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Variables	Mild to moderate CKD (grade 1, 2 and 3a)				Advanced CKD (grade 3b and 4)			
	Mean	SD	t	P Value	Mean	SD	t	P Value
RDA	10	0			10	0		
Cu (mg/d)	0.6	0.65	1.818	0.076	0.46	0.49	0.770	0.446
RDA	0.42	0.04			0.4	0.05		
VitA (mg/d)	117.08	209.26	- 8.374	0.000*	172.79	290.26	-4.236	0.000*
RDA	377.78	42.04			363.64	48.66		
VitC (mg/d)	13.79	12.51	−4.807	0.001*	15.69	23.69	-1.535	0.132
RDA	22.78	4.2			21.36	4.87		
VitB1 (mg/d)	0.33	0.17	- 9.736	0.000*	0.31	0.19	-8.254-	0.000*
RDA	0.58	0.04			0.56	0.049		
VitB2 (mg/d)	0.51	0.34	- 1.303	0.199	0.54	0.37	-0.414	0.681
RDA	0.58	0.04			0.56	0.049		

Iron intake deficiency (compared to RDA) was more evident among children suffering from advanced CKD than children with mild to moderate CKD, with a statistically significant difference. Sodium intake was increased among patients with advanced CKD than the other group of mild to moderate CKD, with a statistically significant difference.

Discussion:

Important problems in young CKD patients include anemia and iron insufficiency. Aggressive anemia therapy aims to enhance children's quality of life, cognitive performance, ability to exercise, and cardiovascular function while avoiding frequent red blood cell transfusions. (Koshy and Geary, 2008)

EPO- stimulating and iron supplementation medicines are the best treatments for anemia and iron deficiency; nevertheless, their usage in hemodialysis or peritoneal dialysis patients is known to be less successful than that in adults. (USRDS, 2016)

As a result, it's critical to early detect anemia and iron deficiency in juvenile CKD patients and take steps to aggressively treat them. Other juvenile CKD cohort studies, such as CKiD or "The Functional Outcomes in Adolescent CKD study" (Atkinson et.al, 2010) (Furth et.al, 2007), revealed hemoglobin levels but only partially documented the prevalence of anemia.

In the KNOW- PedCKD cohort research, the percentage of CKD patients with anemia decreased between the ages of 2 and 5 years old, then rose as patients aged. This outcome was similar to that seen in the NAPRTCS cohort study of children with chronic kidney disease (Atkinson et.al, 2010) showing increased risk of anemia in school- aged patients with CKD (ages 12 to 17).

Studies on the connections between conditions that cause CKD and anemia, however, are few. Interestingly, research revealed that patients with glomerulonephritis have more severe anemia than those without. According to recent research, drugs that inhibit the renin- angiotensin system (RAS) pathway to lower proteinuria in glomerulonephritis also regulate angiotensin II signaling to modify erythropoiesis. According to Vlahakos et.al (2009), angiotensin- converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARB) both have negative consequences connected to lower hematocrits.

As the cohort's CKD stage progressed, ferritin levels rose. Another study suggested that ferritin itself might function as an indicator of inflammation (Kell and Pretorius, 2014).

Conclusion:

Iron intake deficiency (compared to RDA) was more evident among children suffering from advanced CKD than children with mild to moderate CKD, with a statistically significant difference.

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Conflict of interest:

None declared.

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Variables	CKD Stage				F	P Value
	Mild to moderate CKD (grade 1, 2 and 3a)		Advanced CKD (grade 3b and 4)			
	Mean	SD	Mean	SD		
K (mg/d)	1170.97	529.1	1493.9	829.27	4.819	0.031*
Ca (mg/d)	355.43	211.81	448.73	379.76	2.061	0.155
Ph (mg/d)	399.45	174.26	498.44	334.06	3.091	0.082
Mg (mg/d)	65.5	34.12	62.71	35.65	0.142	0.707
Fe (mg/d)	5.68	2.96	5.82	2.16	0.072	0.789
Zn (mg/d)	3.97	1.85	3.97	1.89	0.000	0.997
Cu (mg/d)	0.59	0.65	0.46	0.49	1.122	0.292
Vit A (mg/d)	117.08	209.26	172.79	290.26	1.083	0.301
Vit C (mg/d)	13.79	12.51	15.69	23.69	0.227	0.635
Vit B1 (mg/d)	0.33	0.17	0.32	0.19	0.246	0.621
Vit B2 (mg/d)	0.51	0.34	0.54	0.37	0.140	0.710

