Relationship between Dietary Pattern and Nutritional Status among Hemodialysis Patients

Sanaa Mohamed Ahmed Alaa Eldin, *Professor*
Medical Surgical Nursing, Faculty of Nursing, Alexandria University.

Alshaimaa Ragab Abdel Gawad Elnadery, *Demonstrator*
Medical Surgical Nursing, Faculty of Nursing, Matrouh University.

Thoraya Mohamed Abdelaziz, *Professor*
Medical Surgical Nursing, Faculty of Nursing, Alexandria University.

Hanaa Abbass Ahmed, *Lecturer*
Medical Surgical Nursing, Faculty of Nursing, Matrouh University

Abstract:

Background: *Chronic kidney disease (CKD) is a worldwide public health problem representing more than 10% of the general population. Moreover, malnutrition is a significant comorbidity for patients with ESRD undergoing HD with prevalence ranges from 18 to 75%.* ***Aim of the study:*** *Assess the dietary pattern and the nutritional status among hemodialysis patients and to explore the relationship between dietary pattern and the nutritional status among hemodialysis patients.* ***Design****: A descriptive correlational research design was utilized.* ***Setting****: The present study was conducted at the Hemodialysis Unit Matrouh General Hospital; affiliated to the Egyptian Ministry of Health.* ***Subjects****: A convenience sample of 80 adult hemodialysis patients was recruited in the current study. Three* ***tools*** *were used for data collection; namely: The Bio-sociodemographic and Clinical Data Structured Interview Schedule, Patients' Dietary Pattern Recall Interview Schedule, and Patients' Nutritional Status Assessment Interview Schedule including PG-SGA, Anthropometric, and Biochemical Measurements.* ***Results****: Nearly half of the studied hemodialysis patients were malnourished and most of the studied patients had inadequate dietary intake. There was a significant relationship between the* ***patients' nutritional status (Global PG-SGA)*** *and gender, level of education, occupation, hemodialysis hours per session, activity level, eating problems, dietary sodium intake, and ionized calcium level.* ***In conclusion****: The severely malnourished patients had inadequate dietary energy, macronutrients, and micronutrients intake.* ***Recommendation:*** *Increase the hemodialysis patients' knowledge concerning malnutrition and their daily nutrient recommendations.*

Keywords: Chronic kidney disease. Nutritional status, Hemodialysis, Dietary pattern, ESRD.

Received 21 February 2024; Accepted 28 February 2024; Published December 2024

Introduction:

Chronic kidney disease (CKD) is a worldwide public health concern; defined as an irreversible impairment of kidney functioning, which may promote end-stage renal disease (ESRD) requiring renal replacement therapy. Renal replacement therapies include peritoneal dialysis, hemodialysis (HD), and kidney transplants. **(Azzeh et al., 2022)**.

However, hemodialysis (HD) is the main alternative treatment of ESRD, as it raises the quality of life, prolongs survival, and decreases complications. It involves manually removing toxins as metabolic waste in the blood from the body. However, HD replaces kidney removal of body metabolites; but has not fully achieved the effect of normal kidney function.

Nevertheless; to a certain extent, these patients are prone to malnutrition, metabolic disorder, and other complications **(Sahathevan et al. 2020., Elrefaey et al., 2021).**

Malnutrition is a strong predictor of mortality and morbidity, as well as increased hospitalization rates, lower physical activity, poor quality of life, and inadequate dialysis. Nevertheless, the reported severe malnutrition affects 6% - 8% of hemodialysis patients **(Mali et al., 2022)**. Nutritional assessment and dietary pattern tracking performed by the nurse are a vital parts as they maintain adequate nutritional status, reduce uremic-induced symptoms, improve metabolic imbalances, avoid complications, and enhance the quality of life and health outcomes in a dietetic management for HD patients **(Gebretsadik et al., 2020)**.

