Original Article

Assessment of Psychological and Behavioural Disorders in Egyptian Children with Chronic Kidney Disease.

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ABSTRACT

Introduction: Chronic Kidney Disease children's psychosocial disorders often go unnoticed during follow-up in the pediatric nephrology clinic because of their crowdedness, with different complaints, laboratory investigations, and different treatment modalities for the disease or its complications. Many researchers suggest the important role of behavioral and psychosocial disorders in the quality and outcomes of treatment received by CKD children and their families.

Aim of the study: This study aimed to assess the prevalence of psychological and behavioral disorders in children with chronic kidney disease and the possible risk factors for these disorders.

Methods: This cross-sectional study included 200 CKD children and was conducted at Minia University Hospital of Pediatrics, Egypt, from February 2023 to January 2024. CBCL is a checklist used in this study to detect psychological and behavioral problems in children and adolescents with CKD.

Results: Nearly all the CKD children studied (96%) on regular dialysis and (66%) children not on regular dialysis had psychiatric disorders. Univariate linear regression revealed that duration of disease, school performance, anemia, vitamin D deficiency, and dialysis were the most dependent risk factors for the development of psychiatric disorders in children with CKD.

Conclusion: Psychological disorders are common in children with CKD and are more common in children on regular dialysis. Dialysis, duration of disease, anemia, and vitamin D deficiency were the most powerful risk factors for psychiatric disorders in CKD children.

Keywords: Psychological disorders; Behavioral disorders; Child Behavior Checklist; Chronic kidney disease; CKD; Dialysis; Egypt; Children.

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INTRODUCTION

The incidence and prevalence of chronic kidney disease (CKD) are increasing, and CKD has become a major health problem and a serious global health concern. [1] CKD is defined by the guidelines of the Kidney Disease Improving Global Outcomes (KDIGO) as structural or functional abnormalities of the kidneys that have been present for more than three months with health implications. [2] Regardless of the underlying etiology, CKD is characterized by a progressive decline in kidney function over time. [3]

CKD children's psychosocial disorders often go unnoticed during follow-up in the pediatric nephrology clinic because of their crowdedness, with different complaints, laboratory investigations, and different treatment modalities for the disease or its complications. [4] Many researchers suggest the important role of behavioral and psychosocial disorders in the quality and outcomes of treatment received by CKD children and their families. [5]

The psychosocial factors associated with different chronic diseases can negatively affect both the course of disease and the overall cost of health care. [6] Numerous studies on children with chronic health problems have shown that comorbid psychiatric illness has negative effects on the main medical condition, including increased healthcare expenses, decreased treatment adherence, and poor control of the underlying medical condition. [7] Although there is a lack of extensive research on these outcomes in children and adolescents with CKD, few studies have reported a correlation between adherence and depression or anxiety disorders in pediatric hemodialysis (HD) patients and renal transplant children. For this reason, it is crucial for the best clinical management and care of CKD throughout the lifespan to have a thorough comprehension of the psychological and social difficulties associated with the disease. [8]

Psychiatric disorders can be categorized into two broadband syndrome (internalizing and externalizing) problems: internalization disorders, such as anxiety, depression, attention, social isolation, and somatic disorders, and withdrawal symptoms and externalization disorders, such as aggressive behavior or delinquent (criminal) behavior. [9]

The survival rates of children with CKD have improved due to advancements in dialysis and transplantation. The long duration of the disease increases the risk of developing psychological illness among these children. [10] In this study, we aimed to evaluate psychological and behavioral disorders in children with CKD and, if so, to detect the risk factors for these disorders in CKD.

METHODS

This prospective study was performed at Minia University Hospital of Pediatrics and included 200 children aged 6--18 years with chronic kidney disease who attended the outpatient nephrology clinic, hemodialysis unit, and pediatric nephrology department from February 2023-January 2024.

The studied children were classified into two groups: Group I (hemodialysis group), which included 100 CKD children on regular dialysis and 3 sessions per week. Group II (nonhemodialysis group) included 100 CKD children not on regular dialysis. The diagnosis of CKD was performed according to the Kidney

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Disease Outcome Quality Initiative (KDOQI). [2] We excluded children with acute kidney injury, those aged less than 6 years, those with other chronic systemic diseases, and those with neurodevelopmental disorders.