Children with advanced CKD had higher amounts of carbohydrates, fiber and potassium intake per day, compared to children with mild to moderate group, with a statistically significant difference. There was no statistically significant difference between study groups as regards other nutritional elements (as water, total calories, proteins, fat, vitamins or minerals).

Table (8) The mean intake of different food groups among the total number of patients compared to recommended dietary allowance (RDA), (expressed in means± SD)

	Mean	SD	t	P Value
Water (mL/d)	1333.78	130.98	- 10.65	0.000*
RDA	1583.15	182.93		
Total calories (Kcal/d)	970.73	417.67	- 5.425	0.000*
RDA	1317.08	415.23		
CHO (gm/d)	120.04	45.61	- 2.061	0.042*
RDA	130	0		
Proteins (gm/d)	32.19	15.04	9.223	0.000*
RDA	17.25	2.74		
Fiber (gm/d)	3.14	1.58	- 59.11	0.000*
RDA	23.25	2.74		
Na (mg/d)	1312.5	717.13	2.263	0.026*
RDA	1141.57	91.46		
K (mg/d)	1330.62	708.78	- 27.35	0.000*
RDA	3566.29	365.86		
Ca (mg/d)	401.56	308.38	- 8.579	0.000*
RDA	712.36	137.2		
Ph (mg/d)	448.39	268.68	- 1.386	0.169
RDA	488.31	18.29		
Mg (mg/d)	64.12	34.72	- 24.89	0.000*
RDA	203.37	40.45		
Fe (mg/d)	5.75	2.58	- 16.13	0.000*
RDA	11.46	2.29		
Zn (mg/d)	3.97	1.86	- 30.57	0.000*
RDA	10	0		
Cu (mg/d)	0.53	0.57	1.908	0.060
RDA	0.41	0.046		
VitA (mg/d)	144.62	252.68	- 8.262	0.000*
RDA	370.79	45.73		
VitC (mg/d)	14.73	18.8	- 3.580	0.001*
RDA	22.08	4.57		
VitB1 (mg/d)	0.32	0.18	- 12.67	0.000*
RDA	0.57	0.05		
VitB2 (mg/d)	0.53	0.35	- 1.191	0.237
RDA	0.57	0.046		

Among the total number of cases, the intake of water, total calories, carbohydrates, fibers, potassium, calcium, magnesium, iron, zinc, vitamin A, vitamin C and vitamin B1 were significantly inadequate (lower than RDA). The intake of proteins and sodium were significantly higher than RDA. On the other side, the intake of copper, phosphorus and vitamin B2 were adequate.

Table (9) The mean intake of different food groups among the study groups compared to recommended dietary allowance (RDA), (expressed in means± SD)

