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Nutritional Status, Dietary Practices and Biochemical Parameters of Hemodialysis Patients in Riyadh

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Abstract

Background: Malnutrition is an evident problem in 40-50% of patients with end-stage renal disease (ESRD). **Aim:** The aim of the present study was to assess the nutritional status and dietary practices of maintenance hemodialysis patients at Prince Salman Center for Kidney Diseases in Riyadh (PSCKD). **Subjects and methods**: A cross-sectional study was conducted in (PSCKD) for 120 hemodialysis patients who agreed to participate in the study. Malnutrition score was used to quantify the degree of malnutrition. Two parameters from anthropometric and clinical manifestation data were used. Dietary practice score was measured . **Results**: the data showed that 79.2% of cases had normal nutritional status, while only 6.7% had moderate malnutritional status. Only 18.3% of them had good dietary practices while 65% had fair level. In patients with normal nutritional status, the body mass index (BMI) (29.57±10.34 vs. 17.19±1.80), mean weight (70.38±15.98 vs. 48.04±9.66), dry weight (68.537±15.55 vs.46.188±7.93), mean albumin (35.50±3.63 vs. 35.07±4.06) and low density cholesterol (1.94±1.10vs1.25±0.52) were significantly higher than in moderately malnourished patients. In patients with normal nutritional status, the mean body height (154.67±9.47vs. 162.63±9.87), mean urea level (64.16±18.65 vs. 67.14±22.90) and mean creatinine level (750.94±271vs.926.63±358.79) were significantly lower than in moderately malnourished patients. Patient' age, marital status were significant predictors for nutritional status. Patients aged $\geq$ 50 years had 8 times the chance to develop malnutrition compared to those < 50 years. Single patients had 11 times the chance of getting malnutrition compared to married. These differences were statistically significant. (OR=8.213, 11.158, P=0.014, 0.011) respectively. **Conclusion:** Patient and nutrition education must be employed to hemodialysis for recommended dietary needs and for follow up of biochemical parameters.

Key words: Dietary practice, Hemodialysis, Nutritional status.

INTRODUCTION

End-stage renal disease (ESRD) is a major health problem worldwide nowadays. Conventional hemodialysis (HD) is the most widely used modality physiologic treatment.[1] HD will continue to be by far the most widely used treatment for patients with acute renal failure and ESRD.[2] About 300,000 patients in USA with Chronic Kidney Failure (CKF) are of working age, but up to 70% lose their job within the first year of renal

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replacement therapy.[3]

Malnutrition is an evident problem in 40-50% of patients with ESRD. Malnutrition is associated with increased infection; poor wound healing, muscle wasting and increased mortality. It is caused by inadequate dietary intake, anorexia, gastrointestinal disturbances, psychosocial and socioeconomic factors or unmet increased nutritional requirements due to impaired protein or energy and/or concomitant diseases namely cardiovascular diseases, sepsis and inflammation.[4,5]

When dialysis therapy is started, the uremic symptoms are reduced, the diet is less restricted and some patients may show improved nutritional status.[6] However, the results of cross sectional studies throughout the world indicate that maintenance HD patients are still at risk of malnutrition.[5] This could be due to the losses of nutrients into dialysate, chronic blood loss, inflammation and associated diseases.[7]

The aim of the present study was to assess the nutritional status and dietary practices of all patients with chronic renal failure on maintenance hemodialysis attending the Prince Salman Center for Kidney Diseases in Riyadh.

Subjects and methods:

A cross sectional study was conducted for assessment of the nutritional status and dietary practices of patients of end stage renal disease on maintenance hemodialysis.

Study setting:

The present study was carried out in the Prince Salman Center for Kidney Diseases, Riyadh, Saudi Arabia.

Target population: The study was conducted on all adult patients, of both sexes, with chronic renal failure who were treated with maintenance hemodialysis.

Sampling design:

All adult patients with chronic renal failure, who were attending Prince Salman Center for Kidney Diseases at Riyadh, for receiving hemodialysis treatment and accepted to participate in the study were included in the present work. The total sample amounted to

120 patients. Data were collected from every patient and recorded in predesigned interview questionnaire,

The questionnaire included the following items:

1. Personal characteristics:

These included questions about age, sex, marital status and level of education.