The studied children were subjected to a complete history including age, sex, residence, socioeconomic status, school performance, school attendance, occupation of parent, family problem, duration of disease, parent drug addiction or substance abuse, disease age of onset, presence of comorbidity, medication usage as antihypertensive, cytotoxic drugs, corticosteroids or supportive treatment in the form of vitamin and mineral supplementation and, if the child was on regular dialysis, the duration and frequency of the dialysis session. laboratory investigation in the form of complete blood count, electrolytes, parathyroid hormone levels, blood urea nitrogen, serum creatinine, hepatitis virology, and serum vitamin D.

Research instruments:

The Child Behavior Checklist (CBCL) is a parent checklist that was completed to detect psychological and behavioral disorders in children and adolescents. The CBCL is part of the Achenbach System of Empirically Based Assessment (ASEBA). The CBCL/6-18 is used with children aged 6 to 18. The test is composed of 113 questions scored on a three-point scale (0=absent, 1= occurs sometimes, 2=occurs often). The last six months are the time range for which items can be answered. This chick list was previously evaluated by Dr. Lila Ahmed, clinical psychology, Cairo University, Egypt, via a pilot study of language editing to assess the degree of difficulty in Arabic sentence and phrase formation and rewarding and language editions.

The CBCL-6-18 is used to screen eight subscales: depression, somatic disorders, thought problems, attention problems, anxiety, delinquency (criminal), withdrawal, and aggressive behavior. The time the questionnaire took to explain to parents was approximately 40 minutes.[11] The normal range for the Child Behavior Checklist (CBCL) is generally considered to be below the 95th percentile, which translates to an approximate T score of 65 and below. Scores between the 95th and 98th percentiles (T scores of 65--70) are considered borderline, and those above the 98th percentile (T scores of 70 and above) are considered clinical. [11]

Ethical approval

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Minia University. Informed written consent was obtained from all participants' legal guardians to participate in the study after the study's aim and procedures were explained to them.

Data analysis

We used IBM's SPSS 28.0 statistical package (IBM; Armonk, New York, USA) to analyze the collected data. Quantitative data are presented as the median, interquartile range (IQR), and mean ± SD for numerical data, in addition to both the number and percentage for categorized data. The normality of the data was tested via the Kolmogorov–Smirnov and Shapiro–Wilk tests. For numerical data that followed a normal distribution, we used an independent sample t test; for data that did not, we used a Mann–Whitney U test. The chi-square test or Fisher's exact test was performed to compare categorized data. Additionally, linear regression analysis was performed to determine the

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effects of different independent variables on psychological and behavioral problems in children. A p value less than 0.05 was considered significant.

RESULTS

The study included 200 children with CKD, 100 participants on regular dialysis (dialysis group), and 100 children not on dialysis (nondialysis group), all of whom fulfilled the inclusion criteria previously provided. There were no statistically significant differences in the sociodemographic data between the 2 groups except for school performance, where there was significant weak school performance in the dialysis group **Table 1**. A comparison between the two groups, with respect to the studied clinical data, revealed a significantly greater frequency of steroid use, cytotoxic drug use, and BMI in the nondialysis group than in the nondialysis group, whereas a significantly longer duration of disease and significant use of antihypertensive drugs were detected in the dialysis group than in the nondialysis group. In the laboratory investigations, there was significantly greater parathyroid hormone (PTH), urea, creatinine, and HCV infection in the dialysis group than in the other groups; however, significantly higher phosphorus, Na, and K ionized Ca and vitamin D levels were reported in the nondialysis group than in the dialysis group **Table 2**.

Nearly all of the studied CKD children (96%) on regular dialysis and (66%) in the nondialysis group had clinically significant psychiatric disorders **Table 3.** There was a significantly high frequency of aggressive behavior, delinquent (criminal) behavior, and total score for CBCL externalization problems in CKD children on regular dialysis **Table 4** and **Figure 1.** Similarly, there was a significantly greater frequency of total internalization scores on the CBCL and its subscores (anxiety, depression, attention, social isolation, somatic disorders, and last withdrawal symptoms) in CKD children on regular dialysis than in CKD children not on regular dialysis **Table 5& Figure 2.** The duration of disease, school performance, low hemoglobin, vitamin D, and dialysis effect are the most powerful risk factors for the prediction of psychological and behavioral disorders in CKD children **Table 6**

Table 1: Sociodemographic data of the studied groups.

