Assessment of Nutritional Status of Chronic Renal Failure Patients on Hemodialysis in Damanhour National Medical Institute in El-Beheira Governorate, Egypt

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Abstract

Background: Nutritional problems are of the most important risk factors of increasing mortality rates in chronic renal failure patients on hemodialysis and morbidity occurring from malnutrition significantly severely affects their quality of life. **Aim:** To assess the nutritional status of chronic renal failure patients on hemodialysis (HD) attending HD unit in Damanhur National Medical Institute.

Methods: A cross-sectional study was carried out in the hemodialysis unit on 174 patients. Data collection was done via a specially designed questionnaire containing; socio-demographic and clinical data, anthropometric measurements, biochemical measurements, 24-hour recall list and questions for assessment of nutritional knowledge. Malnutrition inflammation score (MIS) was used for assessment of the nutritional status.

Results: 65.5% of the patients were mildly malnourished, 24.7% were moderately malnourished and only 9.8% were normal and the level of malnutrition was significantly affected by duration of renal disease and hemodialysis duration. 44.3 % of patients had poor nutritional knowledge level, and only 4% had good nutritional knowledge and the nutritional knowledge level had a significant association with level of malnutrition. 96% did not attend any nutritional health education sessions, but they were willing to attend these sessions.

Conclusions: Malnutrition was highly prevalent among the studied patients. There was a statistically significant relationship between levels of malnutrition (MN) and the level of nutritional knowledge of hemodialysis patients.

Keywords: Nutritional status, Hemodialysis, MIS score, Chronic Renal Failure

1. INTRODUCTION:

Chronic kidney disease is an irreversible deterioration in kidney function for three months that can cause death if dialysis or transplantation is not used quickly.(1) The most common reasons for chronic kidney disease (CKD) are diabetic nephropathy, hypertension, glomerulonephritis, interstitial nephritis, pyelonephritis, polycystic kidney disease, and obstructive nephropathy. (2) With time, the prevalence rate of ESRD increases in most countries as Japan, the USA, and the European Union. (3) Africa is three to four times more than developed countries in the incidence rate of CKD unlike the relatively lower prevalence rate, which indicates the shortage in the medical capabilities. (4) In Egypt, the annual increase of ESRD cases is around 74 per million and the total number of patients on dialysis is 483 per million in the last renal registry done in 2008.(5)

Dialysis may affect the nutritional status of hemodialysis (HD) patients. It can cause loss of protein and soluble vitamins and also loss of appetite. [6] Nutritional problems that occur in stage 5 CKD patients who receive hemodialysis can be protein-energy wasting (PEW), obesity, and others. [7] Nutritional problems are of the most important risk factors of death in chronic renal failure patients on hemodialysis and can impair quality of life. [8] The magnitude of malnutrition in hemodialysis patients increases both internationally and nationally according to the different studies done in most countries. For example, in a study done in India 2017 on 100 HD patients, 30% of them were malnourished.[9] A cross-sectional study was done in Palestine in 2019 on 174 HD patients showed that nearly 65% of patients were malnourished.[10]

A study in Alexandria/ Egypt was applied to 160 HD patients in 2013 showed that 86.3% of patients had mild to moderate malnutrition.[11] Another study done in Cairo 2019 on 100 HD patients showed that 50% of patients had mild to moderate malnutrition and 17% had severe malnutrition and the remaining number of patients was well-nourished.[12] The nutritional status of a person can be measured by anthropometric measurements, biochemical measures, clinical examination, demographic factors, and environmental and social factors assessment.[13]

The most accurate method of assessment is anthropometric measures that include body mass index, waist circumference, skinfold thickness, and arm circumference. All these points except waist circumference are included in Malnutrition Inflammation Score (MIS). MIS includes all points of the Subjective Global Assessment Score added to 3 additional points that are Body Mass Index (BMI), Total Iron Binding Capacity (TIBC), and Serum Albumin level. Most studies that were done for assessment of the nutritional status of HD patients use subjective global assessment (SGA) score or MIS score or only some points of them. Other studies use 24-hour recall only. The third group of studies depends on the assessment of patients' knowledge. [14]

In El- Beheira Governorate, the presence of hemodialysis unit in Damanhour National Medical Institute including 204 HD patients of different ages provoked this study. Therefore, the objective of this study was to carry out a cross sectional to assess the nutritional status of chronic renal failure patients on hemodialysis (HD) attending HD unit in Damanhur National Medical Institute and to assess the knowledge of chronic renal failure patients on HD regarding healthy diet suitable to their medical condition.

