKD patients in a tertiary care setting. Understanding the prevalence and nature of these disturbances is crucial for developing comprehensive clinical approaches that integrate nephrologic and gynecologic care, ultimately improving the quality of life and health outcomes for women affected by CKD (5-8).

METHODS

This descriptive cross-sectional study was conducted at the Department of Nephrology, PIMS Hospital, Islamabad, from August 1, 2024, to January 15, 2025, after obtaining approval from the institutional review board. The study aimed to assess menstrual irregularities among women with chronic kidney disease (CKD). The sample size was calculated as 140 participants using the WHO sample size calculator, with a 95% confidence level and 5% absolute precision. Female patients aged 14 to 45 years, diagnosed with CKD regardless of etiology, were enrolled after obtaining informed written consent. Postmenopausal women and those with previously diagnosed gynecological disorders such as fibroids were excluded to minimize potential confounding variables (9).

Data collection involved structured interviews and a review of medical records, focusing on demographic and clinical details, including menstrual irregularities. Menstrual disturbances were categorized based on standard clinical definitions: amenorrhea was defined as the absence of three or more consecutive menstrual cycles in individuals with a history of menstruation, oligomenorrhea as infrequent or abnormally light bleeding with cycles exceeding 35 days, and menometrorrhagia as excessive or prolonged bleeding requiring more than two fully soaked pads per day at irregular intervals (10). All gathered information was recorded on a predesigned proforma and analyzed using SPSS version 25.0. Qualitative variables were expressed as frequencies and percentages, whereas quantitative variables were reported as mean ± standard deviation. Potential confounders were addressed through stratification, ensuring the validity of findings. The chi-square test was applied to assess associations between categorical variables, with a p-value of ≤ 0.05 considered statistically significant (11).

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RESULTS

A total of 140 female patients diagnosed with chronic kidney disease (CKD) were included in the study. The mean age of participants was 30.64 ± 8.86 years, with an age range of 16 to 45 years. The mean BMI was 24.02 ± 5.17 kg/m², and the average duration of CKD was 12.65 ± 5.39 months. Among the study participants, 26.4% were on dialysis, and 15.7% were smokers. Hypertension was the most frequently observed comorbid condition, affecting 24.3% of the patients, followed by polycystic ovarian syndrome (16.4%), cerebrovascular accident (9.3%), thyroid disorders (9.3%), diabetes mellitus (12.1%), ischemic heart disease (7.9%), and chronic obstructive pulmonary disease (10.0%). Menstrual irregularities were common among CKD patients, with only 26.4% maintaining a normal menstrual cycle. Amenorrhea was the most prevalent menstrual disorder, affecting 37.1% of patients, followed by oligomenorrhea (22.1%) and menometrorrhagia (14.3%). Stratification of menstrual irregularities based on demographic and clinical variables revealed that amenorrhea was more frequently observed in patients with a higher BMI, polycystic ovarian syndrome, and a longer duration of CKD. A significant association was found between menstrual disorders and polycystic ovarian syndrome (p=0.015), cerebrovascular accident (p=0.006), and smoking (p=0.041). However, no statistically significant relationship was observed between menstrual irregularities and factors such as age, income, hypertension, diabetes, ischemic heart disease, thyroid disorders, and dialysis.

Among smokers, amenorrhea was less prevalent compared to non-smokers (13.5% vs. 86.5%), while oligomenorrhea (9.7% vs. 90.3%) and menometrorrhagia (5.0% vs. 95.0%) were also observed more frequently in non-smokers. Patients with cerebrovascular accidents demonstrated a significantly higher prevalence of menometrorrhagia (30.0%) compared to those without this condition (70.0%). Additionally, individuals with polycystic ovarian syndrome exhibited a higher likelihood of experiencing oligomenorrhea (29.0%) and menometrorrhagia (30.0%) than those without the condition.