Socio demographic Characteristics	Group 1 (Dialysis group) (N 100)	Group 2 (Nondialysis group) (N 100)	p value
Age group N (%) 6 -10 years	26 (26%)	27(27%)	
10-14 years	57 (57%)	47(47%)	
14 -18 years	17 (17%)	26 (26%)	0.2
Sex N (%) Male	60(60%)	52 (52%)	
Female	40 (40%)	48 (48%)	0.2
Residence N (%) Urban	39 (39%)	33 (33%)	0.37
Rural	61(61%)	67 (67%)	
Occupation of father N (%) Employed	72 (72%)	69 (69%)	
unemployed	28 (28%)	31(31%)	0.6
Occupation of mother N (%) Employed	24 (24%)	33(33%)	
unemployed	76 (76%)	67(67%)	0.15
Parent Marital state N (%) Married	76 (76%)	77 (77%)	
Divorced	18 (18%)	10 (10%)	0.11
Widow	6 (6%)	13 (13%)	
Family problem N (%)			
Separation of family members	18 (18%)	10 (10%)	0.20
Addiction of family members	22 (22%)	20 (20%)	
No family problem	60 (60%)	70 (70%)	

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Table 1: Sociodemographic data of the studied groups. **(Continued)**

Socio demographic Characteristics	Group 1 (Dialysis group) (N 100)	Group 2 (Nondialysis group) (N 100)	p value
School attendance N (%) Go to school Never go to school Separated due to disease or problem	74 (74%) 11 (11%) 15 (15%)	87 (87%) 7 (7%) 6 (6%)	0.05
Performance at school according to grades of previous year N (%). Weak. Average. Above average. Excellent.	38 (38%) 42 (42%) 15 (15%) 5 (5%)	19 (19%) 34 (34%) 28 (28%) 19 (19%)	0.001*

Table 2: Clinical and laboratory data of the CKD children studied

	Group 1 (Dialysis group) (N 100)	Group 2 (Nondialysis group) (N 100)	p value
Age at diagnosis(years) Mean ± SD Range	3.9 ± 0.5 1:5	3.7± 0.6 1: 7	0.1
Duration of disease (years) Mean ± SD Range	5 ± 1.2 1:8	3 ± 0.5 1:4	0.001*
Medication Supportive treatment Anti-hypertensive Steroid Cytotoxic drugs	100 (100%) 60(60%) 13(10%) 14(14%)	98 (98%) 15 (15%) 55 (55%) 44 (44%)	0.9 0.001* 0.001* 0.001*
BMI Underweight Normal	99 (99%) 1(1%)	60 (60%) 40 (40%)	<0.001*
Hb (g/dl) Median ± IQR Range	9 ± 2.2 5 : 12	9.2 ± 2 6:13	0.09
PTH (pg/ml) Median ± IQR Range	186 ± 443 16: 3723	110 ± 242 20: 1818	0.004*
Ca (mmol/l) Median ± IQR Range	1 ± .2 0.7: 1.3	1.1 ± .2 0.8: 1.5	<0.001*
Ph (mg/dl) Median ± IQR Range	3.7 ±1 1.7: 9.4	4 ± 1.8 2.4: 8.5	<0.001*
Na (mEq/l) Median ± IQR Range	139± 6 132:142	143± 7 133:145	<0.001*
K (mEq/l) Median ± IQR Range	4.5± .8 3.7 :5.7	4.9 ±1.4 4.1:7.1	<0.001*
Urea (mg/dl) Median ± IQR Range	121± 50 44: 189	65 ± 31 23:98	<0.001*
Creatinine (mg/dl) Median ± IQR Range	6.9± 2.6 1.55: 9.1	2.6 ± 1.1. 1.3 :4.4	<0.001*
Vitamin D (ng/ml) Median ± IQR Range	29± 9 13 :39	34 ±8 19:43	<0.001*
HCV Positive Negative	10(10%) 90(90%)	4(4%) 96(96%)	0.09

*Significant, BMI: body mass index, Ca: calcium, Hb: hemoglobin, HCV: hepatitis C virus, IQR: interquartile range, K: potassium, Na: sodium, SD: standard deviation, PTH: parathormone hormone, Ph: phosphorus