2. SUBJECTS AND METHODS:

A cross sectional study was carried out in the hemodialysis unit in Damanhour National Medical Institute/ El- Beheira Governorate on all chronic patients attended to the unit who met the inclusion criteria that were patients aged 18 years old or more and the history of at least three months of hemodialysis. The number of these patients was 174.

Questionnaire sheet consisted of three parts: [15] questions about socioeconomic information of the participant, questions to assess the medical status, hemodialysis and nutritional assessment of the patient that was done using two types of measurements: Anthropometric measurements and Biochemical measurements. Malnutrition Inflammation score (MIS) was used to assess the nutritional status of all chronic patients. It consists of 10 points that are change in body weight (overall change in the past 3–6 months), dietary intake, gastrointestinal symptoms, functional capacity, comorbidity, loss of subcutaneous fat, signs of muscle wasting, BMI, serum albumin and TIBC. [16]

24 hour recall score: was done for each patient by asking him/her about what he/she ate in the last 24 hours and classify his/her meals under the six food groups. The amount of fluids and dietary supplementation were also asked about. [17] Questionnaire for assessment of patient nutritional knowledge: that included nine questions that are the meaning of over-nutrition, under-nutrition, malnutrition, the effect of malnutrition on their health, the best sources of protein, the maximum amount of fluids permitted to him/her, foods rich in potassium and phosphorus and If he/she adhered to the doctors' instructions or not? Additional seven questions were added which were changes that should be done in the level of protein, salts, and fluids to suit the patient's health condition, doctor's nutritional advice to him, the source of their knowledge, and attendance of health education sessions and where? Finally the patient was asked about his/her desire to attend health education sessions. [15]

Data were collected via interview questionnaire sheet. The average time spent for filling the questionnaire from each patient ranged between 15-25 minutes. Data were collected in three shifts. Data collection needed nearly 4 times attendance in each shift. The collected data were organized, tabulated and statistically analyzed using SPSS. Qualitative data were represented as frequencies and relative percentages. Chi square test, Fisher exact and Monte Carlo tests were used to calculate difference between qualitative variables as indicated. Quantitative data were expressed as mean ± SD (Standard deviation). Sprearman Rank correlation between variables was evaluated using Spearman Rank correlation coefficient (rs). Significance was adopted at $P<0.05$ for interpretation of results of tests of significance. [15]

3. RESULTS:

The mean age was 51.19 years, 57.5% of patients were males, 67.2% were married, 46% were illiterate, and 68.4% were not working, 48.9% rural, 76.4% had no enough income, and 69% had a family size 4 and more members.

The mean time of renal disease was 6.9 years, 57.5% of cases were dialyzed for >4 years, 60.9% had hypertension, 24.1% had no comorbid diseases, 18.4% had diabetes mellitus and 15.5% had cardiovascular diseases. Only 12.1% were smokers, 36.2% suffered from gastrointestinal symptoms. The most common cause of ESRD in 36.8% of cases was hypertension. 73% of cases had no edema below the eye and 25.3% of patients had lower limb edema.

The functional capacity of the studied cases was assessed by Karnofsky scale which highlighted that 47.1% of patients had mild deterioration of the functional capacity. The mean score of functional capacity scale was 6.66. The mean height of cases was 1.65 meters, 37.9% had normal BMI. The mean triceps skin fold thickness was 17.68 mm, The mean mid-upper arm circumference was 27.48 cm. The weight of 84.5% of cases changed <0.5 kg in the last 3 months. The mean serum albumin of the cases was 3.88gm/ dl. The mean total iron-binding capacity of cases was 240.97 µg /dl.

Near to half of the patients had sufficient food intake and the majority of them were receiving supplementation.

Half of the patients had fair nutritional knowledge level as assessed by the questionnaire showed in **Table (1)**. More than half of the patients depended on the doctors as a source of information and received nutritional

advice from them, but they did not adhere to this advice. Most of the patients did not attend any nutritional health education sessions but more than half of them reported that they like to attend these sessions.