Moreover, it seems that the nutritional status of hemodialysis patients has rarely been studied in detail and is often ignored in many dialysis centers at both the global and national levels. Thus, the assessment of the relationship between dietary pattern and nutritional status among hemodialysis patients is mandatory to assist HD nurses in early detecting malnutrition and defining specific and proper nutritional interventions.

Aims of the study are to:

1. Assess the dietary pattern and the nutritional status among hemodialysis patients.

2. Explore the relationship between dietary pattern and the nutritional status among hemodialysis patients.

Research questions:

1. What is the dietary pattern and nutritional status among hemodialysis patients?

2. What is the relationship between the dietary pattern and nutritional status among hemodialysis patients?

Materials and Method:

Materials

Research Design: A descriptive correlational research design was used to carry out the current study.

Setting: The present study was carried out at the Hemodialysis Unit of Matrouh General Hospital; affiliated to the Egyptian Ministry of Health in Matrouh governorate.

Subjects: A convenience sample of 80 adult patients of both genders with ESRD undergoing hemodialysis at the previously mentioned setting were included. Patients participating in the study had met the following

inclusion criteria: Adult of both genders aged from 18 to 60 years, conscious and able to communicate verbally, patients with ESRD undergoing maintenance hemodialysis for at least six months and did not exceed four years, and patients who do not complain from severe gastrointestinal, hepatic disease, cancer, acute renal failure, or recent infection during the time of the study.

Tools of the study: Three tools were used in English version to attain the aim of the study.

Tool I: Patient's Biosocio-demographic and Clinical Data Interview Schedule: It was developed by the researcher based on relevant and related literature **(Joukar et al., 2019; Sualeheen et al., 2019; Susetyowati et al., 2017)** It consisted of two parts:

A. **Part one: Biosocio-demographic Data:** Including the following: Patient's name, age, gender, marital status, level of education, residence, occupation, income, number of family members, who prepared the food, food dislikes, and smoking habits.
B. **Part two: Clinical Data:** Included items related to: patients' diagnosis, major co-morbidities, prescribed medications, over the counter medications, medication administered during dialysis, duration of

hemodialysis, frequency of hemodialysis per week, average of ultrafiltration goal (volume) per week, and hours of hemodialysis per session.

Tool II: Patients' Dietary Pattern Recall Interview Schedule: This tool was developed by the researcher based on relevant and related literature **(Saglimbene et al., 2021; Moore, 2020; Maurya et al., 2019; Sualeheen et al., 2019);** to assess the patient's daily (24-hour) dietary intake for the previous three consecutive days; including two non-dialysis days and the dialysis day. This tool included data regarding: time, type, and amount of consumed food. The three dietary intake days were analyzed using the modified food processor software by the Egyptian Food Composition Table **(Aboudeif et al., 2018)** to calculate the average of the three days. As well as the researcher estimated the recommended dietary nutrient intake for each HD patient. The average of the analyzed three 24-hour dietary recall was compared to the daily nutrient recommendations for HD patients according to clinical practice guideline for nutrition in CKD **(KDOQI, 2020)**. It was classified into three categories as follow: **Inadequate**: Patient's dietary intake was considered **less than** average of recommended dietary nutrient intake, **Adequate**: Patient's dietary intake was considered **within average** of recommended dietary nutrient intake, and **Over requirement**: Patient's dietary intake was considered **more than recommended** dietary nutrient intake.

Tool III: Patients' Nutritional Status Assessment Interview Schedule: This tool was used to assess the nutritional status of the HD patients, and was composed of three parts as follows:

Part one: Scored Patient-Generated Subjective Global Assessment (PG-SGA).

