

## Assessment of Nutrition Status of Children with Chronic Renal Failure Undergoing Hemodialysis

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**Background:** Chronic renal failure is a worldwide health problem, with increasing prevalence and adverse outcomes. Children's nutritional status reflects the degree to which physiologic needs for nutrients are being met. In challenges of pediatric nurse role, she must gathering data for nutrition assessment, provide education regarding dietary modifications, encourage appropriate food choice, and evaluate the adequacy of nutrient intake for children with CRF as they are already in risk for poor nutritional health. **Aim of the study** was to assess the nutritional status of the school age children with CRF undergoing hemodialysis. **Setting** it was carried out in hemodialysis unit of Alexandria University Children at El-Shatby Hospital (AUCH) and Health Insurance Student's Hospital (HISH) in Alexandria, Egypt. **Subject:** A convenient sample of all children (30) with chronic renal failure undergoing hemodialysis was involved. **Materials and Method:** A structured interview questionnaire was designed and used to interview the child or mothers. It included nutritional assessment of studied children such as Physical examination, anthropometric measurements and lab investigation. **The results** revealed that the majority of studied children had height, weight, BMI, MAC, TSFT less than normal. The majority of children were anemic. Most of children had low in vitamins such as A (93.3%), C (93.3%) and D (100%). 63.3 % of the studied children had hypoalbuminaemia. high percent of children had hypocalcemia and hypokalemia. All of studied children had hypercreatinemia. **Recommendation:** nutritional counseling should be performed based on individualized assessment of children with consideration of the children age, development, food preference, activity, cultural beliefs, and psychological status.

**Key words:** nutritional assessment, school age children, hemodialysis.

### Introduction:

Chronic renal failure (CRF) is a permanent irreversible destruction of nephrons. It leads

to severe deterioration of renal function resulting in end stage renal disease (ESRD)<sup>(1)</sup>. In 6-12 year age group, the most

common causes of ESRD are glomerular disease, hereditary renal disorder and renal vascular disease <sup>(2)</sup>. Treatment of chronic renal failure requires either dialysis or transplantation. Dialysis can be accomplished either by hemodialysis (HD) or peritoneal dialysis (PD). In the United States and United Kingdom, the most common method is hemodialysis in which blood passes by a semipermeable membrane of the artificial kidney. The waste products are removed by diffusion while fluid by ultrafiltration <sup>(3)</sup>

According to the United States Renal Data System in the year 2008, CRF of hospitalized children between ages from birth to 19 years of age has been reported to be approximately 1.2% of all hospitalized children. Furthermore, mortality rate of ESRD was 157.3 deaths per 1,000 children yearly <sup>(4, 5)</sup>. In Egypt, CRF of hospitalized children between ages from birth to 15 years of age is approximately 4.9% of all hospitalized children as reported by the Central Administration for National Information Center for Health and Population <sup>(6)</sup>. There are many abnormalities associated with chronic renal disease. These include retention of nitrogenous metabolites, decreased ability to regulate plasma or tissue levels of sodium, magnesium, phosphorus, calcium, potassium, water and other

compounds as well as certain vitamin deficiencies <sup>(7)</sup>.

Wasting is commonly seen in uremic children and has many adverse clinical effects. This syndrome is characterized by decreased body weight, muscle mass, adipose tissue and low level of many serum proteins. The wasting is engendered by multiple factors such as poor dietary intake, loss of nutrients during dialysis and catabolic effects of superimposed illness. Furthermore, altered amino acid and protein metabolism are associated with renal failure and possibly endocrine disorders and impaired metabolic function of the kidney. The causes of inadequate dietary intake include anorexia from uremic toxicity, medications, psychological depression, and relatively unpalatable meals due to restricted intake of protein, purified sugars, minerals and water <sup>(7,8)</sup>.

Nutrition of children with renal failure has to be taken into consideration. It is crucial to promote optimal growth and development, minimize consequences of uremia and to avoid fluid as well as electrolytes imbalance <sup>(9)</sup>. The diet is modified according to the kidney function and the etiology of primary renal disease. In some conditions, certain restrictions need to be followed <sup>(10)</sup> children's nutritional status reflects the degree to which physiologic needs for nutrients are being met. Nutrients intake are influenced by multiple

factors such as economic situation, eating behavior, emotional climate, culture influences, effects of various disease states on appetite and the ability to consume and absorb adequate nutrients. The balance between nutrient intake and nutrient requirements is the nutritional status so nutrition status should monitor regally in all children with CRF <sup>(11)</sup>.