2. **Data about renal failure and dialysis**: included questions about:

i- **The cause of renal failure:** this can be diabetic nephropathy, chronic glomerulonephritis, acute and chronic pyelonephritis or any other cause.

ii- **History of associated diseases**: that the patient is suffering now other than renal troubles and not related to the course of the renal failure as for example: cardiac diseases, chest diseases and other.

iii- **Manifestations of renal failure**: as gastrointestinal symptoms like anorexia, nausea, vomiting, abdominal pain, diarrhea and change of taste sensation.

iv- **Time on dialysis**: the duration on dialysis, it is determined in years.

v- **Length of dialysis**: how much time each dialysis session takes, it is determined in hours.

3. **Nutritional History**: Included data about intake of food rich in protein, as well as if the patients get any dietary knowledge.

4. **Dietary practices**: were measured by asking if the patient was following a certain diet and what kind of diet (kidney, diabetes, hypertension and hyperlipidemia). If the patient consumed high protein diet, high calcium diet, high phosphorus diet, high potassium diet and/or high sodium diet.

5. **Anthropometric measurement**: height, weight, BMI, ideal weight and dry weight.

6. **Nutritional needs**: Type of foods; kidney, diabetes, heart, low fat diet, low Biorine, amount of calories needed and amount of protein.

Biochemical analysis: Blood glucose level (random), urea, creatinine, potassium, calcium, phosphorus, sodium, total cholesterol, triglycerides, low density

cholesterol, high density cholesterol, uric acid (millimol/liter (mM/L)) and albumin (gm/liter).

Statistical analysis:

The following analyses were performed:

Malnutrition score: was used to quantify the degree of malnutrition. Two parameters from anthropometric and clinical manifestation data were used. Each parameter was given score ranged from 3-6.

1. Anthropometric parameter: it was BMI, in this parameter a score of (3) was given when the measurement was >90% of normal, score (4) for 80-90%, score (5) for 70-79% and score (6) for <70%.

2. Presence of GIT manifestations, where a score of (3) was given for absence of any GIT manifestations, score (4) for presence of only one manifestation, score (5) for two manifestations and score (6) for more than two manifestations.

The total score of malnutrition ranged from minimum of 6 to maximum of 12, and was divided as follows: normal nutritional status (from score 6-<7), mild malnutrition (7-<9), moderate malnutrition (9-10) and severe malnutrition (> 10).[8 9)]

Dietary practice score: was measured by 48 items regarding dietary practice. Each item scored from 0-4. The total score is calculated by summing up the 48 items. The range of total score ranged from 0-192 and was divided as follows: poor from 0-63, fair from 64-127, while good≥128

RESULTS

Table 1 points out that 75.8% of the patients were females, 54.2% aged <50 years, 50.8% were married and 28.4% were widowed, 56.6% belonged to families with 5-9 members. It is also clear that 60.8% of the patients families' heads had ≤ 9 years of education, 74.2% of the patients had ≤9 years of education, 79.2% were not working, while 13.4% were employee, 65% resided at villa, 96.7% were Saudis.

Table 1: Distribution of the hemodialysis patients according to their Sociodemographic characteristics

Sociodemographic characteristics	No.=120	
	No	%
Sex		
Males	29	24.2
Females	91	75.8
Age		
<50 year	65	54.2
50-+	55	45.8
Marital status		
Single	16	13.3
Married	61	50.8
Widows	34	28.4
Divorced	9	7.5
Family size		
<5 person	20	16.7
5-9	68	56.6
10+	32	26.7
Education of family head		
≤9 years	73	60.8
10-12	30	25.0
>12	17	14.2
Education of patient		
≤9 years	89	74.2
10-12	20	16.6
>12	11	9.2
Work of patient		
Not Working	95	79.2
Student	5	4.1
Employee	16	13.4
Professional	4	3.3
Type of house		
Apartment	42	35.0
Villa	78	65.0
Nationality		
Saudi	116	96.7
Non Saudi	4	3.3
Economic level (Saudi Riyal)		
<3000	55	45.8
3000-	28	23.4
5000-	20	16.6
7000	11	9.2
>10,000	6	5.0

Table 2 demonstrates that 41.7%, 34.2%, 15.8%, 8.3% of the patients' renal failure was caused by hypertension, diabetes, renal inflammation and renal stones respectively. It was also evident that 92.5%, 37.5%, 11.67%, and 7.5% of the patients were following renal diets, diabetes, cardiovascular diseases (CVD) and low fat diet respectively.