This part was adopted from **(Ottery 2001, as cited in Prasad & Sinha, 2019)** and composed of "seven" items including; weight changes, food intake, nutrition impact symptoms (NIS), activities and function, disease and its relation to nutritional requirements, metabolic demand and physical examination. **Scoring system:** (PG-SGA) items have (0-4) points; sum score equal (0-≥9). **The Global assessment category rating of (PG-SGA)**: First category: Stage (A) = Score (0-3), it was considered "Well nourished", second category: Stage (B) = Score (4-8), it was considered "Moderately malnourished or suspected malnutrition", and third category: Stage (C) = Score (≥ 9) it was considered "Severely malnourished". **Part two: Anthropometric Measurements.** These measurements were performed by the researcher and composed of "Dry weight, height, body mass index, mid-arm circumference, Triceps skinfold thickness, mid-arm muscle circumference, and waist circumference." **Part three: Biochemical Measurements.** These measurements were composed of: hemoglobin level, serum creatinine, serum blood urea nitrogen (before and after HD), sodium, potassium, ionized calcium, and random blood glucose level. It was obtained from patients' medical records which were kept in the nursing staff office.

Method

- An official approval to conduct the study was obtained from the Research Ethical Committee of the Faculty of Nursing, Alexandria University, in addition to permission from the responsible authorities (director) of the Matrouh General Hospital was obtained to collect data.
- The study tools I, II, and III (part two & three) were developed by the researcher based on the recent literature review. While, the study tool III (part one) **"PG SGA"** was adopted from **(Ottery 2001, as cited in Prasad & Sinha, 2019).** Its reliability was tested by Cronbach's alpha Coefficient test with a value (0.73) which indicated acceptable internal reliability. **(Desbrow et al., 2005)**

- The developed tools were submitted to a jury of five experts in the Medical-Surgical Nursing field.
- A pilot study was carried out on 10% of the study patients (9 patients) to ascertain the clarity and applicability of the study tools.
- Data collection was initiated covering a period of 18 months (January 2022 to end of June 2023).
- The total subjects who met the study's inclusion criteria were enrolled, consisting of 80 adult HD patients. Each patient was interviewed twice for at least 30 minutes each in the HD unit.
- **In the first interview**: The researcher met with each patient during the HD session using tool one and tool three to collect sociodemographic and clinical data and to assess the "PG-SGA."
- Then, the researcher performed the anthropometric measurements and physical examination of "PG-SGA" after HD session by 10-30 minutes using study tool III (part one and two) after patients' permission. The researcher obtained the recent biochemical measurements once for each HD patient from the patients' medical records.
- **In the second interview:** the researcher questioned each patient about the types and amount of food consumed on three consecutive days: two non-dialysis days and the dialysis day.
- The 24 hours dietary intake consumed in the previous three consecutive days were analyzed using the modified food processor software by the Egyptian Food Composition Table, and then the average of the three dietary recalls was calculated.
- The researcher then estimated the daily nutrient recommendations based on the previous formulas for each HD patient utilizing Microsoft Excel Worksheet.
- Then, the researcher compared the average of the patients' daily (24 hour) dietary intake for the previous three consecutive days with the daily nutrient recommendation for each HD patient in order to estimate the studied HD patients' dietary pattern categories.

Ethical Considerations: Written informed consent was obtained from the study subjects. Patient privacy was assured. Confidentiality of data was maintained, and anonymity of subjects was maintained during the study. Subjects' voluntary participation and right to withdraw from the study were ensured throughout the study.

Statistical Analysis: Data were analyzed using IBM SPSS software package version 27.0. (Armonk, NY: IBM Corp). Qualitative data were described using numbers and percentage. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and the obtained results were judged at significance level $p \leq 0.05$.

Results: **Table (1)** illustrated that less than half (45%) of the studied HD patients aged between 50 to 60 years old with mean± SD 45.11 ± 11.39 years, less than two thirds (60%) were males, the majority (80%) were married, and lived in urban areas, while less than two-thirds (65%) didn't work. Moreover, **Table (2)** presented that more than three quarters (76.3%) of patients had hypertension, nearly one half (43.7%) of the studied patients' HD duration lasted between 5 to less than 20 months, three quarters (75%) were performing HD three times weekly, and nearly half (48.8%) of the studied patients performed each HD session for four hours. **Table (3)** clarified that most of the studied patients 100% 97.5%, 93.8%, 93.8%, 91.3%, and 81.3% had inadequate dietary fiber, fat, energy, carbohydrate, protein, and fluid intake, respectively. Nearly half (43.8%) of the patients had sodium over requirement intake, while 100%, 98.8% 96.3%, 93.8%, 85%, and 76.3% had inadequate magnesium, calcium, zinc, potassium, phosphorus, and iron intake, respectively. **Table (4)** showed that more than half (55%) of the patients were well-nourished (stage A), nearly one third (31.1%) were moderately malnourished or suspected malnutrition (stage B), and the minority (13.8%) were severely malnourished (stage C).