It is important to assess dietary intake of children with renal failure on maintenance hemodialysis as it helps to identify potential and actual nutritional problem <sup>(12)</sup> Nutritional assessment serves as the foundation on which nutritional assessment intervention goals are based. A complete nutritional assessment comprises four major components relying on historical information, physical examination, anthropometric measurement, biochemical analyses <sup>(13,14)</sup>

The pediatric nurse has a respectable role in management of children undergoing hemodialysis because she is involved in dietary planning and identification of the nutritional problems of children. Nutrition assessment is an important intervention for children with these conditions. In a challenger role, the pediatric nurse must gather data for nutrition assessment, provide education regarding dietary modifications, encourage appropriate food choice, and evaluate the adequacy of nutrient intake for

children with CRF who are already in risk for poor nutritional health <sup>(15,16)</sup>

Malnutrition is considered a marker of poor prognosis in hemodialysis. The children's nutritional status is inversely associated with increased risk of hospitalization and mortality. Furthermore, the success of dialysis is dependent on adequate nutrition. Therefore, assessing the nutritional status of children undergoing hemodialysis is essential both to prevent malnutrition and to indicate appropriate intervention in malnourished child.

### **Aim of the study:**

was to assess the nutritional status of children with chronic renal failure undergoing hemodialysis.

### **Research question:**

What is the nutritional status of children with chronic renal failure undergoing hemodialysis?

### **Materials and Method**

#### **Materials**

#### **Research design**

A descriptive research design was implemented.

#### **Setting of the study:**

This study was carried out in the hemodialysis unit of Alexandria University Children's Hospital at El-Shatby (AUCH) and Health Insurance Student's Hospital (HISH) in Alexandria, Egypt.

#### **Subjects:**

A convenient sample of all children with chronic renal failure undergoing hemodialysis was involved. Their number was 30 children who fulfilled the following criteria including:

1. Age range from 6-12 years old.
2. Both sexes.
3. On maintenance hemodialysis for at least six months.
4. Free from other chronic diseases such as heart disease, diabetes mellitus and hepatic failure.

**Tools of data collection:**

Two tools were used for data collection that involves:

**Tool I: Nutritional Assessment Tool**

Nutritional assessment parameters of children with chronic renal failure undergoing hemodialysis were developed by the researcher after thorough review of literature in Arabic language to collect the data. It included four parts:

**Part I: Biosocial and medical data:**

- Biosocial data concerning the child's name, age, sex, residence and educational level. In addition, parent's education level and occupation.
- Family history of CRF.
- The duration, frequency of HD among children.
- Uremic symptom leading to feeding difficulties such as nausea, vomiting, and changes of food taste.

**Part II: Physical assessment sheet:**

Clinical examination is focused particularly on inspection of general appearance and functional abilities as condition of hair, skin, face, eyes, mouth, and muscles.

**Part III: Anthropometric measurements sheet:**

It involved measurements of the body weight, height, mid- arm circumference (MAC), triceps skinfold thickness (TSFT) and body mass index (BMI). Each of these measurements was taken according to standard procedures recommended by Jelliffe<sup>(17)</sup>. It was used to record the child's measurements.

**Part VI: Biochemical tests**

The following biochemical investigations were done for every child in the clinical chemistry laboratory of AUCH and HISH. The results of the laboratory investigation were obtained from the child's records such as urea in mg/dl, creatinine in mg/dl, hemoglobin in g/dl, serum calcium and phosphorus in mg/dl, serum potassium and sodium in mEq/L, serum albumin level in g/L, and random blood sugar in mg/dl.

**Tool II: Dietary intake survey:** which included diet history from the child or the caretaker was taken by using the following method:

- Feeding pattern of the child included the number of main meals consumed daily, his/her appetite, likes and dislikes as well as

intake and nature of snacks, amount of fluid, supplements and salt intake.

- Food consumption pattern was assessed using the twenty-four hour recall method. Child or the caretaker was asked to record every food in portion sizes that the child has consumed the last 24 hours to determine the quantity and quality of the child's food intake.