Variables	Mild to moderate CKD (grade 1, 2 and 3a)				Advanced CKD (grade 3b and 4)			
	Mean	SD	t	P Value	Mean	SD	t	P Value
Water (mL/d)	1338.31	133.44	- 7.828	0.000*	1329.14	129.78	- 7.224	0.000*
RDA	1611.11	168.17			1554.55	194.64		
Total calories (Kcal/d)	893.24	301.8	- 4.937	0.000*	1049.98	501.09	- 3.182	0.003*
RDA	1242.83	333.65			1393.01	476.73		
CHO (gm/d)	110.61	37.07	- 3.509	0.001*	129.68	51.59	-0.041	0.976
RDA	130	0			130	0		
Proteins (gm/d)	30.7476	10.49	7.553	0.000*	33.67	18.6	6.127	0.000*
RDA	17.67	2.52			16.82	2.92		
Fiber (gm/d)	2.79	1.3	- 45.637	0.000*	3.5	1.76	- 40.161	0.000*
RDA	23.67	2.52			22.82	2.92		
Na (mg/d)	1180.16	443.86	0.368	0.715	1447.85	902.11	2.397	0.021*
RDA	1155.56	84.09			1127.27	97.32		
K (mg/d)	1170.97	529.1	- 24.858	0.000*	1493.9	829.27	- 16.321	0.000*
RDA	3622.22	336.35			3509.09	389.29		
Ca (mg/d)	355.4	211.81	- 11.294	0.000*	448.73	379.76	- 3.808	0.000*
RDA	733.33	126.13			690.91	145.98		
Ph (mg/d)	399.45	174.26	- 3.574	0.001*	498.44	334.06	0.254	0.801
RDA	491.11	16.82			485.45	19.46		
Mg (mg/d)	65.5	34.12	- 20.944	0.000*	62.71	35.65	- 15.128	0.000*
RDA	208.89	38.86			197.73	41.7		
Fe (mg/d)	5.68	2.96	- 9.344	0.000*	5.82	2.16	- 14.921	0.000*
RDA	11.11	2.1			11.82	2.43		
Zn (mg/d)	3.97	1.85	- 21.856	0.000*	3.97	1.89	- 21.137	0.000*

Table (4) Distribution of CKD stages in the study group (expressed in number and percentage)

	CKD Stage					Total
	Grade 1	Grade 2	Grade 3a	Grade 3b	Grade 4	
No.	18	11	16	20	24	89
%	20.2%	12.4%	18%	22.5%	27%	

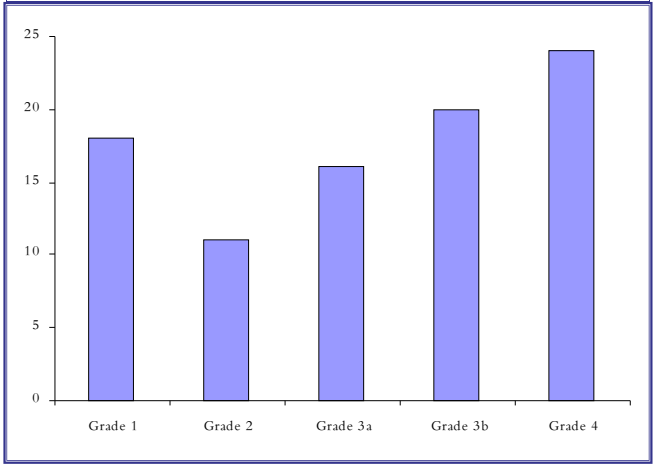

Figure (1) Distribution of CKD stages among the study group.

Table (5) Comparison between study groups as regards nutritional status and frequency of certain foods (expressed in number and percentage)

				CKD Stage: Mild to moderate CKD (grade 1, 2 and 3a)	Total: Advanced CKD (grade 3b and 4)	P Value
Meals No.	1 Meal Per Day	No.	1	0	1	0.763
		%	100.0%	0.0%		
	2 Meals Per Day	No.	9	8	17	
		%	52.9%	47.1%		
	3 Meals Per Day	No.	31	31	62	
		%	50.0%	50.0%		
	More than 3 meals per day	No.	4	5	9	
		%	44.4%	55.6%		
Main Meal	Breakfast	No.	19	24	43	0.171
		%	44.2%	55.8%		
	Lunch	No.	26	20	46	
		%	56.5%	43.5%		
Chips	No.	No	11	9	20	0.422
		%	55.0%	45.0%		
	Yes	No.	34	35	69	
		%	49.3%	50.7%		
Pepsi	No	No.	29	30	59	0.441
		%	49.2%	50.8%		
	Yes	No.	16	14	30	
		%	53.3%	46.7%		
Fruits/ Vegetables	No	No.	10	7	17	0.314
		%	58.8%	41.2%		
	Yes	No.	35	37	72	
		%	48.6%	51.4%		
Sweets	No	No.	10	6	16	0.219
		%	62.5%	37.5%		
	Yes	No.	35	38	73	
		%	47.9%	52.1%		
Fast Food	No	No.	41	42	83	0.349
		%	49.4%	50.6%		
	Yes	No.	4	2	6	
		%	66.7%	33.3%		
Nuts	No	No.	36	35	71	0.583
		%	50.7%	49.3%		
	Yes	No.	9	9	18	
		%	50.0%	50.0%		
Tea	No	No.	44	43	87	0.747
		%	50.6%	49.4%		
	Yes	No.	1	1	2	
		%	50.0%	50.0%		