Table 3: Prevalence of psychiatric disorders in the studied CKD patients

	Group 1 (Dialysis group) (N=100)	Group 2 (Nondialysis group) (N=100)	p value
Children without psychiatric disorder	4(4%)	34(34%)	<0.001*
Children with psychiatric disorder	96(96%)	66(66%)	<0.001*
Children with externalization problems only	17 (17%)	11(11%)	<0.001*
Children with internalization problems only	8 (8%)	10(10%)	<0.001*
Children with both externalization and internalization problems	62(62%)	27(27%)	<0.001*
Children with other psychiatric disorder not otherwise specified	9 (9%)	18(18%)	<0.001*

*Significant

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Table 4: Comparison of behavioral externalization problems between the studied groups

Externalization problems	Group 1 (Dialysis group) (N=100)	Group 2 (Nondialysis group) (N=100)	P value	P value for clinical significant disorder only
Aggressive Normal Borderline Clinical significant	37 (37%) 3 (3%) 60 (60%)	74 (74%) 3 (3%) 23 (23%)	<0.001*	<0.001*
Delinquent Normal Borderline Clinically significant	2 (2%) 4 (4%) 94 (94%)	29 (29%) 11(11%) 60 (60%)	<0.001*	<0.001*
Total externalization raw score (mean ± SD)	29.6 ±8	19.5± 10.3	<0.001*	

*Significant

Table 5: Comparison of the behavioral internalization subscales between the studied groups

Internalization problems	Group 1 (Dialysis group) (N=100)	Group 2 (Nondialysis group) (N=100)	P value	P value for clinical significant disorder only
1.Attention *Normal *Borderline *Clinical significant	42 (42%) 12 (12%) 46 (46%)	69 (69%) 9 (9%) 22 (22%)	<0.001*	<0.001*
2. Thought *Normal *Borderline *Clinical significant	53(53%) 14(14%) 33(33%)	71(71%) 14(14%) 15(15%)	<0.001*	0.003*
3.Social isolation *Normal *Borderline *Clinical significant	52(52%) 0 48(48%)	73(73%) 0 27(27%)	0.002*	0.001*
4.Somatic *Normal *Borderline *Clinical significant	44(44%) 2(2%) 54(54%)	71(71%) 11(11%) 18(18%)	<0.001*	<0.001*
5. Anxious depressed *Normal *Borderline *Clinical significant	14(14%) 0 86(86%)	50(50%) 3(3%) 47(47%)	<0.001*	<0.001*
6.Withdrawl *Normal *Borderline *Clinical significant	56(56%) 12(12%) 32(32%)	79(79%) 12(12%) 9(9%)	<0.001*	<0.001*
Total internalization raw score mean± SD	45.7±12.3	30.5 ±17	<0.001*	

*Significant

Table 6: Univariate linear regression for the prediction of psychological and behavioral disorders in the studied children

	Unstandardized Coefficients		Standardized Coefficients	P value	95.0% Confidence Interval for B	
	B	Std. Error	Beta		Lower Bound	Upper Bound
Age	0.919	0.962	0.060	0.341	-0.980	2.818
Sex	-1.219	1.342	-0.057	0.365	-3.867	1.428
Residence	1.068	1.368	0.048	0.436	-1.631	3.768
Family Problem	2.044	0.897	0.147	0.24	0.273	3.814
School Statues	-0.729	1.166	-0.045	0.533	-3.031	1.572
School Performance	-2.82	0.747	-0.258	<0.001*	-4.295	-1.34
Duration of disease	1.059	0.493	0.218	0.03*	0.087	2.3
BMI	0.246	0.336	0.050	0.464	-0.416	0.909
Hb	-0.947	-449	-0.137	0.036*	-0.062	-1.832
PTH	-0.001	0.001	-0.075	0.250	-0.004	0.001
Ca	-4.564	4.820	-0.062	0.345	-14.074	4.946
Ph	0.680	0.460	0.091	0.141	-0.227	1.587
Na	-0.042	0.163	-0.016	0.799	-0.364	0.280
K	-0.600	0.978	-0.044	0.540	-2.529	1.329
Urea	0.003	0.023	0.013	0.889	-0.042	0.048
Creatinine	-1.059	0.493	-0.218	0.10	-2.031	1.01
Vitamin D	-0.32	0.10	-0.22	0.002*	-0.52	-0.12
Dialysis effect	11.970	2.702	0.56	<0.001*	6.6	17.3