Table 2: Distribution of the hemodialysis patients according to the cause of renal failure and type of diets

Variables	No. (120)	%
Causes of renal failure*		
Hypertension	50	41.70
Diabetes	41	34.20
Renal inflammation	19	15.80
Renal stones	10	8.30
Type of diet		
Renal	111	92.50
Diabetes	45	37.50
cardiovascular (CVD)	14	11.67
Low fat diet	9	7.50
Obesity	7	5.83
-low Burien	1	0.83

* Patients had more than one cause, percentage calculated from number in parenthesis.

Table 3 shows that the mean length, weight and dry weight of males (164.05±9.91, 74.01±20.87, 70.79±20.26) were significantly higher than that of female (153.85±8.82, 63.92±14.23, 62.57±14.11), ($p < 0.05$ at 95% C.I.).

Table 3: Distribution of hemodialysis patients according to their sex in relation to mean length, weight and dry weight

factors	Male	Female	t	P
Length (cm)	164.05±9.91	153.85±8.82	5.26	0.000*
Weight (kg)	74.01±20.87	63.92±14.23	2.43	0.020*
Dry weight (??)	70.79±20.26	62.57±14.11	2.44	0.016*
BMI (??)	29.80±17.33	26.73±6.60	0.92	0.367

* Significant P<0.05 at 95% C.I

Table 4 reveals that 27.6% of males had more than 5 years of dialysis compared to 6.6% of females, while 10.3% of males had 6-12 months of dialysis compared to 22.0% of females, the difference was statistically significant (χ^2= 10.34, p<0.05 at 95% CI). It was demonstrated that 79.2% of the hemodialysis patients had normal nutritional status, while 14.1% and 6.7% of them had mild and moderate malnutrition status, respectively. It was also apparent that 80.2% of female patients had normal nutritional status compared to 75.9% of males; this difference was not statistically significant (**table5**).

Table 4: Distribution of hemodialysis patients according to their sex and length of dialysis

Length of dialysis	Male		Female		Total	
	No.	%	No.	%	No.	%
≥ 5 years	8	27.6	6	6.6	14	11.7
1-<5 years	16	55.2	60	65.9	76	63.3
6-12months	3	10.3	20	22.0	23	19.2
<6months	2	6.9	5	5.5	7	5.8
Total	29	100.0	91	100.0	120	100.0

χ^2=10.34, P<0.05 at 95%
* Significant P<0.05

Table 5: Distribution of the hemodialysis patients according to their sex and nutritional status

Malnutrition	Male		Female		Total	
	No.	%	No.	%	No.	%
Normal	22	75.9	73	80.2	95	79.2
Mild	5	17.2	12	13.2	17	14.1
Moderate	2	6.9	6	6.6	8	6.7
Total	29	100.0	91	100.0	120	100

χ^2=0.311, P=0.856>0.05 at 95% C.I.

Table 6 points out that 89.23% of patients aged <50 years had normal nutritional status compared to 67.27% of those aged ≥50 years this difference was statistically significant. Table 7 shows that only 18.3% of the patients had good dietary practice compared to 65% of them had fair dietary practice.

Table 6: Distribution of the hemodialysis patients according to their age and nutritional status

Malnutrition	<50 years		≥ 50 years		Total	
	No.	%	No.	%	No.	%
Normal	58	89.23	37	67.27	95	79.2
Mild	4	6.15	13	23.64	17	14.1
Moderate	3	4.62	5	9.09	8	6.7
Total	65	100.0	55	100.0	120	100

x^2_2=9.137, P=0.010<0.05 at 95% C.I.
* Significant P<0.05

Table7: Distribution of the hemodialysis patients according to their dietary practice

Dietary practice	No.	%
Good	22	18.3
Fair	78	65.0
Poor	20	16.7
Total	**120**	**100.0**

Mean practice score=125.18±14.614 (total range: 0-192)

Table 8 demonstrates that the mean practice score was non-significantly higher among patients getting knowledge about their diseases. It was also evident that the mean nutrition status score was non-significantly lower among patients getting knowledge about their diseases denoting that their nutritional status were better.