Majority of cases in the study were having 3 meals per day with lunch was the main meal, however with no statistically significant difference between the study groups. There was no statistically significant difference between the study groups regarding the type of food eaten by patients per day.

Table (6) Comparison between male and female children as regards mean intake of different nutritional elements per day

Variables	Sex				F	P Value
	Male		Female			
	Mean	SD	Mean	SD		
Water (mL/d)	1322.8	135.01	1354.31	122.55	1.172	0.282
Total calories (Kcal/d)	965.62	461.12	980.28	327.96	0.025	0.876
CHO (gm/d)	117.71	46.94	124.39	43.40	0.432	0.513
Proteins (gm/d)	31.72	16.96	33.07	10.76	0.162	0.688
Fat (gm/d)	40.9	29.72	38.42	17.74	0.182	0.671
Fiber (gm/d)	3.16	1.69	3.1	1.36	0.026	0.873
Na (mg/d)	1328.96	811.12	1281.7	506.97	0.087	0.769
K (mg/d)	1345.61	742.53	1302.58	651.76	0.074	0.787
Ca (mg/d)	390.31	223.72	422.61	427.97	0.22	0.640
Ph (mg/d)	431.23	191.62	480.49	374.65	0.676	0.413
Mg (mg/d)	63.05	33.08	66.12	38.08	0.157	0.693
Fe (mg/d)	5.89	2.64	5.48	2.49	0.518	0.474
Zn (mg/d)	3.99	1.71	3.91	2.14	0.051	0.822
Cu (mg/d)	0.53	0.64	0.52	0.43	0.021	0.886
Vit A (mg/d)	145.87	293.06	142.28	155.21	0.004	0.950
Vit C (mg/d)	12.13	11.11	19.59	27.66	3.260	0.074
Vit B1 (mg/d)	0.34	0.17	0.3	0.19	1.134	0.290
Vit B2 (mg/d)	0.55	0.35	0.49	0.36	0.527	0.470

There was no statistically significant difference between males and females included in this study as regards mean SD of different nutritional elements intake per day.

Table (7) Comparison between study groups regarding mean intake of nutritional elements per day

Variables	CKD Stage				F	P Value
	Mild to moderate CKD (grade 1, 2 and 3a)		Advanced CKD (grade 3b and 4)			
	Mean	SD	Mean	SD		
Water (mL/d)	1338.31	133.44	1329.14	129.78	0.108	0.744
Total calories (Kcal/d)	893.24	301.8	1049.98	501.09	3.212	0.077
CHO (gm/d)	110.61	37.07	129.68	51.59	4.024	0.048*
Proteins (gm/d)	30.75	10.49	33.67	18.6	0.837	0.363
Fat (gm/d)	36.47	18.22	43.69	32.04	1.716	0.194
Fiber (gm/d)	2.79	1.3	3.5	1.76	4.725	0.032*
Na (mg/d)	1180.16	443.86	1447.85	902.12	3.176	0.078

and group (B) included advanced CKD (grade 3b and 4) cases who were subjected to:

1. Complete History Taking.
2. Personal data: Name, sex, age, order of birth, birth age and weight; socioeconomic status and maternal nutritional status during pregnancy.
3. Present history of CKD including: age of onset, underlying cause, drug intake history and family history of consanguinity and similarly affected family members.
4. Nutritional assessment: to obtain both qualitative and quantitative information about the different items of food and beverage consumed by every child. The food frequency and 24- hours dietary recall methods were used, in which recording of food intake for three scattered days (3 days recall sheet), including 2 regular days and one weekend, then taking their mean (Emmons and Hayes, 1973). The conversion of household measures to grams was achieved through the use of a prepared list of commonly used household measures in Egypt. Data of the dietary history was computed using the National Nutrition Institute's (Egypt) food consumption tables, in order to calculate the average daily intake of each child of total calories, macronutrients (calories, protein, fat and carbohydrates) and micronutrients (minerals as sodium, potassium, calcium, phosphorus and iron). These nutrients were calculated as percentage of recommended dietary daily allowances (RDA) for age and sex (RDA, 1989).
5. Clinical Examination: General as well as systemic physical examination was done for all children. Examination of chest and heart, abdomen and neurological evaluation was done, with special emphasis on clinical signs of CKD and its cause.
6. Growth assessment: Measurement of basic parameters (length or height in centimeters, and weight in kilograms), body mass index (BMI) was calculated according to the formula (BMI= weight in kilograms/ (height in meters)^2, midarm and waist circumferences; all were plotted on the CDC (Centre for Disease Control) curves for interpretation of results.
7. Investigations: Peripheral blood sample (4 ml) was obtained from each child on assessment. The samples were analyzed for: complete blood picture (CBC); iron profile (serum iron and serum TIBC using Greiner Diagnostic GmbH, Germany); kidney functions and blood electrolytes: serum creatinine and phosphate, each according to standard laboratory techniques; and plasma C-terminal FGF23 (using second generation ELISA, Nova, Bioneovan Co., Ltd, China).

   Glomerular filtration rate (GFR): calculated using the standard Schwartz equation (Schwartz et.al, 2012), where estimated GFR eGFR= 41.3× (height in meters /serum creatinine in mg/dL).

Statistical Analysis:

The collected data was tabulated and graphically presented and was statistically analyzed in terms of range, mean, standard deviation (±SD), median, frequencies 10 (number of cases), and relative frequencies (percentages). A probability value (p-value) less than 0.05 was considered significant. All statistical calculations were done using computer programs Microsoft Excel 2016 (Microsoft Corporation, NY, USA) and SPSS version 23 (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) statistical program.

Results:

Table (1) Descriptive statistics of age and anthropometric measurements among the study group (expressed in means± SD, minimum and maximum)

Variables		Total cases in the study group
Age (In Years)	Mean± SD	5.32± 2.28
	Range (min.- max.)	2- 8
Height (In Cm)	Mean± SD	103.98± 16.78
	Range (min.- max.)	74- 129
Weight (In Kg)	Mean± SD	19.1± 6.85
	Range (min.- max.)	8- 40
BMI	Mean± SD	17.35± 4.02
	Range (min.- max.)	12.17- 30.06
Mid- Arm Circumference (Mac)	Mean± SD	14.46± 1.63
	Range (min.- max.)	12- 19.7
Waist Circumference (WC)	Mean± SD	56.3± 5.56
	Range (min.- max.)	50- 72

Among the study group, mean age was 5.32± 2.28 with min.- max. of 2- 8 years old, mean height was 103.98± 16.78 cm and mean weight was 19.1± 6.85 kg.

Table (2) Descriptive analysis of laboratory investigations (expressed in means± SD, minimum and maximum)

Variables		Total cases in the study group
Serum iron (ug/dL)	Mean± SD	93.08± 66.38
	Range (min.- max.)	13.53- 293.98
Serum TIBC (ug/dL)	Mean± SD	213.45± 129.32
	Range (min.- max.)	30.55- 793.16
Hb (gm/dL)	Mean± SD	10.95± 1.34
	Range (min.- max.)	6.5- 13.5
MCV (Fl)	Mean± SD	77.01± 7.52
	Range (min.- max.)	48.9- 99
MCH (Pgm)	Mean± SD	25.35± 2.73
	Range (min.- max.)	14.8- 34
MCHC (gm/dL)	Mean± SD	33.07± 1.73
	Range (min.- max.)	29.6- 37.2
Serum Phosphorus (mg/dL)	Mean± SD	9.33± 4.43
	Range (min.- max.)	4.33- 36.54
Serum Creatinine (mg/dL)	Mean± SD	1.052±0.66
	Range (min.- max.)	0.14- 3.05
Serum FGF- 23 (pg/mL)	Mean± SD	228.24± 339.44
	Range (min.- max.)	46.9- 1724.65