Table 1: Demographic and clinical details of the quantitative variables of the study participants (n=140)

Quantitative Variables	Minimum	Maximum	Mean	± SD
Age (Years)	16.00	45.00	30.64	8.86
Weight (kg)	40.00	78.00	57.44	10.84
Height (cm)	140.00	169.00	155.32	8.76
BMI (kg/m2)	14.20	38.20	24.02	5.17
Systolic Blood Pressure (mmHg)	70.00	165.00	124.49	17.33
Diastolic Blood Pressure (mmHg)	60.00	110.00	79.89	9.60
Duration of CKD (months)	4.00	24.00	12.65	5.39
Duration of Dialysis (months)	4.00	18.00	8.14	3.52
Serum Creatinine (mg/dL)	0.84	5.80	1.58	0.68
eGFR (ml/min)	3.10	59.80	29.11	15.59
Albumin (mg/dL)	3.30	9.90	6.35	1.77
Blood Urea Nitrogen (mg/dL)	16.00	96.00	53.11	17.68
Urine Albumin-Creatinine Ratio (mg/g)	34.00	66.00	48.81	5.34
Parathyroid Hormone (pg/ml)	5.36	104.61	53.37	17.30

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Table 2: Clinical, demographic and comorbid details of study subjects (n=140)

Variables	Frequency	Percentage (%)
Hypertension (Blood Pressure)		
Yes	34	24.3
No	106	75.7
Diabetes Mellitus		
Yes	17	12.1
No	123	87.9
Ischemic Heart Disease		
Yes	11	7.9
No	129	92.1
Chronic Obstructive Pulmonary Disease		
Yes	14	10.0
No	126	90.0
Cerebrovascular Accident		
Yes	13	9.3
No	127	90.7
Polycystic Ovarian Syndrome		
Yes	23	16.4
No	117	83.6
Thyroid Disorders		
Yes	13	9.3
No	127	90.7
Smoking		
Yes	22	15.7
No	118	84.3
Dialysis		
Yes	37	26.4
No	103	73.6

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Table 3: Frequency of menstrual disorders among female with chronic kidney disease

Outcomes	Frequency (n)	Percentage (%)
None	37	26.4
Amenorrhea	52	37.1
Oligomenorrhea	31	22.1
Menometrorrhagia	20	14.3
Total	140	100.0

Table 4: Stratification of menstrual irregularities on the basis of various clinical and demographic variables

Variable	Menstrual Disorder				p-Value
	None	Amenorrhea	Oligomenorrhea	Menometrorrhagia	
Age Groups					
<25 Years	16 (43.2%)	15 (28.8%)	10 (32.3%)	03 (15.0%)	0.363
25-35 Years	08 (21.6%)	19 (36.5%)	12 (38.7%)	08 (40.0%)	
>35 Years	13 (35.1%)	18 (34.6%)	09 (29.0%)	09 (45.0%)	
BMI Groups					
<20 kg/m2	13 (35.1%)	14 (26.9%)	06 (19.4%)	03 (15.0%)	0.134
20-25 kg/m2	16 (43.2%)	18 (34.6%)	08 (25.8%)	05 (25.0%)	
25.1-29 kg/m2	07 (18.9%)	10 (19.2%)	09 (29.0%)	07 (35.0%)	
>29 kg/m2	01 (2.7%)	10 (19.2%)	08 (25.8%)	05 (25.0%)	
Duration of CKD					
Upto 6 Months	06 (16.2%)	11 (21.2%)	04 (12.9%)	02 (10.0%)	0.457
7-12 Months	11 (29.7%)	19 (36.5%)	15 (48.4%)	11 (55.0%)	
>12 Months	20 (54.1%0	22 (42.3%)	12 (38.7%)	07 (35.0%)	
Dialysis					
Yes	07 (18.9%)	14 (26.9%)	10 (32.3%)	06 (30.0%)	0.625
No	30 (81.1%)	38 (73.1%)	21 (67.7%)	14 (70.0%)	
Income					
<50,000 PKR	12 (32.4%)	15 (28.8%)	06 (19.4%)	03 (15.0%)	0.697
50-100,000 PKR	21 (56.8%)	28 (53.8%)	19 (61.3%)	14 (70.0%)	
>100,000 PKR	04 (10.8%)	09 (17.3%)	06 (19.4%)	03 (15.0%)	
Smoking					
Yes	11 (29.7%)	07 (13.5%)	03 (9.7%)	01 (5.0%)	0.041
No	26 (70.3%)	45 (86.5%)	28 (90.3%)	19 (95.0%)	