*Significant, BMI: body mass index, Ca: calcium, Hb: hemoglobin, K: potassium, Na: sodium, PTH: parathormone hormone, Ph: phosphorus

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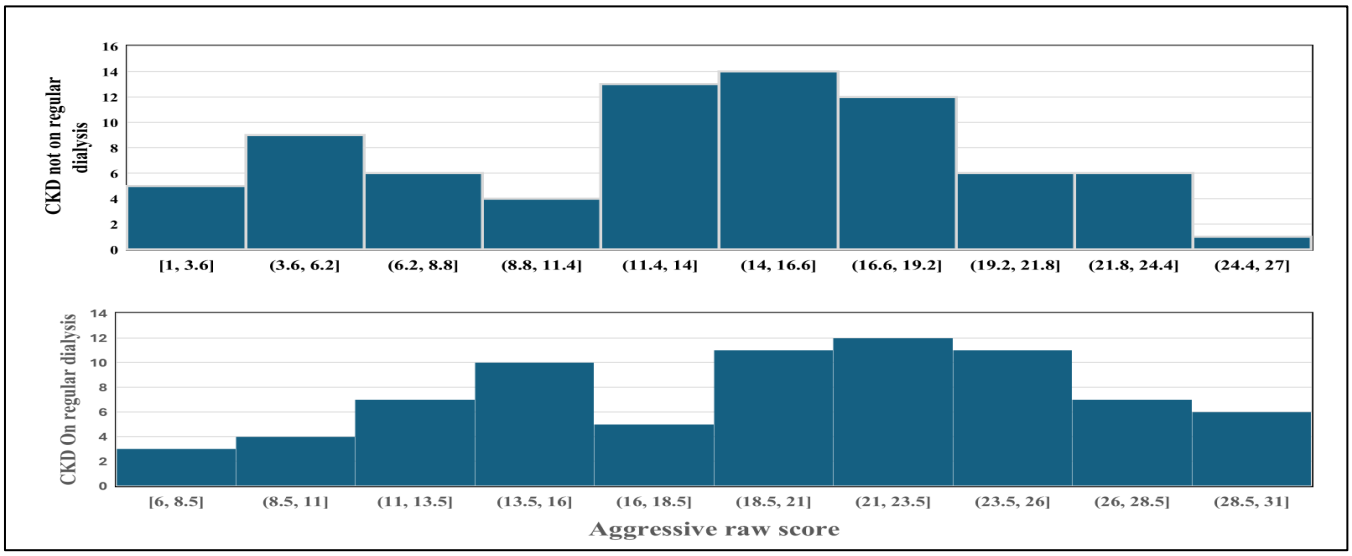

Figure 1: Frequencies of patients with clinically significant aggressive disorders