**Method:**

1. An official Permission was obtained from the director of Alexandria University Children's at El-Shatby and Health Insurance Student's Hospital in Alexandria, Egypt.
2. Personal communication with the attending pediatrician and nurses was carried out to ensure their cooperation.
3. Tools were tested for their content validity by five experts in pediatric nursing field and reliability was ascertained using test–retest technique.
4. Each mother was asked individually by the researcher at the waiting mother's room for small children in hemodialysis unit. The purpose of the study was explained to the mothers and children according to their ability to understanding. Caretaker signed the permission to participate in this study and child rights' to withdraw at any time was ensured. There were also assured that all information gathered will be

confidential and used only for the purpose of the study, this helped in gaining full cooperation of the mothers

5. A pilot study was conducted on five children and their caregiver to evaluate the tools for clarity and feasibility of questionnaire. Necessary modification was done .These five children were excluded from the sample.
6. The data was collected first at (AUCH) and then at (HISH).
7. During initial meeting, each caretaker or child according to his/her age was asked at the beginning of HD session to obtain the required data about biosocial data, medical data, and child's feeding pattern, anthropometric data were measured.
8. Physical examination was done to every child as regards :
  - a) Manifestations of anemia: inspection of oral mucosa and the conjunctiva for pallor.
  - b) Signs of nutritional deficiencies: Assessment of general appearance and functional abilities as condition of hair, face, eyes, mouth, skin problems, muscles –skeletal system. For example, inspection of face and hands for pallor, also inspection of skin for rough, scaly or dry. Mouth condition for signs of nutritional deficiencies like dry lips.

9. Anthropometric measurements were taken for each child, where:
- a) Body weight of children was measured by using beam balance scale which is found in the dialysis unit and the child was asked to stand on the center of the scale without touching anything. Minimal clothing and shoes were removed. The scale reading to zero point before each use and calibrated frequently. Both pre and post dialysis weight was recorded to the nearest tenth of kilogram. The difference between them is considered the Intra Dialytic Weight Gain (IDWG).
  - b) Standing height was measured by using a tape measure fixed on the wall. Height was recorded to the nearest tenth of centimeter. The child was standing erect without shoes, while, the shoulder, buttocks and heels were against a wall. A Child foot was close to each other while keeping the head in the Frankfort plane.
  - c) Mid-arm circumference (MAC) was measured with hemodialysis access free arm. Place the zero end of the measuring tape at the acromion process to the olecranon (elbow tip) and note the midpoint. Measure around the arm at the level of the mark, with firm and uniform contact with the skin surface without compressing the soft tissue of the area.
  - d) Triceps skinfold thickness (TSFT) was firmly grasped and slightly lifted up between the index finger and thumb of the left hand. The Lange skinfold caliper was applied about 1cm below to skin fold while the skin fold was still gently held throughout the measurements.
10. All laboratory investigations were recorded from each child record, which included urea in mg/dl, creatinine in mg/dl, hemoglobin in g/dl, serum calcium and phosphorus in mg/dl, serum potassium and sodium in mEq/L, serum albumin level in g/L, and random blood sugar in mg/dl.
11. Dietary information was obtained through the following:
- a) Dietary habits: every child was asked about his appetite, intake of supplementary vitamins, salt intake and amount of fluid intake.
  - b) The 24-hour recall method: During the session, caretaker or children were asked to record every food in portion sizes that the child has consumed for the past 24-hour. Food consumption pattern was

presented in the form of 24-hour recall method, which the patient was asked to remember and report all foods and beverages he consumed in the preceding 24-hours. This was helped by the use of food and plates model, to determine the actual amount of food consumed. The data on how food was prepared was also collected. The intake from each of the food groups (number of servings /day) was compared with the recommended daily food guide, for that specific age group. The 24-hour recall method was analyzed using Egyptian food composition tables established by the Nutrition Institute in Cairo, to know the amount of carbohydrate, fat, protein, vitamins etc. and to compare it with the normal for the age<sup>(18)</sup>.

12. The data were collected over a period of three months; starting from May 2011 and were ending in July 2011. Hemodialysis unit was visited five days a week for a period of three months.

#### **Data Analysis**

##### **Physical assessment**

Signs of nutritional deficiencies were detected and recorded.

##### **Laboratory tests**

The results of laboratory investigations were compared with the normal range of values for standard children with CRF in the same age and sex. The decision taken was either the child value was either low, normal or high as the following.<sup>(3)</sup>

##### **Anthropometric measurements:**

Each anthropometric measurement of weight, height, mid-arm circumference and skin fold thickness were compared with the normal standard of corresponding age and sex of the percentile.