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Table 5: Stratification of menstrual irregularities on the basis of various comorbid

Comorbid	Menstrual Disorder				p-Value
	None	Amenorrhea	Oligomenorrhea	Menometrorrhagia	
Hypertension (Blood Pressure)					
Yes	08 (21.6%)	15 (28.8%)	05 (16.1%)	06 (30.0%)	0.530
No	29 (78.4%)	37 (71.2%)	26 (83.9%)	14 (70.0%)	
Diabetes Mellitus					
Yes	05 (13.5%)	04 (7.7%)	04 (12.9%)	04 (20.0%)	0.531
No	32 (86.5%)	48 (92.3%)	27 (87.1%)	16 (80.0%)	
Ischemic Heart Disease					
Yes	03 (8.1%)	03 (5.8%)	02 (6.5%)	03 (15.0%)	0.613
No	34 (91.9%)	49 (94.2%)	29 (93.5%)	17 (85.0%)	
Chronic Obstructive Pulmonary Disease					
Yes	06 (16.2%)	05 (9.6%)	01 (3.2%)	02 (10.0%)	0.365
No	31 (83.8%)	47 (90.4%)	30 (96.8%)	18 (90.0%)	
Cerebrovascular Accident					
Yes	02 (5.4%)	04 (7.7%)	01 (3.2%)	06 (30.0%)	0.006
No	35 (94.6%)	48 (92.3%)	30 (96.8%)	14 (70.0%)	
Polycystic Ovarian Syndrome					
Yes	02 (5.4%)	06 (11.5%)	09 (29.0%)	06 (30.0%)	0.015
No	35 (94.6%)	46 (88.5%)	22 (71.0%)	14 (70.0%)	
Thyroid Disorders					
Yes	04 (10.8%)	03 (5.8%)	04 (12.9%)	02 (10.0%)	0.715
No	33 (89.2%)	49 (94.2%)	27 (87.1%)	18 (90.0%)	