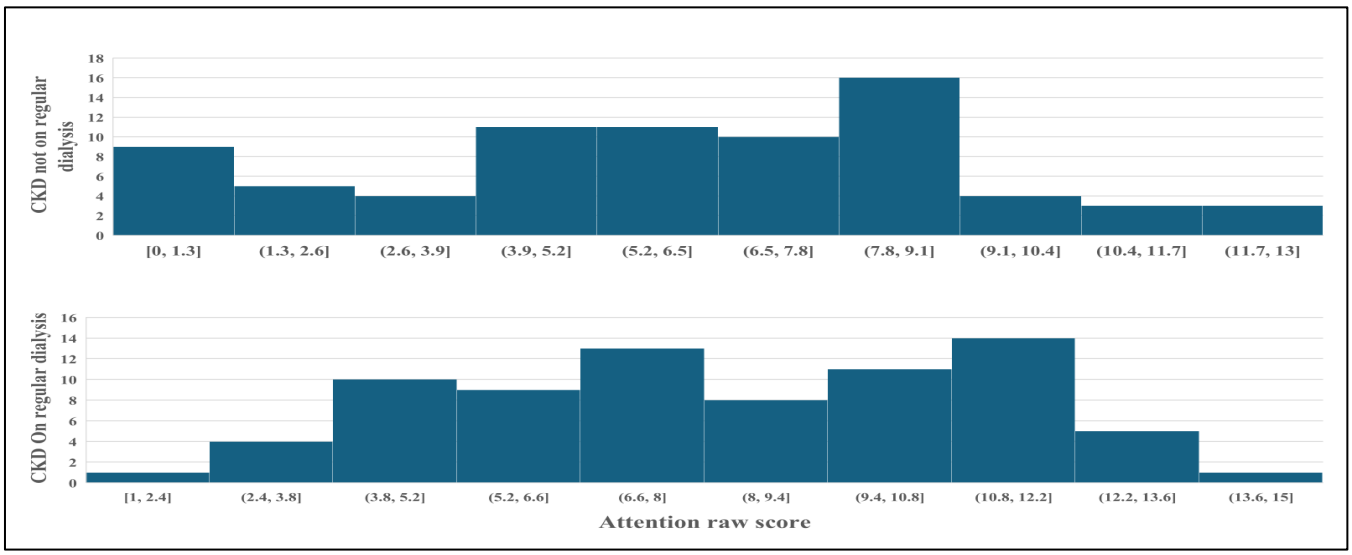

Figure 2: Frequency of patients with clinically significant attention disorders

DISCUSSION

Children with chronic diseases may experience psychological disorders that arise not only from the illness itself but also from its treatment. CKD is a significant contributor to pediatric morbidity and is associated with notable mortality rates. Invariably, CKD presents considerable stress and profoundly affects the lives of both patients and their families. Thus, it serves as a predisposing factor for the onset of psychiatric pathologies among these patients and their primary caregivers. [12] Therefore, a thorough understanding of the psychosocial challenges associated with CKD is essential for optimal clinical management and patient care.

The current study examined psychiatric disorders among children with CKD and revealed that a significant majority of the children, whether undergoing regular dialysis or not, exhibited psychiatric disorders. This high prevalence of psychiatric conditions in children with CKD can be attributed to the severe impact of the disease on their daily lives, as they negotiate the stress associated with disease management and the prospect of a shortened life span.

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Additionally, children undergoing regular dialysis are subject to more severe physical symptoms, more medical interventions, and more dependence on machines that could malfunction at any time. Like children with other chronic conditions, those with CKD often experience restricted growth, multiple surgical scars, and frequent absences from school and other childhood activities. [13]

The present study revealed a significantly elevated incidence of aggressive behavior, delinquent (criminal) behavior, and overall externalization problems among children in the dialysis group. This finding aligns with previous studies with the same conclusion [14,15], although a study by Aier et al. reported no clinically significant aggressive or delinquent behaviors in children with CKD, regardless of whether they were on regular dialysis. [9]

In terms of internalization issues, the current research revealed a notably greater prevalence of total internalization problems, as measured by the Child Behavior Checklist (CBCL) score and its subscales (anxiety, depression, attention, social isolation, somatic disorders, and withdrawal symptoms), in CKD children undergoing regular dialysis than in those not on regular dialysis. Different studies screen for these variables with different research methodologies, and they find conflicting results. [16,17]

Depression in children with CKD is linked to a threefold to fourfold increased mortality risk and is correlated with worsened clinical outcomes, such as higher hospitalization rates and earlier initiation of dialysis. [18] In pediatric populations, the detrimental effects of depression are evident in studies among adolescents, where depression is associated with neurocognitive impairments that ameliorate subsequent depression remission. [19] Various hypotheses exist for these observations, including reluctance to accept the prognosis, the need to remain vigilant owing to persistent disease symptoms, social isolation, and disturbances in social and familial interactions. [20] Additionally, factors such as educational and professional circumstances, the availability of social support, the severity of the child's illness, the child's age, increased need for medical care, and various other factors influence parental acceptance of the disease and their cooperation with child stress and anxiety levels. [21]

Several factors contribute to increased anxiety levels in children and adolescents with CKD. Children with chronic illnesses are frequently exposed to aversive stimuli, such as alarming symptoms and distressing medical interventions (e.g., injections). [22,23] In cases involving life-threatening conditions, there is increased fear of mortality. [23] Furthermore, the unpredictability and lack of control over medical procedures, disease progression, and symptom recurrence contribute to increased anxiety. [24] Additionally, children with chronic illnesses are at an elevated risk of social anxiety due to potential peer rejection. [25]

This study identified dialysis as the most significant risk factor for the development of psychological and behavioral disorders in children with CKD. This finding is consistent with other research indicating that dialysis is a principal contributor to comprehensive behavioral and psychiatric disorders. [26,27] Dialysis can disrupt a child's daily

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routine, adversely affecting their quality of life and that of their family and imposing a restricted lifestyle that curtails social and educational engagement, which may lead to psychiatric issues.