Table 8: Distribution of the hemodialysis patients according to whether they get knowledge about their diseases in relation to nutritional status and practice score.

Variables	Getting knowledge			t	Sig
	Yes (No.=116)	No (No.=4)	Total (No.=120)		
	Mean±SD	Mean±SD	Mean±SD		
Practice score	130.50±25.541	125.00±14.247	127±19.341	0.739	0.069
Nutrition status score	6.96±1.175	7.00±0.816	6.98±1.964	0.073	0.474

Table 9 reveals that the mean length and body mass index (BMI) of patients with normal nutritional status were 154.67±9.47 and 29.57±10.34 compared to 162.63±9.87 and 17.19±1.80 among moderately malnourished patients respectively. These differences were statistically significant ($p<0.05$ at 95% C.I). The table also shows that the mean weight and dry weight of patients with normal nutritional status were 70.38±15.98 and 68.54±15.55 compared to 48.04±9.66 and 46.19±7.93 among moderately malnourished patients respectively. These differences were statistically significant ($p<0.05$ at 95% C.I). It was also apparent that recurrent urinary tract infection was higher among mild malnourished patients compared to those having normal nutritional status, this difference was statistically significant. ($p<0.05$ at 95% C.I.)

It was revealed that the mean albumin and urea among patients with normal nutritional status were 35.50±3.63 and 64.16±18.65 compared to 35.07±4.06 and 67.14±22.90 among moderately malnourished patients respectively, these differences were statistically significant ($p<0.05$ at 95% C.I). It

was also pointed out that the mean creatinine level, and low density cholesterol among patients with normal nutritional status were 750.94±271.64 and 1.94±1.10 compared to 926.63±358.79 and 1.25±0.52 among moderately malnourished patients respectively, these differences were statistically significant (p<0.05 at 95% C.I.).

Table 9: Distribution of the hemodialysis patients according to their nutritional status in relation to anthropometric measurements and other factors.

Anthropometric measurements and other factors	Nutritional status				F	Sig
	Normal (No.=95)	Mild Malnutrition (No.=17)	Moderate Malnutrition (No.=8)	Total (No.=120)		
	Mean±SD	Mean±SD	Mean±SD	Mean±SD		
Length (cm)	154.67± 9.47	162.53± 10.30	162.63± 9.87	156.32± 10.06	6.66	0.002*
Body weight (kg)	70.38± 15.98	52.49± 5.57	48.04± 9.66	66.36± 16.56	17.40	0.00*
Dry weight (kg)	68.54± 15.55	50.94± 4.91	46.19± 7.93	64.56± 16.11	18.27	0.000*
body mass index (BMI)	29.57± 10.34	19.59± 1.44	17.19± 1.80	27.47± 10.23	12.26	0.000*
Dietary practices	125.25± 14.43	122.71± 15.72	129.63± 15.22	125.18±1 4.61	0.61	0.545
Interdialytic weight gain (kg)	1.22± 0.70	1.12± 0.78	1.00±0.76	1.19± 0.71	1.355	0.145
Duration of HD	47.06± 22.06	48.41± 22.40	48.50± 23.29	47.35± 22.00	0.038	0.963
Presence of recurrent urinary tract infection	0.073	1	0.75	0.77	3.107	0.048*
The recommended (needed) energy intake	1556.45± 183.46	1564.71± 145.52	1612.50± 155.27	1561.3±1 76.21	0.373	0.690
The recommended (needed) protein	70.62± 9.48	65.65± 9.23	70.00± 15.12	69.88± 9.94	1.830	0.165

* Significant P<0.05

Table 10. The results show that 225.8% of the patients took vitamins, 78.3% of them took iron, 47.8% of them took calcium, and 33.3% of them took antacids. Number of drug/patient= 5.85, Number of vitamins/patient =2.26

Table10: Distribution of the hemodialysis patient according to their biochemical parameters and nutritional status