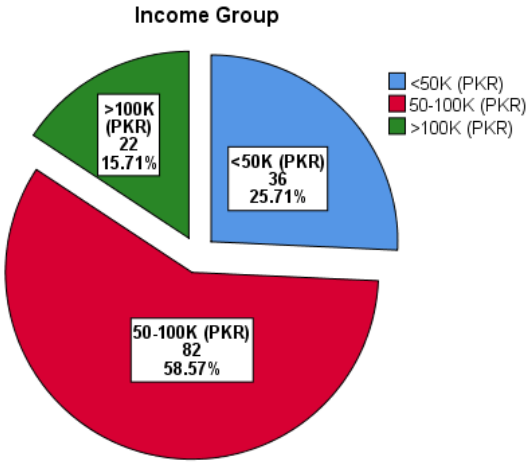


Figure 1 Distribution of study patients on the basis of monthly income in PKR

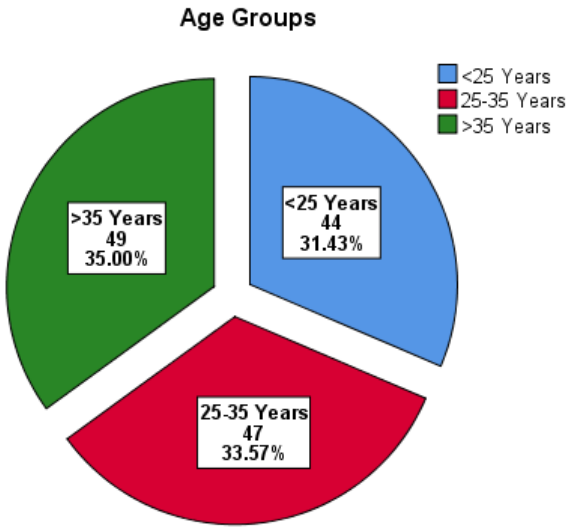


Figure 2 Distribution of study patients in different age groups

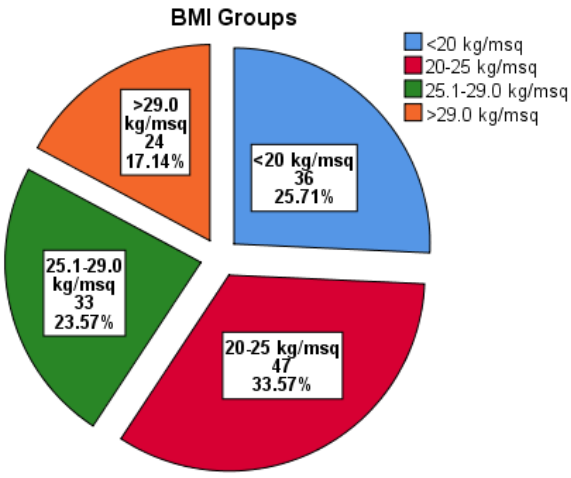


Figure 3 Distribution of study subjects in different categories of body mass index (BMI)

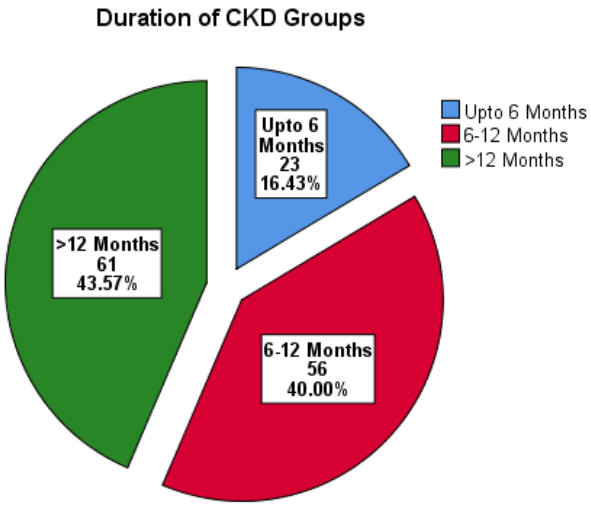
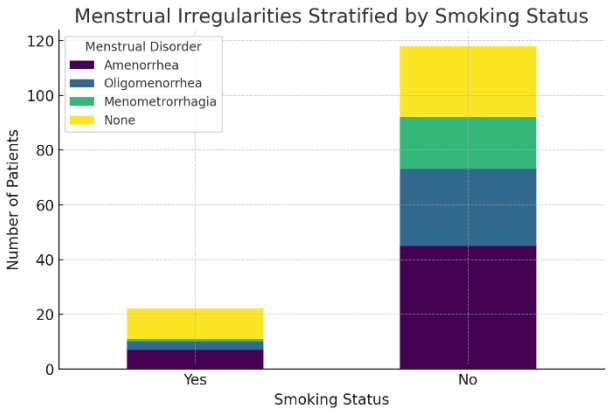
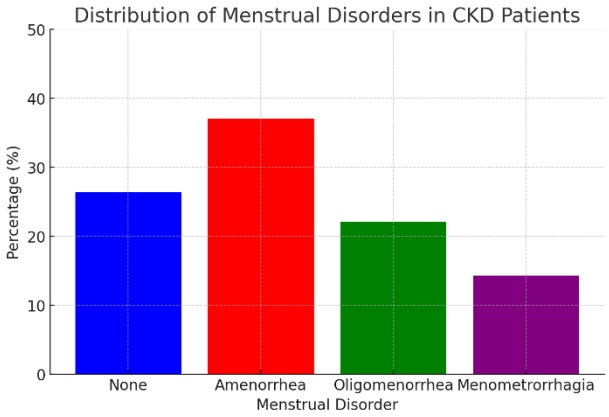


Figure 4 Distribution of study subjects in different groups on the basis of duration of chronic kidney disease