Two thirds of the patients were mildly malnourished as assessed by MIS score, one fourth of the patients were moderately malnourished and only 9.8% were normal. There was a significant relationship between level of malnutrition and duration of kidney disease, hemodialysis duration, vomiting, calcium intake, level of nutritional knowledge and functional capacity ($P<0.05$) but other parameters were not significantly related to the level of malnutrition as shown in **Tables (2, 3)**.

The level of nutritional knowledge was significantly related to educational level, occupation, income, folic acid intake, dietary intake, and health education session attendance ($P<0.05$) but other parameters were not significantly related to the level of nutritional knowledge as shown in **Tables (4, 5).**

4. DISSCUSSION:

Prevalence of malnutrition in hemodialysis patients:

The prevalence of malnutrition in this study was high. The prevalence was higher than some studies like a study in USA in 2004 which revealed that 53.3% of patients were malnourished. [(18)] In Brazil (2008), a study was applied on 44 HD patients, 22.6% were malnourished. [(19)] This result, as well, were higher than the result of some other Egyptian studies as that was done in Assiut (2015) and revealed that 81.6% were moderately malnourished and 3.6% were severely malnourished [(20)] and another study in Alexandria in 2014 which showed that 86.3% of patients had mild to moderate malnutrition. [(21)]

Effects of socio-demographic and clinical properties on malnutrition:

In this study, the mean age was similar to the mean of age in a study in El-Harem Centre for Dialysis / Egypt 2010 that was 51.7 years. [(22)] In the current study, prevalence of malnutrition was greater in elderly patients than in younger age groups. Out of them, 96.4% had malnutrition. This may be attributed to many other factors rather than ESRD as increase muscle catabolism, loss of fat mass, low functional capacity, and poor physical activity. [(23)] There was no significant relationship between malnutrition and both education and occupation of HD patients. This result was inconsistent with the **Hinar et. al. study (2018)** [(24)] which revealed that there was a significant correlation between malnutrition assessed by SGA and both education and occupation. The present study comes in agreement with **Hinar et. al. study (2018)** which showed that no significant relationship was found between malnutrition score and both income and family size of the participants. [(24)] No significant relationship was found between MIS score and gender or residence of the participants in the present study. This result is supported by the result of a study done by **Huda et. al., 2004**. [(25)]

This study showed that there was a significant relationship between malnutrition and the duration of kidney disease. This result is supported by a study by **Freitas et. al.** which found a strong relationship between long hemodialysis period and poor nutritional status, this is because hemodialysis is a high catabolic process that causes a considerable loss of essential nutrients. [(26)] The prevalence of hypertension in this study was 60.9% of patients and it was the commonest comorbid disease found in this study (18.4%). This result was in a line with **Ibrahim et al.** study (2010) [(22)] which showed that 90% of patients were hypertensive. These results are corresponding with other

studies that revealed that the most common risk factors of renal failure are diabetes mellitus and hypertension that together account for approximately 69% of the new cases. [27]

This study did not find a significant relationship between the presence of comorbid diseases and the nutritional status of hemodialysis patients. This result comes in agreement with **Ana et. al.** study which showed that comorbidities were not associated with malnutrition. [28] Vomiting was the only gastrointestinal symptom, which had a significant relationship with malnutrition of the studied patients. This result is inconsistent with **Dinorah et. al.** study which showed that vomiting had no significant relation with the level of malnutrition. [29] In this study, a strong negative relationship was found between functional capacity and nutritional status of the patients. This result comes in agreement with **Khalid, et. al.** study which found that there was a strong correlation between deterioration of functional ability and severe malnutrition, [30] No significant relationship was found between the cause of ESRD and nutritional status.