Table (5) presented that the severely malnourished patients aged between 40 years to less than 50 years old, were female, divorced, illiterate, lived in rural, were not working, and had low income. Furthermore, there was a statistically significant relationship between the patients' nutritional status (Global PG-SGA) and gender, level of education, and occupation. **Table (6)** showed that severely malnourished patients' HD session duration lasted between 5 months to less than 20 months, were performing HD three times weekly for 3.5 hours per session, had problems in eating, and were below normal activity level. There was a statistically significant relationship between the patients' nutritional status (Global PG-SGA); and hemodialysis hours, eating problems and activity level.

While, **table (7)** showed that the studied patients who had inadequate energy, fiber, fat, carbohydrate, protein, fluid, sodium, potassium, calcium, magnesium, phosphorus, zinc, and iron intake were found to be severely malnourished. Moreover, there was a statistically significant relationship between the patients' nutritional status (Global PG-SGA) and sodium intake.

Discussion:

Chronic kidney disease is a major public health and clinical problem throughout the world including Egypt. Malnutrition is a relatively common problem in chronic renal failure which can be secondary to poor nutrient intake, increased nutrient losses, or an increase in protein catabolism. This present study goes in line with **Akter & Alam (2020), Moustakim et al. (2020) and Akhlaghi et al. (2021)** who stated that, the majority of hemodialysis patients had low adequacy of energy, carbohydrate, protein, fat, and fiber. Moreover, **Tallman (2020)** and **Moustakim et al. (2020)** reported that most of the patients exceeded the recommended sodium intake and had less than the recommended calcium, zinc, and magnesium. This may be related to the nutrition impact symptoms especially nausea, anorexia, fatigue after HD. This present study was supported by **Caruana et al. (2022)** and **Akhlaghi et al (2021)** who reported that, less than one half of the patients were malnourished. In Egypt, on contrary to the current study, **Khalil et al. (2021)** stated that, the majority of the participants were malnourished, and **Elbakary et al. (2019)** stated that, most of the patients were well-nourished. These discrepancies between the current study and other studies might be related to sample size variances, food cultural differences, alterations in the duration of hemodialysis.

The current study revealed that there was a statistically significant relationship between the patients' nutritional status **(Global PG-SGA)**, and gender, level of education, occupation, hemodialysis hours, eating problems and activity level. Moreover, there was a statistically significant relationship between the patients' nutritional status (Global PG-SGA) and sodium intake. These findings were supported by **Racha et al. (2020), Caruana et al. (2022),** and **Joukar et al. (2019).** While, **Akhlaghi et al. (2021) Zaki et al. (2019)** disagreed with the current study. This may be related to the development of severe uremic symptoms that affect the nutritional status such as anorexia, metallic taste, and fatigue. Additionally, it could be related to lack of essential health information related to the disease's necessary dietary requirements.

The result declares that the current study's aims, and research questions were fully understandable and answered through a suitable statistical analysis. Thus, the present findings had explored the relationship between dietary pattern and nutritional status among hemodialysis patients.

Conclusion: Nearly one half of the studied HD patients were malnourished, either moderately or severely malnourished. Moreover, most of the studied HD patients had inadequate dietary energy, macronutrients, and micronutrients

intake. There was a statistically significant relationship between the patients' nutritional status (Global PG-SGA), and gender, level of education, occupation, hemodialysis hours, eating problems as well as activity level. Also, a statistically significant relationship between the patients' nutritional status (Global PG-SGA) and sodium intake in addition to ionized calcium level.