##### **Dietary Data**

Analysis of the daily dietary intake was done using local food composition tables put out by the Nutrition Institute in Cairo. Food consumption pattern was presented in the form of 24-hour recall method which the patient was asked to remember and report all foods and beverages he consumed in the preceding 24-hours. The following nutrients were categorized into three groups, low, normal high according to the recommended dietary allowances (RDA) for school age.<sup>(3)</sup>

##### **Statistical Analysis**

After data were collected, they were revised, coded and fed to statistical software SPSS version 16. The statistical analysis used considered all tests to be two tailed with alpha error = 0.05. After data coding the following data manipulations were done:

##### **1. Anthropometric indicators measurement:**

The Z-score or standard deviation unit (SD) was used. The cut-off with Z-scores that was used is -2 standard deviations. This means that children with a Z-score for underweight, stunting or wasting, below -2 SD are considered moderately or severely malnourished. The computerized WHO programs **EPINUT** was used for calculating the different nutritional indicators<sup>(19)</sup>.

#### **Data analysis**

All numeric data were expressed in the form of range (minimum to maximum), mean and standard deviation (SD). Categorical data were expressed in the form of frequencies and percentages.

#### **A. Analysis of numeric data:**

Independent sample t test were used.

#### **B. Analysis of categorical data**

Pearson's chi square test and Fishers exact test were used.

#### **Results:**

Table (1) shows the sociodemographic characteristics of the studied children. It was found that 66.7% of the studied children are aged 9-12 years while 33.3 % of them are aged 6-< 9 years with a mean age  $9.19 \pm 2.19$  years. In addition, the highest percentage (53.3%) of children was females. Concerning place of residence, it was found that 53.3 % of the studied children live in rural areas. Regarding the level of child education, it was clear that 20% of the studied children were in the 1<sup>st</sup> and 2<sup>nd</sup>

primary grade while 30% were in the 5<sup>th</sup> and 6<sup>th</sup> primary grade.

Table (2) demonstrates the duration and frequency of HD among children with CRF. Duration of hemodialysis elapsed less than one year among one third of the studied children while, 36.7% of them are starting hemodialysis since more than three years.

Approximately three quarters (73.3%) of the studied children had 3 sessions per week while 10.0% had two sessions per week. All dialysis sessions lasted about 3-4 hours.

Table (3) presents the 24-hour dietary intake by children with CRF. It was found that 86.7% of studied children had low protein with a mean of  $31.78 \pm 8.84$  gm. Moreover, 73.3% of them had low fat with a mean of  $18.77 \pm 4.18$  gm and 80% of the studied children had high CHO with a mean of  $151.43 \pm 62.28$  gm. Highest percentage (83.3%) of studied children consumed low energy foods with a mean of  $787.7 \pm 370.37$  kcal.

The majority of children had low vitamins intake such as A , D and C (93.3%, 100% and 93.3% respectively ). In addition, it was observed a higher percentage of children had low minerals intake such as Ca ,P, Na, K ,iron and zinc(90% , 63.3%, 66.7%, 46.7%, 83.3% and 60% respectively).

Table (4) represents the percent distribution of children according to their percent standard of anthropometric measurements

for age and sex. The highest percentage (83.3 %) of studied children were underweight (< 90) while, 16.7% of them had normal weight (90-110 %). The mean weight was of  $22.7 \pm 6.5$  kg.

It was evident from the table that the height of the largest percentage of the studied children (70%) was less than normal (< 90%). The mean height was  $118.4 \pm 14.9$  cm.

With reference to body mass index for age, it was noticed that 73.3 % of the studied children were <18.5 (underweight) and considered malnourished, while 26.7% of them were considered normal, their mean BMI was  $15.9 \pm 2.1$  kg/m<sup>2</sup>. . In addition, the majority of studied children (80%) had a MAC less than normal (<90 %) while only 20 % of them had normal MAC (90-110 %) with a mean of  $16.8 \pm 3.4$  cm. Besides, triceps skin fold thickness was less than normal <80 among 86.7 % of studied children and only 13.3% of them had normal TSFT (80-110%) with mean of  $5.8 \pm 2.4$  mm.