Biochemical parameters	Nutritional status				F	Sig
	Normal (No.=95)	Mild Malnutrition (No.=17)	Moderate Malnutrition (No.=8)	Total (No.=120)		
	Mean±SD	Mean±SD	Mean±SD	Mean±SD		
Random blood sugar(mM/L)	7.60±3.85	7.87±4.73	8.35±5.90	7.69±4.10	0.141	0.869
Albumin (g/L)	35.50±3.63	35.00±3.20	35.07±4.06	35.09±3.90	0.049	0.000*
Urea (mg/dl)	64.16±18.65	76.41±26.25	67.14±22.90	66.10±20.41	2.681	0.000*
Creatinine (unit)	750.94±271.64	959.24±378.65	926.63±358.79	792.16±302.81	4.507	0.013*
Potassium (unit)	5.25±0.90	5.53±0.69	5.23±0.87	5.29±0.87	0.727	0.485
Calcium (unit)	2.12±0.22	2.05±0.30	2.07±0.40	2.10±0.25	0.574	0.565
Phosphorus (mM/L)	1.59±.78	1.96±1.04	2.30±1.36	1.69±0.88	3.505	0.033*
Sodium (unit)	159±0.78	196±1.04	230±1.36	1.69±0.88	3.505	0.033*
Total cholesterol(mg/dl)	136.32±3.35	136.12±3.60	136.75±2.61	136.32±3.32	0.097	0.907
Triglyceride(mg/dl)	4.03±1.09	3.95±0.98	3.73±0.79	4.00±1.05	0.223	0.222
Low density cholesterol (mg/dl)	1.94±1.10	1.63±0.87	1.25±0.52	1.85±1.06	1.360	0.00*
High density cholesterol(mg/dl)	2.24±0.85	2.04±0.54	1.74±0.42	2.18±0.79	0.040	0.961
Uric acid((mM/L)	1.210±0.8135	1.264±0.8707	1.160±0.2985	1.214±0.7927	0.360	0.70

* Significant P<0.05

The stepwise multiple logistic regression (**Table11**) shows that age of the patients and patients' marital status are significant predictors for nutritional status. Patients aged $\geq$ 50 years had 8 times the chance to develop malnutrition compared to those < 50 years. Single patients had 11 times the chance of getting malnutrition compared to married. These differences were statistically significant. (OR=8.213, 11.158, P=0.014, 0.011 respectively).

Table11: Stepwise multiple logistic regression between nutritional status and different factors of the studied patients

Factors	B	S.E.	df	Sig	Odds Ratio	95% CI of Exp (B)	
						Lower	Upper
1-Age*	2.106	0.854	1	0.014*	8.213	1.541	43.782
2-Sex	0.744	0.906	1	0.412	2.105	0.356	12.438
3-Marital status*			3	0.069			
Single	2.412	0.945	1	0.011*	11.158	1.752	71.076
Divorced & widow	1.542	1.164	1	0.185	4.675	0.477	45.811
Married	0.527	0.907	1	0.561	1.694	0.287	10.012
4-Educational level			4	0.130			
Read& write	1.992	1.237		0.107	7.329	0.649	82.808
Primary	2.133	1.519	1	0.160	8.437	0.430	165.720
Secondary	0.965	1.589	1	0.544	2.625	0.117	59.124
University and above	-0.611	1.436	1	0.670	0.543	0.032	9.059
5-Socioeconomic status			4	0.643			
Low	0.434	1.527	1	0.776	1.543	0.077	30.780
Middle	0.184	1.678	1	0.913	1.202	0.045	32.258
High	1.185	1.637	1	0.469	3.271	0.132	80.938
Very high	1.692	1.725	1	0.327	5.433	0.185	159.733
6-Residency type			3	0.276			
Apartment	-1.719	1.220	1	0.159	0.179	0.016	1.958
Rent villa	-0.998	0.857	1	0.244	0.369	0.069	1.976
Owned villa	-1.425	0.843	1	0.091	0.241	0.046	1.255
7-Physical exercise			3	0.765			
≤2 times/week	0.277	1.082	1	0.798	1.320	0.158	10.998
3 times/week	0.992	1.187	1	0.404	2.696	0.263	27.631
Daily	-19.883	15,242.135	1	0.999	0.000	0.000	
8-Duration of hemodialysis	-0.001	0.007	1	0.836	0.999	0.986	1.012
9-Interdialytic weight gain	-0.100	0.824	1	0.904	0.905	0.180	4.548
Constant	-4.804	2.015	1	0.017	0.008		

The dependent variable: total nutritional status, reference category: for Age: <50, marital status: married, sex: Women, educational: university, socioeconomic: low, residency: apartment, physical exercise: daily, duration of dialysis: 6 months, interdialytic weight gain: <2kgm
* Significant P<0.05