Recommendations:

- Establish an illustrated booklet including individualized dietary plan according to the daily nutrient recommendations for the hemodialysis patients.
- Develop and apply an educational program for the hemodialysis patients regarding:
  a. Recommended dietary nutrient intake and the dietary restrictions.
  b. Importance, causes, and complications of malnutrition among the hemodialysis patients.
  c. Importance of the recommended dietary nutrient intake for hemodialysis patients' families and caregivers.

Table (1): Frequency Distribution of the Studied Hemodialysis Patients according to their Sociodemographic Data n=80

Sociodemographic Data	No.	%
Age (years)		
20-<30	9	11.3
30-<40	16	20
40-<50	19	23.8
50-60	36	45
Mean ± SD	**45.11 ± 11.39**	
Gender		
Male	48	60
Female	32	40
Marital Status		
Single	8	10
Married	64	80
Divorced	3	3.8
Widow	5	6.3
Level of Education		
Illiterate	17	21.3
Read & write	10	12.5
Preparatory	9	11.3
Secondary	21	26.3
University	22	27.5
Others	1	1.3
Residence		
Rural	16	20
Urban	64	80
Occupation		
Employee	18	22.5
Worker	10	12.5
Not work	24	30
Retired	5	6.3
Housewife	23	28.7
Income		
Low	20	25
Moderate	59	73.8
High	1	1.3
Number of Family members		
≤ 8	74	92.5
> 8	6	7.5
Preparation of food		
By himself /Herself	18	22.5
By others	62	77.5
Food dislikes		
Yes	17	21.3
No	63	78.8
Smoking habit		
Active Smoker	19	23.8
Non-smoker	39	48.8
Ex-smoker	11	13.8
Passive smoker	11	13.8

Table (2): Frequency Distribution of the Studied Hemodialysis Patients according to their Clinical Data (n = 80)

Clinical Data		No.	%
Major comorbidities #			
Hypertension		61	76.3
Cardiovascular disease		14	17.5
Diabetes mellitus Type I		6	7.5
Hepatitis C		3	3.8
Diabetes mellitus Type II		2	2.5
Others		6	7.5
Medication			
Prescribed medication #	Antihypertensive medication	62	77.5
	Cardiovascular medication	14	17.5
	Hypoglycemic medication	7	8.8
	Corticosteroid medication	2	2.5
	Antigout medication	2	2.5
Medication during hemodialysis #	Heparin	80	100
	B-com	80	100
	L-Carnitine	80	100
	EPrix	55	68.8
Duration of hemodialysis (Months)			
5 months - < 20 months		35	43.7
20 months - <35 months		21	26.3
35 month - 50 months		24	30
Mean ± SD		**24.013 ± 14.3**	
Frequency of hemodialysis			
Once		4	5.0
Twice		16	20.0
Three times		60	75.0
Average of ultrafiltration goal (volume) (ml/week)		**2077.50 ± 1158.53**	
Hemodialysis hours (hours/session)			
3 hrs.		5	6.3
3.5 hrs.		36	45
4 hrs.		39	48.8
Mean ± SD		**3.71 ± .306**	

 # multiple responses.

Table (3): Frequency Distribution of the Studied Hemodialysis Patients according to their Dietary Pattern Recall (n = 80)

Dietary Pattern Recall Items	Categories	No.	%
Dietary Energy Intake (DEI) (Kcal/day)	Over requirement	5	6.3
	Adequate	0	0
	Inadequate	75	93.8
Macronutrients:			
Fiber Intake (gm/day)	Over requirement	0	0.0
	Adequate	0	0.0
	Inadequate	80	100
Dietary Fat Intake of total calories (Kcal. /day)	Over requirement	2	2.5
	Adequate	0	0
	Inadequate	78	97.5
Dietary Carbohydrate Intake of total calories (Kcal/day)	Over requirement	5	6.3
	Adequate	0	0
	Inadequate	75	93.8
Dietary Protein Intake (gm/day)	Over requirement	7	8.8