Table (3) Descriptive analysis of eGFR estimation (expressed in means± SD, minimum and maximum)

Variables		Total cases in the study group
eGFR (mL/ min/ 1.73m^2)	Mean± SD	71.12± 73.1
	Range (min.- max.)	16.69- 378.58

Mean eGFR among the total number of the study group was 71.12± 73.1, with minimum of 16.69 and maximum of 378.58 mL/ min/ 1.73m^2. According to eGFR, the study groups included 18 patients in grade 1 CKD (20.2%), 11 patients in grade 2 (12.4%), 16 patients in grade 3a (18%), 20 patients in grade 3b (22.5%) and 24 patients in grade 4 (27%).

Introduction:

A serious consequence of childhood chronic kidney disease (CKD) is anemia. According to the stage of CKD, the incidence of anemia in children with CKD ranged from 73 to 93%, according to data from the North American Pediatric Renal Trials and Collaborative Studies (NAPRTCS). (Lee et.al, 2019)

Anemia is a significant risk factor for the onset and development of cardiovascular illness, particularly left ventricular hypertrophy, in children with CKD (Hayashi et.al, 2015). Additionally, anemia has a detrimental impact on patients' and their carers' quality of life (Carlson et.al, 2020).

In patients with CKD, the chronic inflammatory condition leads to diminished erythropoiesis in the bone marrow, decreased erythropoietin (EPO) synthesis in the kidneys, and poor iron absorption and mobilization owing to increased hepcidin production in the liver. Anemia in CKD is also influenced by uremia, oxidative stress, and dietary deficits. (Atkinson et.al, 2018)

Therefore, erythropoiesis- stimulating agents (ESAs) and iron supplements are important strategies for the therapy of anemia in CKD patients, even if therapeutic objectives involving hemoglobin and iron levels remain debatable. (Babitt et.al, 2021)

However, investigations on anemia and iron deficiency are restricted owing to the small number of pediatric patients with CKD and the fact that treatment of anemia in children with CKD is known to be less successful than that in adults. (Becherucci et.al, 2017)

Early- stage chronic kidney disease (CKD) is associated with higher fibroblast growth factor 23 (FGF23) expressions, which continue to rise when the glomerular filtration rate falls. (Portale et.al, 2014)

FGF23 is an osteocyte- derived hormone that controls how phosphorus and 1, 25- dihydroxyvitamin D (1.25[OH]2D] are metabolized. A negative feedback loop is completed when 1.25(OH)2D and high dietary phosphate intake upregulate the expression of FGF23, increasing renal excretion of phosphate and reducing 1.25(OH)2D synthesis in the process (Han and Quarles, 2016). According to recent research, FGF23 production is also impacted by iron deficiency and erythropoietin (EPO). (Toro et.al, 2018)

Numerous clinical research on renal disease patients have shown that elevated FGF23 expression is linked to worse patient outcomes. The increased rates of death and morbidity among patients with CKD are also a result of high- dose EPO therapy. (Souma et.al, 2016)

Iron insufficiency, brought on by excessive EPO production or HIF (hypoxia inducible factor) activation, increases FGF23 expression and is linked to negative outcomes in CKD patients. As a result, it's critical to find therapies that reduce FGF23 expression in order to treat iron deficiency and enhance patient outcomes. (David and others, 2016)

Iron serves as a cofactor in a number of enzymatic processes and is an essential part of hemoglobin, which is necessary for regular oxygen delivery. Pregnancy, a poor diet, inflammation, iron malabsorption, and CKD are just a few of the causes that may result in iron shortage and anemia. (Brannon and Taylor et.al, 2017)

Low iron levels and high cFGF23 expression levels have been linked in a study of CKD patients. In patients with CKD and kidney transplant recipients, Eisenga et.al have established that iron shortage is linked to elevated blood FGF23 levels. (Eisenga et.al, 2017)

Aim of the study:

To assess the nutritional status and to compare the mean of intake of different food groups among children with CKD to recommended dietary allowance (RDA).