DISCUSSION

Malnutrition is one of the major problems with high prevalence in those with end-stage renal disease (ESRD) who are receiving maintenance HD or peritoneal dialysis therapy.[10-12] According to the malnutrition score, patients are categorized into three grades. Patients with normal nutritional status were about four fifths of the sample (79.2%). This result is in agreement with that of Desbrow et al., (2005) where 80% of the

patients were well nourished.[13] On the other hand, it is much higher than that found in Jordon (38.5%)[14]and in Egypt 2001(10.4%).[15] In the current work, 14.1% of patients suffered from mild malnutrition, which is less than that found in the Egyptian study 2001 (22.9%).[15] While patients with moderate malnutrition, in the present study, were 6.7% which is much lower than that found in the Egyptian study in 2001 (35.4%). [15] Desbrow et al., (2005) found that 20% of the patients were malnourished.[13] On the other hand, Tayem et al., (2008) found that approximately 62% of the participants were malnourished.[14] Basaleem et al., (2004) observed that 70% and 20% of the studied patients were moderately or severely malnourished respectively.[16] Holley and Kirk, (2003) pointed out that 50% of maintenance hemodialysis patients were malnourished and severe malnutrition affected only 6-8 %.[17] Also Duma et al., (2008) demonstrated that 56% of their studied patients were malnourished.[18]

The adequate nutrients intake could be attributed to nutrition supervision and counseling, is an important factor, as in the present study, 66.7% of the patients stated that they are following dietary regimen. In addition to the importance of dietary knowledge, 96.7% of the patients mentioned that they have got dietary knowledge. On the other hand, Basaleem et al., (2004) found that only 14% of the studied patients got satisfactory level of knowledge and 58% of them did not follow clear dietary instructions and there was evident poor intake of high dietary protein.[16]

The present study revealed that mean length, weight, dry (post dialysis) weight of males were significantly higher than females, table 3. This result coincides with that of Basaleem et al., (2004).[16] In the current study, the mean length among patients with normal nutritional status was significantly lower than in moderately malnourished patients. This result is in agreement with that of Basaleem et al., (2004).[16] The results of the present study points out that urea and

creatinine levels were significantly higher among moderately malnourished patients than that among patients with normal nutritional status. The same results were revealed in Basaleem et al. study, (2004).[16]

The results of cross sectional studies indicated that patients on maintenance HD are at risk of malnutrition,[19,20] that is why identification of factors associated with more risk of malnutrition in HD patients are of great importance as they were the predictors of malnutrition in those patients.[21] the most common factors that have been associated with malnutrition in HD are old age.[18,20,22,23]

The present study shows that 32.73% of patients aged ≥50 years had mild and moderate malnutrition which was significantly higher than those aged <50 years (10.77%). Moreover, age was the first predictor of malnutrition in stepwise multiple regression analysis and patients aged ≥50 years were 8 times more liable to malnutrition than patients <50 years. Similarly, the results of Basaleem et al., (2004) study showed that the risk of moderate/severe malnutrition was four times significantly higher among those aged >50 than their younger counterparts.[16] Other studies revealed that duration of dialysis was significantly correlated with malnutrition score[24] and it was one of its predictors. [15, 24] Similarly, in the present study mean duration of hemodialysis increased with malnutrition but not to a significant level.

The present study pointed out that interdialytic weight gain (IDWG) decreased with malnutrition but not to a significant level. On the other hand, other study done in Egypt showed that IDWG (> 2 kg) showed about seven times significant higher risk of malnutrition.[15] Also in Basaleem study, stepwise multiple regression analysis showed that IDWG was the only associating factor with moderate/ severe malnutrition, as those with (> 2 kg) Interdialytic weight gain were 20 times more likely to be moderately/ severely malnourished.[16] Body mass index has been used in the present study in the malnutrition score. Its significant relation to malnutrition

grades has been detected. Means of anthropometric measurements (weight, dry weight, BMI) in the present study were lowest in moderately malnourished patients, and significantly different from means in the other groups (Table 9). Same results were found in a study done in Egypt, 2001.[15]