Table (5) represents the distribution of the anthropometric indicators of children with CRF. Concerning the height of children for their age, 83.3% of the studied children were stunted. Regarding weight for age, underweight was recorded among 70 % of studied children. Moreover, it was found that

70% of the studied children were in wasting health status.

Table (6) illustrates the laboratory investigations of children with CRF. The majority (93.3%) of the studied children had high blood urea. It ranged from 5.0 – 215.0 mg/dl with a mean of  $102.5 \pm 54.2$  mg/dl. While, albumin value ranged from 2.30 – 4.60 g/L with a mean of  $3.42 \pm 0.54$  g/L and 63.3 % of the studied children had hypoalbuminemia.

Random blood sugar level ranged from 81.0 – 121.10 mg/dl with a mean of  $121.10 \pm 24.28$  mg/dl and 53.3% of studied children were hyperglycemic. Concerning calcium value is ranged from 3.10–11.0 mg/dl with a mean of  $7.4937 \pm 2.051$ mg/dl, also high percent (76.7%) of children were hypocalcemic. Blood electrolytes were also

measured as phosphorous level which ranged from 1.50 –5.60 mg/dl with a mean of  $3.17 \pm 0.8039$  mg/dl. It was observed that 66.7% of studied children had hyponatremia ranging from 102.0 – 192.0 mEq/L with a mean of  $130.80 \pm 14.71$  mEq/L. Finally, all of them had hypercreatinemia; it ranged from 3.60 – 17.0 mg/dl with a mean of  $8.01 \pm 2.74$  mg/dl. All studied children were anemic, blood hemoglobin level ranged from 3.5-11.5g/dl with a mean of  $7.5867 \pm 2.68$  g/dl.

Table (7) illustrates the general appearance of children with CRF. It shows that light, dry

and loss of hair were clearly apparent in studied children (58.6%, 51.7%, and 46.7 % respectively). Concerning pale conjunctiva, it was observed among 69.0% of studied children. Loss of eye shine was also observed among 31.0 % of studied children. Regarding to mouth changes, it was observed that 64.0% of studied children had dry lips while 44% of them had cracked lips and 64% of them had dental caries.

Considering bone condition, backbone curvature abnormalities was reported among 30% of the studied children followed by bowed leg among 20% of them. Moreover, the result shows that 69% of studied children had dry skin while only 6.9% of them had edematous skin. In addition, more than half of the studied children had pale face appearance (58.6%). Finally, muscles weakness reported by 83.3% of them.

**Table (1): Socio demographic characteristics of children with CRF**

Characteristics of children	No (n =30)	%
<b>Age (years)</b>		
6- < 9	10	33.3
9 – 12	20	66.7
<b>Range</b>	6.0 – 12.0	
<b>Mean ± SD</b>	9.19 ± 2.19	

<b>Sex</b>		
Male	14	46.7
Female	16	53.3
<b>Residence</b>		
Urban	14	46.7
Rural	16	53.3
<b>Child education</b>		
Illiterate	8	26.7
1 <sup>st</sup> & 2 <sup>nd</sup> primary grade	6	20.0
3 <sup>rd</sup> & 4 <sup>th</sup> primary grade	7	23.3
5 <sup>th</sup> & 6 <sup>th</sup> primary grade	9	30.0

**Table (2): The duration and frequency of HD among children with CRF.**

<b>The duration and frequency of HD</b>	<b>No (n=30)</b>	<b>%</b>
<b>Duration of hemodialysis</b>		
< 1 year	10	33.3
1-3 years	9	30.0
> 3 years	11	36.7
<b>Frequency of dialysis sessions /wk</b>		
2 times	3	10.0
3 times	22	73.3
> 3 times	5	16.7

Duration of hours per session		
3-4 hours	30	100.0

**Table (3): The 24-hour dietary intake by children with CRF children with CRF**

Dietary intake	Studied children (n=30)		Range	Mean $\pm$ SD
	No	%		
<b>Protein (gm/d)</b>				
▪ Low	26	86.7	15.0 – 49.0	31.78 $\pm$ 8.84
▪ Normal	4	13.3		
<b>Fat(gm/d)</b>				
▪ Low	22	73.3	6.0 – 24.0	18.77 $\pm$ 4.18
▪ Normal	8	26.7		
<b>CHO(gm/d)</b>				
▪ Low	6	20	46.0 – 305	151.43 $\pm$ 65.28
▪ High	24	80		
<b>Energy(kcal/d )</b>				
▪ Low	25	83.3	250 – 1503	787.7 $\pm$ 370.37
▪ Normal				