Methods:

This cross- sectional study was conducted at the Pediatric Nephrology Unit Clinics- Pediatrics Hospital- Ain Shams University, from January to December 2022. The study included 89 children with the following criteria:

- Inclusion Criteria:
  1. Male and Female Children
  2. Aged from 2 to 8 years
  3. Diagnosis of CKD stages 1- 4 (where CKD is defined as abnormalities of kidney structure or function, present for > 3 months, with implications for health. GFR categories (ml/min/1.73 m2) range are as follows: Stage 1 (G1): > or= 90, Stage 2 (G 2): 60- 89, Stage 3a (G3a): 45- 59, Stage 3b (G3b): 30- 44, Stage 4 (G4): 15- 29, Stage 5 (G5): < 15.
- Exclusion Criteria:
  1. Children with CKD on dialysis.
  2. Children on GH Therapy
  3. Children with genetic diseases or dysmorphic syndromes.
  4. Children with chronic diseases other than CKD.
  5. Sampling method A consecutive purposive sampling technique.
- Ethical Considerations: Patient information and informed consent Before being enrolled into the study, the patient's parents (or guardians) consented to participate after the nature, scope and possible consequences of the clinical study had been explained in a form understandable to them.

  Confidentiality and protocol approval Before the beginning of the study and any accordance with the local regulation followed, the protocol and all the corresponding documents were declared for ethical and research approval by the council of Medical Studies department, Faculty of Postgraduate Childhood Studies, Ain Shams University, and the Ethical Committee at the National Research Centre.

  Concerning safety and efficacy No evidence of harmful effects of study interventions. Patients' blood samples were discarded after performing the required investigations and were not used for any other purposes.

  Limitations of the study Refusal of some parents or guardians to enroll their child in the study.
- Study procedures All children with CKD were divided into 2 groups; group (A) included mild to moderate CKD (Grade 1, 2 and 3a) cases,

Nutritional Assessment among Egyptian Children with Chronic Kidney Disease not on Dialysis

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Summary

Background: Chronic kidney disease (CKD) is a major health problem worldwide, characterized by a gradual loss of kidney function over time. Improving Global Outcomes (KDIGO) guidelines have defined CKD as: "abnormalities of kidney structure or function, present for more than 3 months, with implications to health". Aim: To assess the nutritional status and to compare the mean of intake of different food groups among children with CKD with their recommended dietary allowance (RDA). Methodology: This cross- sectional study was conducted on 89 children aged (2- 8) years, with the diagnosis of CKD (stages 1 to 4), recruited from the Pediatric Nephrology Unit Clinics, Ain Shams University from January to December 2022. Nutritional assessment was performed to obtain both qualitative and quantitative information about the different items of food consumed by every child by 24- hours dietary recall method. They were subjected to thorough clinical assessment with special emphasis on present history of CKD, nutritional and laboratory studies of complete blood picture, iron profile, kidney functions, blood electrolytes and glomerular filtration rate. Results: Among the included subjects, the intake of water, total calories, carbohydrates, fibers, potassium, calcium, magnesium, iron, zinc, vitamin A, vitamin C and vitamin B1 were significantly inadequate (lower than RDA). The intake of proteins and sodium were significantly higher than RDA. On the other side, the intake of copper, phosphorus and vitamin B2 were adequate. Children with advanced CKD had higher amounts of carbohydrates, fiber and potassium intake per day, compared to children with mild to moderate CKD, with a statistically significant difference. Iron intake deficiency and increased sodium intake as compared to RDA, were also more evident among children suffering from advanced CKD (respectively mean iron 5.82 versus 11.82, and mean sodium 1447.85 versus 1127.27) than children with mild to moderate CKD (respectively mean iron 5.68 versus 11.11, and mean sodium 1180.16 versus 1155.56), with a statistically significant difference. Conclusion: Iron intake deficiency was more evident among children suffering from advanced CKD than children with mild to moderate CKD, with a statistically significant difference.