Hypoalbuminemia is another problem correlated with malnutrition. It is also a major risk factor for morbidity and mortality in dialysis patients.[25] In the present study, serum albumin showed statistically significant difference between the three groups of nutritional status, with the highest mean observed among patients with normal nutritional status, which was significantly slightly different from moderately malnourished patients. Many studies detected low serum albumin level associated with malnutrition in HD patients, and it was proportional to the degree of malnutrition.[15, 24,26] Although, low mean serum albumin (37±4.5g/l) and low BMI (24.4±5.3) were found to be independent predictors of mortality among HD patients in USA according United State renal data system. [27]

Abnormalities in lipid metabolism are documented in patients with chronic renal failure and patients on dialysis, [28] where high levels of cholesterol (> 250 mg/dl) have been associated with an increased risk of death among HD patients. Therefore, patients with elevated blood cholesterol may benefit from lipid-modifying interventions.[29] Both cholesterol and triglycerides levels can be higher in HD patients than healthy people,[30] however; if those patients were malnourished cholesterol level is more likely to be decreased than normal and in proportion to malnutrition grades. [31] In the present study, the mean low density cholesterol level was low among patient with different grades of malnutrition. On the other hand, the mean of total cholesterol was non-significantly higher among malnourished than well-nourished patients. These are in agreement with the results of a study done in Egypt.[15] Hyperlipidemia is frequently present in chronic HD patients and

it is contributing to the presence of cardiovascular diseases (CVD) commonly seen in these patients. [32] However hypertension may be an equally important contributing factor. [32,33] This is in agreement with the results of the present study, where hypertension was mentioned as the most common cause of renal failure, and 11.7% of the patients were on CVD diet (Table 2).

Patients on dialysis reduce their energy intake, with significant increase in carbohydrate fraction and decrease in protein and fat fractions, which will also place those patients in the risk zone for developing malnutrition.[34] In the present study the recommended energy requirements was non-significantly higher among malnourished patients than normally nourished patients. On the other hand, the recommended protein requirements were non-significantly lower among malnourished patients than normally nourished patients. Reduction of protein intake in patients with chronic renal failure found to correct uremic symptoms, slow rate of progression of renal failure and make these patients more favorable for treatment with HD or transplantation as their nutritional status being preserved.[35]

The reduction or increase of micronutrients intake and blood levels found in the present study can be related to certain health problems. The increased sodium intake increases the risk of hypertension and cardiovascular diseases. [36] In the present study 50.8%-90.8% of the patients did not use certain food containing sodium. However, the sodium level was significantly higher among moderately malnourished patients (Table 10). The potassium level was non-significantly lower among moderately malnourished than normally nourished patients (Table 10). The importance of decreased potassium intake is to minimize the risk of metabolic acidosis. [37] In the present study 18.3%-93.3% of the patients did not use certain food containing potassium. Calcium level was non-significantly lower among moderately malnourished patients. 18.5-82.5% of them did not intake

certain food containing calcium. Together with significantly high phosphorus level among moderately malnourished patients, this denotes abnormal calcium-phosphate ratio, 12.5%-80.8% didn't use certain food containing phosphorus. On the other hand, this could explain the prescription of antacids to patients on HD, in order to reduce serum phosphate, as 33.3% of patients in the present study stated that they take antacids. The results of the current study showed that 225. 8% of patients took vitamins, 78.3% of them took iron and 47.8% took calcium. In contrast, 76% and 60% of patients in the Basaleem study were not supplemented with either iron or calcium and about two thirds had antacid, whereas 58% did not take vitamin supplement.[16]

CONCLUSION AND RECOMMENDATION

The majority of cases (79.2%) had normal nutritional status, while only 6.7% of them had moderate malnutritional status. Only 18.3% of them had good dietary practices while 65% of them had fair level. In patients with normal nutritional status, BMI, mean weight, dry weight, mean albumin and low density cholesterol were significantly higher among patients with normal nutritional status than in moderately malnourished patients. In patients with normal nutritional status, the mean length, urea and mean creatinine levels were significantly lower than in moderately malnourished patients. Age of the patients and patients' marital status were significant predictors for nutritional status. Patients aged $\geq$ 50 years had 8 times the chance to develop malnutrition compared to those < 50 years. Single patients had 11 times the chance of getting malnutrition compared to married.

Patient and nutrition education must be employed to hemodialysis for recommended dietary needs and for follow up of biochemical parameters.

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