Effects of different anthropometric and laboratory measurements on malnutrition:

The current study showed that malnutrition was significantly related to the BMI of HD patients. This result was inconsistent with **Huda et. al. study (2004)** [25] which found no significant relationship between the level of MN and BMI. However, this finding comes in agreement with **Chan& Lina** who found a strong relationship between them. [31] This may be attributed to that BMI is a point of MIS score and any decrease in BMI cause increase in the score of this point lead to increase in the total MIS score and increase the level of MN. Triceps skinfold was found to be significantly related to the level of MN. This result is supported by **Yigit et. al. study (2016)** which showed that there was a negative significant correlation between them. [32] In the current study, there was a significant relationship between the level of malnutrition and mid-upper arm circumference which was in agreement with **Huda et. al. study (2004)** [25] and **Agboton et al. (2017)**. [33] There was a negative significant relationship between malnutrition and serum albumin. This result corresponds to **Dai et. al., 2017**, **Chan& Lina, 2019** studies that also revealed a significant correlation between them [31, 34] but it is inconsistent with **Hinar et. al.** study (2018) which showed the opposite. [24] This may be explained by lower amount of protein intake, decrease the level of albumin synthesis, or presence of inflammation among this population. In the current study, a significant negative relationship was found between the malnutrition and TIBC. This result is consistent with **Yigit I. P. study (2016)** [32] which showed a significant correlation between TIBC and SGA score. This may be attributed to low levels of TIBC being associated with anemia due to red blood cell destruction and low levels of protein caused by dialysis and renal impairment.

Effect of dietary & supplementary intake on malnutrition:

Malnutrition and food intake assessed by the 24-hour recall was not found to be significantly related. This result disagrees **Neelesh et. al. study (2017) in India** [35] which showed that under-nutrition increases with decreasing energy intake that in turn positively related to hemodialysis duration. The current study showed that calcium intake was significantly related to MIS score. This result is inconsistent with **Chan & Lina. study (2019)** [31] that showed no correlation between them.

Effect of nutritional knowledge on malnutrition in hemodialysis patients:

There was a significant relationship between the level of malnutrition and the level of nutritional knowledge of the patients. This result comes in agreement with **Maryam**'**s** study (2014) which revealed that higher scores of SGA related to a low level of nutritional knowledge of hemodialysis patients. Patients with a higher knowledge level can help themselves, even partially, to keep their nutritional status by taking a variety of suitable healthy food stuffs. [36]

Total nutritional knowledge score in the studied hemodialysis patients:

The mean of total nutritional knowledge score in the current study was 3.45 out of 13. This result was lower than **Souzan's** study (2020) [37] in which the mean score was 5.7 ±1.6 out of 10. Approximately half of the participants in the present study had fair knowledge. This result is lower than **Gangadhar et al. study (2017)** [35] in India in which 66.6% of the participants had average knowledge level.

Effect of socio-demographic properties on nutritional knowledge of HD patients:

The current study revealed that nutritional knowledge was significantly related to the level of education. This result was supported by **Spies et. al. study (2020)** [39] This may be due to depending of some patients on studying as a main source of their nutritional information. [37] The knowledge was also significantly associated with occupation, this comes in line with **Maria**'**s** study (2017) [40] which showed that job was significantly related to knowledge level. In contrast, **Rotich**'**s** study (2019) [41] reported that there was no significant correlation between level of nutritional knowledge and both occupation and income of the participants that disagrees with the result of the current study. Residence and gender were not found to be significantly related to knowledge level in the present study. This result comes in line with **Souzan et. al. study (2020)** in Palestine which revealed that no significant correlation between level of nutritional knowledge of HD patients and gender or residence of the participants. [37]

Nutritional knowledge about sources of some macronutrients and micronutrients:

Generally, the current study revealed that HD patients had in-adequate information about sources of some macronutrients like protein, potassium and phosphorus. This result comes in line with **Souzan et. al.** study (2020) in Palestine which supported this result. [37] In-sufficient control on phosphate intake may lead to undesired side effects in hemodialysis patients like osteodystrophy and hyperparathyroidism, 85.1% of the participants in the current study reported only 0-2 true sources of potassium. This was higher than **Souzan et al. study (2020)** [37] in which only 37.4% of the participants knew that potassium intake should be limited in their diet. Rapid changes in serum potassium level may cause cardiac arrhythmia and death in HD patients. 63.8% knew more than 2 of the best sources of protein. This finding was higher than **Souzan**'**s study (2020)** which revealed that 34% of participants reported that quality of animal sources of protein is better than plant sources. [37]

Effect of nutritional knowledge on patients' **adherence to dietary instructions:**

In the present study, 78.7% of patients did not adhere to any nutritional advice. This was in agreement with a study done in Egypt on hemodialysis patients in the dialysis unit at Al-Gamhouria Teaching Hospital (2004) which showed that 58% of the studied patients were also not following dietary instructions. This may be attributed to that most of the studied patients did not previously attend any health education sessions and large percentage of them did not receive nutritional advice from their doctors. [42]

Sources of nutritional knowledge in hemodialysis patients:

In the current study, doctors' advice was the main source of information for the participants (55.7%) followed by family and friends (20.1%) but **Rose et. al. study (2019)** [43] showed that nutritionist was the most important source of information (90.3%) So, nutritional counseling is very important for both the patients and their families.