Keywords: Iron Deficiency; Chronic Kidney Disease.

التقييم الغذائي لدى الأطفال المصريين الذين يعانون من أمراض الكلى المزمنة بدون غسيل كلوي

الخلفية: مرض الكلى المزمن هو مشكلة صحية كبيرة في العالم، وفيه فقدان تدريجي لوظائف الكلى مع مرور الوقت. تم تحديد مرض الكلى المزمن على أنه: "تشوهات في بنية الكلى أو وظيفتها، موجودة لأكثر من ٣ أشهر، مع ما يترتب على ذلك من آثار صحية". الاهداف: لتقييم الحالة التغذوية ومقارنة متوسط تناول المجموعات الغذائية المختلفة بين الأطفال المصابين بمرض الكلى المزمن بالكميات الغذائية الموصي بها. المنهج: أجريت هذه الدراسة المقطعية على ٨٩ طفلا تتراوح أعمارهم بين (٢- ٨) سنوات، تم تشخيصهم بمرض الكلى المزمن (المرحلة ١ إلى ٤)، والمترددين على عيادات وحدة أمراض الكلى للأطفال، جامعة عين شمس منذ يناير حتى ديسمبر ٢٠٢٢. تم إجراء التقييم الغذائي للحصول على معلومات حول نوعية وكمية العناصر المختلفة من الطعام التي يستهلكها كل طفل من خلال طريقة الاسترجاع الغذائي لمدة ٢٤ ساعة والتحويل إلى الجرام باستخدام قائمة معدة للتدابير المنزلية الشائعة الاستخدام في مصر وحساب المتوسط اليومي لكل طفل من إجمالي السعرات الحرارية والمواد الغذائية ومقارنة هذه العناصر الغذائية بالكميات الغذائية الموصي بها للعمر والجنس. النتائج: من بين إجمالي عدد الحالات، كان تناول الماء، وإجمالي السعرات الحرارية، والكربوهيدرات، والألياف، والبوتاسيوم، والكالسيوم، والمغنيسيوم، والحديد، والزنك، وفيتامين أ، وفيتامين ج، وفيتامين ب١ غير كاف بشكل ملحوظ. كان تناول البروتينات والصوديوم أعلى بكثير من الكميات الغذائية الموصي بها وكان تناول النحاس والفوسفور وفيتامين ب٢ كافيا. الأطفال الذين يعانون من مرض الكلى المزمن المتقدم يتناولون كميات أعلى من الكربوهيدرات والألياف والبوتاسيوم في اليوم، مقارنة بالأطفال الذين يعانون من المرض بدرجة خفيفة إلى متوسطة، مع وجود فرق ذو دلالة إحصائية. كما كان نقص تناول الحديد وزيادة تناول الصوديوم عن الكميات الغذائية الموصي بها ملحوظا بين المرضى الذين يعانون من مرض الكلى المزمن المتقدم (متوسط الحديد ٥,٨٢ مقارنة بـ١١,٨٢، ومتوسط الصوديوم ١٤٤٧,٨٥ مقارنة بـ١١٢٧,٢٧) مقارنة بالمجموعة الأخرى (متوسط الحديد ٥,٦٨ مقارنة بـ١١,١١، ومتوسط الصوديوم ١١٨٠,١٦ مقارنة بـ١١٥٥,٥٦) مع وجود فرق ذو دلالة إحصائية. الخلاصة: كان نقص تناول الحديد أكثر وضوحا بين الأطفال الذين يعانون من مرض الكلى المزمن المتقدم مقارنة بالأطفال المصابين بمرض الكلى المزمن الخفيف إلى المتوسط، مع وجود فرق ذو دلالة إحصائية.

الكلمات الدالة: مرض الكلى المزمن- نقص الحديد.

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