	5	16.7		
<b>Vitamin A (µg/d)</b>				
▪ Low	28	93.3	8.0 – 524.0	144.57 ± 132.69
▪ Normal	2	6.7		
<b>Vitamin D (µg/d)</b>				
▪ Low	30	100	0.01 – 4.30	1.01 ± 0.91
<b>Vitamin C(mg/d)</b>				
▪ Low	25	93.3	0.20 – 45.0	13.95 ± 13.31
▪ Normal	5	6.7		
<b>Ca(mg/d)</b>	27	90	75.0 – 1181.0	411.80 ± 240.90
▪ Low	3	10		
▪ Normal				
<b>P(mg/d)</b>	19	63.3	267.0 – 1163.0	494.20 ± 201.72
▪ Low	11	26.7		
▪ Normal				
<b>Na(mg/d)</b>				
▪ Low	20	66.7	300 – 1287	562.8 ± 315.54
▪ Normal	10	33.3		
<b>K (mg/d)</b>				
▪ Low	14	46.7	220 – 2950	149.7097 ± 988.56
▪ Normal	5	16.7		
▪ High	11	36.7		
<b>Iron(mg/d)</b>				
▪ Low	25	83.3	1.62 – 8.98	5.42 ± 2.33
▪ Normal	5	16.7		
<b>Zinc(mg/d)</b>	18	60	2.17 – 7.84	4.52 ± 1.46
▪ Low	12	40		
▪ Normal				

**Table (4): Percent distribution of children according to their percent standard of anthropometric measurement for age and sex**

Anthropometric measurements	Total	
	No	%
<b>Body weight percentile</b>		
<90	25	83.3
90-110	5	16.7
>110	0	0
<b>Mean ± SD 22.7± 6.5</b>		
<b>Height percentile</b>		
<90	21	70.0
90-110	9	30.0
>110	0	0.0
<b>Mean ± SD 118.4 ± 14.9</b>		
<b>Body mass index (kg/m<sup>2</sup>)</b>		
Underweight <18.5	22	73.3
Normal 18.5-24.9	8	26.7
Overweight 25.5-29.5	0	0.0

Mean ± SD 15.9 ± 2.1		
Mid arm circumference percentile		
<90	24	80.0
90-110	6	20.0
>110	0	0.0
Mean ± SD 16.8 ± 3.4		
Triceps skin fold thickness percentile		
<80	26	86.7
80-110	4	13.3
>110	0	0.0
Mean ± SD 5.8 ± 2.4		

**Table (5): Distribution of the anthropometric indicators of children with CRF.**

Anthropometric indicators	Total		χ <sup>2</sup> (P)
	No	%	
<b>Height for age</b>			
Normal	9	16.7	1.1 (0.301)
Stunting	21	83.3	
<b>Weight for age</b>			
Normal	5	30.0	0.62 (0.431)
Underweight	25	70.0	
<b>Weight for height</b>			
Normal	9	30.0	- (0.602)
Wasting	21	70.0	

\*P value based on Fisher's exact probability

**Table (6): Laboratory investigations of children with CRF**

Laboratory investigations	Studied children (n=30)		Range	Mean ± SD
	No	%		
<b>Na (mEq/L)</b>				
Low	20	66.7	102.0 – 192.0	130.80 ± 14.71
Normal	9	30.0		
High	1	3.3		
<b>K(mEq/L)</b>				
Normal	12	40.0	3.5-7.5	5.3 ± 1.2
High	18	60.0		
<b>Urea(mg/dl)</b>				
Low	0	0.0	5.0 – 215.0	102.53 ± 54.16
Normal	2	6.7		
High	28	93.3		
<b>Albumin (g/dl)</b>				
Low	19	63.3	2.30 – 4.60	3.42 ± 0.54
Normal	11	36.7		
High	0	0.0		
<b>Blood sugar(mg/dl)</b>				
Low	0	0.0	81.0 – 121.10	121.10 ± 24.28
Normal	14	46.7		
High	16	53.3		
<b>Ca (mg/dl)</b>				
Low	23	76.7	3.10 – 11.0	7.4937 ± 2.051
Normal	7	23.3		
<b>Phosphours(mg/dl)</b>				
Low	25	83.3	1.50 – 5.60	3.17 ± .8039
Normal	5	16.7		
<b>Creatinine(mg/dl)</b>				
High	30	100.0	3.60 – 17.0	8.01 ± 2.74
<b>Hb(g/dl)</b>				
Low	30	100	3.5 – 11.5	7.58676 ± 2.68