DISCUSSION

The findings of this study demonstrated a high prevalence of menstrual irregularities among female patients with chronic kidney disease (CKD), reinforcing the well-established notion that renal dysfunction significantly affects reproductive health. Amenorrhea was the most frequently observed disorder, affecting 37.1% of patients, followed by oligomenorrhea (22.1%) and menometrorrhagia (14.3%). Only 26.4% of patients maintained a normal menstrual cycle, highlighting the widespread disruption of menstrual patterns in this population. These results align with previous studies reporting similar menstrual disturbances in CKD patients, attributing them to uremia, metabolic imbalances, and hormonal dysregulation. The interplay between renal dysfunction and the hypothalamic-pituitary-ovarian axis has been extensively documented, with evidence suggesting that increased prolactin levels and reduced estrogen production play a critical role in menstrual abnormalities in CKD (12,13). The significant associations observed between menstrual disorders and polycystic ovarian syndrome ($p=0.015$), cerebrovascular accidents ($p=0.006$), and smoking ($p=0.041$) underscore the multifactorial nature of reproductive dysfunction in CKD. Patients with higher body mass index (BMI) exhibited an increased prevalence of amenorrhea, corroborating prior research linking obesity and metabolic dysfunction to menstrual irregularities. Smoking, known to accelerate vascular complications and disrupt hormonal balance, was also significantly associated with menstrual disturbances, further supporting the role of modifiable risk factors in reproductive health outcomes. The observed correlation between cerebrovascular accidents and menstrual disorders suggests a broader systemic impact of vascular dysfunction on the endocrine system in CKD patients (14-16).

A major strength of this study lies in its comprehensive analysis of menstrual irregularities across both dialyzed and non-dialyzed CKD patients, offering a broader perspective on the reproductive implications of CKD. Many previous studies have primarily focused on dialysis-dependent patients, limiting the understanding of menstrual dysfunction in pre-dialysis stages of CKD. By incorporating stratification analyses based on demographic, clinical, and comorbid variables, this study provides a nuanced understanding of risk factors contributing to menstrual irregularities. Additionally, the study enhances clinical relevance by identifying high-risk subgroups, advocating for targeted screening and management strategies to mitigate reproductive health complications in CKD patients (17,18). Despite its strengths, certain limitations must be acknowledged. The cross-sectional nature of the study restricts the ability to infer causality between CKD and menstrual irregularities, necessitating longitudinal studies to establish temporal relationships. The absence of hormonal assessments, including serum estrogen, progesterone, and prolactin levels, limits a more detailed exploration of the endocrine mechanisms underlying menstrual disturbances. A more extensive hormonal evaluation could have provided deeper insights into the pathophysiological mechanisms involved. The sample size, though adequate, may not fully represent the entire CKD female population, potentially affecting the generalizability of findings. Additionally, self-reported menstrual history may be subject to recall bias, influencing the accuracy of reported menstrual patterns (19,20).

The clinical implications of these findings are substantial, emphasizing the need for routine reproductive health assessments in female CKD patients. Given the strong association of menstrual irregularities with factors such as polycystic ovarian syndrome, cerebrovascular disease, and smoking, early screening and lifestyle modifications should be integrated into CKD management protocols. Addressing these reproductive health concerns through multidisciplinary care approaches involving nephrologists, gynecologists, and endocrinologists may improve overall quality of life and long-term health outcomes. Future studies should focus on prospective,

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longitudinal designs to track changes in menstrual health over time, incorporating detailed hormonal profiling and evaluating the effects of interventions such as dialysis and pharmacologic treatments on menstrual regularity (20).

CONCLUSION

Menstrual irregularities are a common yet often overlooked complication in female patients with chronic kidney disease, with amenorrhea emerging as the most frequently observed disturbance. While most demographic and clinical variables did not show significant associations, polycystic ovarian syndrome, cerebrovascular disease, and smoking were identified as key contributors to menstrual dysfunction. These findings emphasize the need for a more integrated approach to CKD management, where reproductive health assessments are routinely incorporated into clinical care. Addressing menstrual irregularities through early screening, targeted interventions, and lifestyle modifications may help improve overall well-being and quality of life in this vulnerable population. Future research should focus on longitudinal investigations with hormonal assessments to deepen the understanding of the underlying mechanisms and develop more effective strategies for mitigating reproductive health challenges in CKD patients.

Author Contribution

Author	Contribution
Asmat Ullah*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Sajid Rafiq Abbasi	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Jawad	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Afnan Ullah Shah	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Waqar Zia	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Aqsa Rahat	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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