Effect of health education sessions attendance on nutritional knowledge of HD patients:

Patients who attended nutritional health education sessions (4%) had significantly higher scores of knowledge than those who did not attend these sessions. This result comes in agreement with **Spies et. al. study (2020)** [39] which revealed that receiving nutrition education was significantly related to higher knowledge scores. This lower percentage of nutrition educational sessions` attendance may be due to unavailability of nutritionist in the hemodialysis unit in Damanhour National Medical Institute.

5. CONCLUSIONS

Malnutrition was highly prevalent (90.2%) among the studied patients. There was a statistically significant relationship between malnutrition and the level of nutritional knowledge of hemodialysis patients.

6. RECOMMENDATIONS

Regular assessment of the nutritional status of hemodialysis patients every six months and health education of these patients about their dietary needs are very important. Continuous availability of nutritionist in HD units and providing of well-prepared updated dietary training programs suitable for these patients are necessary. Patients should be given the necessary dietary supplementations regularly to avoid malnutrition.

7. STRENGTHS AND LIMITATIONS:

This study was one of the first studies to detect MN among HD patients in El-Behaira governorate using an inexpensive nutritional assessment known as the MIS score and also it depended on more than one tool to reach the most reliable results. However, this study has some limitations; for example, the fact that a cross-sectional design was used limits the ability to make causal inferences between study variables. Moreover, as participants were only recruited from one HD unit by convenience sampling, the findings cannot be generalized to all patients with HD in El-Behaira governorate. Selection bias also cannot be entirely dismissed as participation in the study was voluntary. Another limitation was that the MIS is considered as a subjective tool for the evaluation of nutritional status, therefore it mainly relies on the assessment and clinical judgment of each examiner. Also, 24 hour recall depends on the memory of the patient. Lastly, there were some clinical factors that might affect patients' nutritional status and potential weaknesses of the study that we didn't include in our study, such as the presence of residual renal function or total weekly dialysis time.

8. CONSENT

Informed consent was taken from each participant in the study. Approval from Ethical Committee of Tanta Faculty of Medicine was obtained before starting the study.

9. ETHICAL APPROVAL

The study was approved by ethical committee with a code 19/05/ 33126.

10. COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Table (1): Questionnaire for assessment of patients' nutritional knowledge

Nutritional knowledge sub items	Response of the studied patients (n=174)			
	Incorrect		Correct	
	n	%	n	%
Meaning of over nutrition	75	43.1	99	56.9
Meaning of under nutrition	71	40.8	103	59.2
Meaning of malnutrition	85	48.9	89	51.1
Effect of malnutrition on your health	53	30.5	121	69.5
The maximum amount of fluids allowed	169	97.1	5	2.9
The suitable changes in protein amount	78	44.8	96	55.2
The suitable changes in salts amount	84	48.3	90	51.7
The suitable changes in fluids amount	50	28.7	124	71.3
Nutritional knowledge	<3 true answers		≥3 true answers	
	n	%	n	%
The best sources of protein	63	36.2	111	63.8
Potassium rich foods	148	85.1	26	14.9
Phosphorus rich foods	165	94.8	9	5.2
Nutritional practice items	No		Yes	
Received nutritional advice from their doctors	71	40.8	103	59.2
Adhered to doctor advice	137	78.7	37	21.3
Attended nutritional health education sessions	167	96.0	7	4.0
Like to attend nutritional health education sessions	68	39.1	106	60.9

List of abbreviations:

n: Number of patients <: Less than ≥: More than or equal to

Table (2): Relationship between levels of malnutrition that was assessed by malnutrition inflammation score (MIS) and clinical data of the hemodialysis patients