**Table (7): General appearance of children with CRF**

General appearance	No	%
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<b>Condition of Hair <sup>a</sup></b>		
light hair	17	58.6
Dry hair	15	51.7
Hair loss	14	46.7
<b>Condition of eyes</b>		
Pale conjunctiva	20	69.0
Loss of eye shine	9	31.0
<b>Condition of Mouth <sup>a</sup></b>		
Dry lips	16	64.0
Cracked lips	11	44.0
Dental caries	15	64.0
<b>Condition of bone <sup>a</sup></b>		
Back bone curvature	9	30.0
Bow leg	6	20.0
<b>Condition of skin <sup>a</sup></b>		
Dry skin	20	69.0
Edematous skin	2	6.9
Pale face	17	58.6
<b>Condition of muscles</b>		
Muscle weakness	25	83.3

<sup>a</sup> more than one response was allowed

**Discussion:**

Chronic renal failure involves irreversible loss of renal function to the extent that the kidneys are unable to meet the metabolic demands of the body<sup>(20)</sup> . Typically, CRF progresses gradually over a period of months

or years and is associated with a variety of complications including water and electrolyte imbalance, metabolic acidosis, and anemia, bone disease, malnutrition and growth failure. The goals of treatment for CRF are to delay the progression of

underlying disease and to minimize the impact of associated complication<sup>(21,22)</sup>

Malnutrition, commonly seen in chronic renal disease, is associated with significant morbidity and mortality. A malnutrition index can be derived by assessing child's feeding habits, anthropometric measurements, clinical parameters and laboratory tests. Therefore, assessment of nutritional status is necessary for early detection and management of malnutrition<sup>(23)</sup>.

In the current study, it was found that slightly more than half of studied children affected by CRF lived in rural area compared to less than half of them who live in urban one (table 1). This finding is supported by World Health Organization (2010) reported that the surroundings can influence the physical health and mental wellbeing through a variety of channels such as unsafe water, pesticide residues in food considered as environmental threats causing disease which alter the growth and development of the child and adverse effects later in the child's life<sup>(24)</sup>. Nutritional assessment and counselling is mandatory in the management of children with CRF and end stage renal disease<sup>(25)</sup>. Concerning the 24-hour dietary intake, the finding of the current study revealed that the majority of children received low amount of protein, fat energy (table 3). This could be due to

dialysis procedure increases catabolism and leads to loss of nutrients into dialysate. This usually continued during maintenance dialysis therapy and leads to development of protein-calorie malnutrition<sup>(25)</sup>. This result contradicting with the finding of Zaki et al (2012) who found 96.7% of Egyptian children undergoing hemodialysis received adequate protein intake exceeding 100 % RDA; while, the protein intake of the rest (3.3%) was below the 100% RDA<sup>(26)</sup>. In spite of, an excessive protein intake should also be avoided in children on dialysis, to prevent metabolic acidosis, hypophosphatemia and the accumulation of toxic nitrogen waste products<sup>(27)</sup>. Goldstein SL et al (2002) suggested that increased caloric and protein intake in addition to optimal dialysis is needed to improve nutritional status (either growth or weight gain) in older children receiving HD<sup>(28)</sup>.

Concerning the dietary intake of calcium, it was found that the majority of children had low calcium intake (table 3). This could be attributed to dislike of milk, meat and vegetables among many children. It is well known that the body can adapt to a certain level of nutrient intake especially calcium and iron by increasing their rate of absorption<sup>(29,30)</sup>. This explains why some of the children suffered from muscle weakness, backbone curvature and bow leg (Table 7). Therefore, it was suggested that evaluation

of malnutrition in children should always include careful history of dietary habits, psychological maladjustment, physical examination and laboratory investigations<sup>(31)</sup>.