The current findings indicate that the duration of the disease, academic performance, anemia, and vitamin D deficiency are independent risk factors for psychiatric disorders in children with CKD. A longer disease duration increases exposure to its complications and the side effects of treatment. This finding is consistent with several studies [28,29], although other studies have reported no significant relationships between the duration of kidney disease, renal impairment, and psychiatric disorders. [13]

The association between poor academic performance and an increased risk of psychiatric disorders in children with CKD can be attributed to the complexities of medical treatment and frequent medical appointments, which disrupt regular school attendance. Additionally, factors such as family overprotection, fatigue, sleep disturbances, and cognitive impairments, which are consequences of deteriorating kidney function, further hinder educational participation. Anemia significantly influences psychiatric disorders in children with CKD because of the critical role of iron in various brain functions, including the synthesis of mood-regulating neurotransmitters such as dopamine, serotonin, and adrenaline. Consequently, iron deficiency may precipitate psychiatric disorders. Additionally, vitamin D plays a crucial role in neuroinflammatory processes within the brain; thus, a deficiency in active vitamin D in children with CKD may result in various psychiatric disorders. [30]

LIMITATION OF STUDY:

This study presents several limitations that must be considered when interpreting its findings. Firstly, the study's single-center design restricts the sample's diversity and potentially limits the generalizability of the results to broader populations. Variations in regional demographics, diagnostic practices, and healthcare access could influence psychological and behavioral disorders in children with chronic kidney disease. Secondly, the cross-sectional design prevents the examination of longitudinal changes and the establishment of causal relationships.

RECOMMENDATIONS

We recommend that all CKD children be screened for psychiatric disorders regularly, and a multidisciplinary team consisting of a psychiatrist and a nephrologist would aid in the early detection and management of psychiatric disorders among CKD children. Anemia and vitamin D deficiency should be treated promptly. Psychological health education for parents of CKD children should be implemented regularly. Further studies to evaluate the effect of correction of anemia and vitamin D deficiency in CKD children.

CONCLUSION

Psychiatric disorders were common in children with CKD & more prominent in children on regular dialysis. Duration of disease, anemia, vitamin D deficiency, and dialysis were the most powerful risk factors for psychiatric disorders in children.

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ABBREVIATIONS

ASEBA	Achenbach System of Empirically Based Assessment
BMI	Body mass index
Ca	Calcium
CBCL	Child Behavior Checklist
CKD	Chronic kidney disease
Hb	Hemoglobin
HCV	Hepatitis C virus
HD	Hemodialysis
IQR	Interquartile range
K	Potassium
KDOQI	Kidney Disease Outcome Quality Initiative
Na	Sodium
Ph	Phosphorus
PTH	Parathyroid hormone
SD	Standard deviation

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AUTHORS' CONTRIBUTIONS

All authors stated the concept of the research; M. Mahgoob and M. Mohamed conceived and planned the design of the study. S. Hassan, and Marrwa Ali. carried out the literature search and clinical study, data acquisition. M. Mahgoob , and M. Ali M analyzed the collected data. Statistical analysis was done by M. Mahgoob, and S. Hassan. M. Mahgoob and M. Ali took the lead in writing the manuscript. Manuscript reviewing and editing were done by M.Mahgoob. M. Mohamed, and M. Ali M. Approval of the version of the manuscript to be published by all authors.

STATEMENTS

Ethics approval and consent to participate

This study protocol and the consents were approved and deemed sufficient by the Ethical Committee of faculty of medicine, Minia university and informed written consent was obtained in every case from their legal guardians.

Consent for publication

The contents and material of the manuscript have not been previously reported at any length or are being considered for publishing elsewhere.

Availability of data and material

"Available on reasonable request"

Conflict of interest

The authors declare no conflict of interest.

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