Clinical data	Levels of malnutrition of the studied patients (n=174)								χ^2	P
	Normal (n = 17)		Mild malnutrition (n = 114)		Moderate malnutrition (n = 43)		Total			
	n	%	n	%	n	%	n	%		
Duration of kidney disease (years)										
0.58-< 1	0	0.0	2	100.0	0	0.0	2	1.2	11.778*	0.012*
1 – 4	10	17.5	40	70.2	7	12.3	57	32.8		
> 4- 27	7	6.1	72	62.6	36	31.3	115	66.1		
Duration of hemodialysis (years)										
0.33-<1	0	0.0	6	100.0	0	0.0	6	3.5	12.044*	0.012*
1 – 4	11	16.2	47	69.1	10	14.7	68	39.1		
> 4- 22	6	6.0	61	61.0	33	33.3	100	57.5		
Comorbidities										
Diabetes mellitus	2	6.3	20	62.5	10	31.3	32	18.4	1.120	0.568
Hypertension	11	10.4	67	63.2	28	26.4	106	60.9	0.641	0.726
Cardiovascular diseases	1	3.7	15	55.6	11	40.7	27	15.5	5.010	0.082
Hepatitis	0	0.0	6	75.0	2	25.0	8	4.6	0.395	1.000
Others	2	14.3	10	71.4	2	14.3	14	8.1	1.218	0.521
Smoking										
Non smoker	14	9.2	98	64.1	41	26.8	153	87.9	3.143	0.208
Smoker	3	14.3	16	76.2	2	9.5	21	12.1		
If smoker (n=21)										
	(n = 3)		*(n = 16)*		*(n = 2)*					
Cigarettes	*2*	*11.1*	*14*	*77.8*	*2*	*11.1*	18	85.7	*1.618*	*0.581*
Others	*1*	*33.3*	*2*	*66.7*	*0*	*0.0*	3	14.2		
Gastrointestinal symptoms										
Anorexia	2	4.5	30	68.2	12	27.3	44	25.3	1.865	0.393
Vomiting	0	0.0	12	44.4	15	55.6	27	15.5	17.591	0.001*
Diarrhea	0	0.0	7	53.8	6	46.2	13	7.5	3.481	0.151
Functional capacity										
1-3	0	0.0	6	40.0	9	60.0	15	8.6	33.097	0.001*
4-6	2	3.3	37	61.7	21	35.0	60	34.5		
7-9	8	9.8	61	74.4	13	15.9	82	47.1		
10	7	41.2	10	58.8	0	0.0	17	9.8		
Cause of ESRD										
Diabetes mellitus	0	0.0	10	62.5	6	37.5	16	9.2	2.493	0.271
Hypertension	6	9.4	41	64.1	17	26.6	64	36.8	0.189	0.910
Kidney stone	1	5.6	11	61.1	6	33.3	18	10.3	0.914	0.681
Congenital abnormality	1	6.3	13	81.3	2	12.5	16	9.2	1.549	0.475
Urinary tract infection	0	0.0	7	100.0	0	0.0	7	4.0	2.712	0.250
Drug /toxin	3	15.8	12	63.2	4	21.1	19	10.9	1.152	0.602
Immune /collagen	2	22.2	6	66.7	1	11.1	9	5.2	2.265	0.295

Others	3	13.6	14	63.6	5	22.7	22	12.6	0.439	0.803

List of abbreviations:

n: Number of patients <: Less than >: More than ESRD: End stage renal disease

x^2: Chi-square P: Test of significance *: Significant value

Table (3): Relationship between level of malnutrition that was assessed by malnutrition inflammation score and both 24 hour recall & supplementary intake and level of nutritional knowledge

Variable	Levels of malnutrition of the studied patients (n=174)						χ^2	P
	Normal (n = 17)		Mild malnutrition (n = 114)		Moderate malnutrition (n = 43)			
	n	%	n	%	n	%		
24 hour recall								
Sufficient (5-6)	13	16.3	52	65.0	15	18.8	8.405	0.075
Insufficient (3-4)	4	5.2	51	66.2	22	28.6		
Poor (1-2)	0	0.0	11	64.7	6	35.3		
Supplementary intake								
Calcium	10	13.7	39	53.4	24	32.9	8.185*	0.017*
Vitamin B12	13	10.7	82	67.2	27	22.1	1.608	0.448
Folic acid	1	12.5	6	75.0	1	12.5	0.818	0.738
Others	5	21.7	15	65.2	3	13.0	5.347	0.069
Level of nutritional knowledge								
Poor (0-3)	3	3.9	49	63.6	25	32.5	11.16*	0.018*
Fair (4-6)	12	13.3	62	68.9	16	17.8		
Good (7-9)	2	28.6	3	42.9	2	28.6		