Anthropometric measurements are considered important parameters in nutritional assessment. They reflect clearly the nutritional status of children undergoing hemodialysis<sup>(3)</sup>. The current study revealed that children body weight, mid arm circumference and triceps skin fold thickness were below normal among the majority of children below 90 % standard for age and sex (table 4). This is partially in agreement with Zaki et al (2012) who found that height is the most severely affected anthropometric parameter in children with CRF on dialysis while, The body weight is less affected<sup>(26)</sup>. Furthermore, North American Pediatric Renal Transplant Cooperative Study (NAPRTCS) showed that 36.6%, 47.0%, and 43.0% of children with chronic renal insufficiency (CRI), dialysis, and transplantation, respectively, have short stature<sup>(32)</sup>.

Anemia is a frequent finding in hemodialysis even with the use of human erythropoietin<sup>(33)</sup>. Although anemia of CRF may be partially corrected by the initiation of dialysis, dialysis procedure in itself may exacerbate anemia<sup>(34)</sup>. In the present study anemia was detected as evidenced by low

Hb level (Table 6). This could be attributed to inadequate dialysis, blood loss through the dialyzer or due to repeated blood tests. It has been found that protein calorie malnutrition is more common in children with low Hb concentration. It could be aggravated by low dietary intake of iron; the presence of anemia is also aggravated by loss of appetite. This finding is congruent with Azhir A (2009) who concluded that the prevalence of anemia in children on hemodialysis in Isfahan appears to be higher than that reported in the other studies in spite of extensive use of rHuEPO and iron supplementation<sup>(35)</sup>. Meeting the special nutritional needs of these children often requires nutritional supplementation, by either the enteral or the parenteral route. According to Srivaths PR et al (2009) report that intradialytic parenteral nutrition (IDPN) has been utilized as a means to provide additional protein and calories for children receiving maintenance hemodialysis who are malnourished<sup>(36)</sup>.

Fluid overload, urinary and dialysate protein losses may result in hypoalbuminemia during hemodialysis<sup>(37)</sup>. It is obvious in the current study that highest percent studied children had hypoalbuminemia (table 6). It can be explained that serum albumin is not only influenced by nutrition status but also by fluid status and inflammation<sup>(38)</sup>. Wong et al (2002) mentioned that serum albumin

values correlate with risk of dialysis initiation. This risk increases by 54% for every 1 g/dL of serum albumin reduction<sup>(39)</sup>. The kidney plays a central role in regulation of potassium levels in the blood. In CRF, especially when oliguria is present, potassium excretion by kidney is diminished and serum level can increase resulting in hyperkalemia<sup>(40)</sup>. This is in agreement with the present findings to explain that hyperkalemia in more than half of studied children was as a complication of CRF even though their dietary intake of K sources was less than recommended (table 6). Serum Potassium needs to be carefully monitored because hyperkalemia can precipitate cardiac arrhythmias<sup>(41)</sup>.

Regarding physical assessment, it was indicated that dental carries was a common health problem affecting the majority of children (table 7). This could be due to poor dental hygiene and /or caretaker ignorance about the importance of dental care for their children. This finding is contradicting with Abdellatif AM, Hegazy SA, Youssef JM (2011) who found that there was no significant difference in the debris index, while caries in primary and permanent dentitions was significantly less prevalent in the study group compared with the controls<sup>(42)</sup>.

Regarding cutaneous changes, dryness of the skin and pallor are the common problems encountered by children (table 7). It could be

due to low hemoglobin level which is parallel with the findings of Thomson et al (2008)<sup>(43)</sup>.

From the results of the present study, it was highlighted that children undergoing hemodialysis had poor nutritional status as indicated by stunting (83.3%), underweight (70%) and wasting (70%) (table 5).

### **Conclusion:**

Malnutrition is an evident problem in children on hemodialysis. Several factors contribute to the impairment of nutritional status of these children such as loss of appetite and inadequate intake of calories, proteins, fats, vitamins and minerals. Their physical parameters were also greatly affected due to their health condition. The pediatric nurse has a major role in gathering the information and assessing the nutritional status of children with renal failure undergoing hemodialysis.

### **Recommendations:**

The following recommendations can be suggested in the light of the result of the current study:

- The pediatric nurse in renal dialysis unit should perform nutritional assessment to all children on hemodialysis with keeping these records and providing dietary education.
- The pediatric renal dietician is crucial to the successful management of nutrition in children with renal disease to prevent the development of malnutrition.

- Nutritional counseling should be performed based on individualized assessment of children considering the children ages, developmental stage, food preference, activity, cultural beliefs as well as psychological status.

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