List of abbreviations:

n: Number of patients x^2: Chi-square P: Test of significance *: Significant value

Table (4): Relationship between total nutritional knowledge score and levels of the studied hemodialysis patients and socio-demographic data

Socio-demographic data	Total nutritional knowledge score of the studied patients (n=174)								χ^2	P
	Poor (n =77)		Fair (n =90)		Good (n =7)		Total			
	n	%	n	%	n	%	n	%		
Age (years)										
18 – <30	8	47.1	7	41.2	2	11.8	17	9.77	6.540	0.138
30 –< 60	41	40.2	56	54.9	5	4.9	102	58.62		
60-79	28	50.9	27	49.1	0	0.0	55	31.61		
Sex										
Male	45	45.0	50	50.0	5	5.0	100	57.47	0.672	0.772
Female	32	43.2	40	54.1	2	2.7	74	42.53		
Education										
Illiterate / read and write	61	76.3	19	23.8	0	0.0	80	45.98	73.489*	0.001*
Basic education	4	57.1	3	42.9	0	0.0	7	4.09		
Secondary or technical	8	16.7	35	72.9	5	10.4	48	27.59		
High education	4	10.3	33	84.6	2	5.1	39	22.41		
Occupation										
Not working/ House wife	57	47.9	59	49.6	3	2.5	119	68.39	19.279*	0.016*
Farmer / un skilled	7	77.8	2	22.2	0	0.0	9	5.17		
Technicians	1	50.0	1	50.0	0	0.0	2	1.15		
Professional	2	15.4	9	69.2	2	15.4	13	7.47		
Employee	4	20.0	14	70.0	2	10.0	20	11.49		
Others	6	54.5	5	45.5	0	0.0	11	6.32		
Residence										
Rural	42	49.4	41	48.2	2	2.4	85	48.85	2.470	0.272
Urban	35	39.3	49	55.1	5	5.6	89	51.15		
Income										
Not enough	68	51.1	60	45.1	5	3.8	133	76.44	12.303*	0.008*
Enough but not spare	9	23.7	27	71.1	2	5.3	38	21.84		
Enough and spare	0	0.0	3	100.0	0	0.0	3	1.73		
Family Size members										
1-3	21	38.9	31	57.4	2	3.7	54	31.03	1.055	0.566
4-19	56	46.7	59	49.2	5	4.2	120	68.97		

List of abbreviations:

n: Number of patients x^2: Chi-square P: Test of significance *: Significant value

Table (5): Relationship between levels of nutritional knowledge of the studied hemodialysis patients assessed by the questionnaire and both dietary & supplementary intake and health education sessions attendance:

Variables	Total nutritional knowledge score of the studied patients (n=174)						χ^2	p
	Poor (n =77)		Fair (n =90)		Good (n =7)			
	n	%	n	%	n	%		
Consumption by 24 hour Recall								
Sufficient (5-6)	33	41.3	43	53.8	4	5.0	9.054	0.047*
Insufficient (3-4)	33	42.9	43	55.8	1	1.3		
Poor (1-2)	11	64.7	4	23.5	2	11.8		
r_s	0.157*							
P	0.038*							
Supplementary intake								
Calcium	34	46.6	38	52.1	1	1.4	2.180	0.375
Vitamin B12	54	44.3	62	50.8	6	4.9	0.661	0.810
Folic acid	0	0.0	8	100.0	0	0.0	7.809*	0.019*
Others	6	26.1	15	65.2	2	8.7	4.348	0.114
Health education sessions attendance								
No	75	44.9	87	52.1	5	3.0	6.734*	0.037*
Yes	2	28.6	3	42.9	2	28.6		

List of abbreviations:

n: Number of patients x^2: Chi-square P: Test of significance *: Significant value

rs: Spearman test