Table (3): Frequency Distribution of the Studied Hemodialysis Patients according to their Dietary Pattern Recall (n = 80)

Dietary Pattern Recall Items	Categories	No.	%
	Adequate	0	0.0
	Inadequate	73	91.3
Fluid Intake (ml./day)	Over requirement	1	1.3
	Adequate	14	17.5
	Inadequate	65	81.3
Micronutrients			
Sodium Intake (mg/day)	Over requirement	35	43.8
	Adequate	37	46.3
	Inadequate	8	10
Magnesium Intake (mg/day)	Over requirement	0	0
	Adequate	0	0
	Inadequate	80	100
Calcium Intake (mg/day)	Over requirement	1	1.3
	Adequate	0	0
	Inadequate	79	98.8
Zinc Intake (mg/day)	Over requirement	3	3.8
	Adequate	0	0
	Inadequate	77	96.3
Potassium Intake (mg/day)	Over requirement	2	2.5
	Adequate	3	3.8
	Inadequate	75	93.8
Phosphorus Intake (mg/day)	Over requirement	5	6.3
	Adequate	7	8.8
	Inadequate	68	85
Iron Intake (mg/day)	Over requirement	1	1.3
	Adequate	18	22.5
	Inadequate	61	76.3

Table (4): Frequency Distribution of the Studied Hemodialysis Patients according to their Total PG-SGA Score and its Global Categories (n = 80)

Total PG-SGA Score	No.	%
(0-1) No intervention required at this time. Re-assessment on routine and regular basis during treatment.	20	25
(2-3) Patient & family education by dietitian, nurse, or other clinician with pharmacologic intervention.	24	30
(4-8) Requires intervention by a dietitian, in conjunction with a nurse or physician as indicated by symptoms.	25	31.3
(≥ 9) Indicates a critical need for improved symptom management and nutrient intervention option.	11	13.8
Global PG-SGA Category		
Stage (A) (0-3) Well-nourished	44	55
Stage (B) (4-8) Moderate malnutrition	25	31.3
Stage (C) (≥ 9) Severely malnourished	11	13.8

Table (5): Relationship between the Studied Hemodialysis Patients' Global PG-SGA Stages of Malnutrition and Sociodemographic Data:

Sociodemographic Data	Stages of Malnutrition						Total N=80		Test of Significance
	Stage A (N= 44)		Stage B (N= 25)		Stage C (N= 11)				
	No.	%	No.	%	No.	%	No.	%	
Age (years)									
▪ 20-<30	4	44.4	4	44.4	1	11.1	9	11.2	
▪ 30-<40	9	56.3	6	37.5	1	6.3	16	20.0	χ^2=2.995
▪ 40-<50	11	57.9	4	21.1	4	21.1	19	23.8	*p*=0.810
▪ 50- 60	20	55.6	11	30.6	5	13.9	36	45.0	
Gender									
▪ Male	31	64.6	15	31.3	2	4.2	48	60.0	χ^2=10.019
▪ Female	13	40.6	10	31.3	9	28.1	42	40.0	*p* =0.007*
Marital status									
▪ Single	5	62.5	3	37.5	0	0.0	8	10.0	
▪ Married	36	56.3	19	29.7	9	14.1	64	80.0	χ^2=5.781
▪ Divorced	2	66.7	0	0.0	1	33.3	3	3.8	*p* =0.448
▪ Widowed	1	20.0	3	60.0	1	20.0	5	6.2	
Level of education									
▪ Illiterate	5	29.4	5	29.4	7	41.2	17	21.2	
▪ Read & write.	6	60.0	4	40.0	0	0.0	10	12.5	
▪ Basic education	6	66.7	2	22.2	1	11.1	9	11.2	χ^2= 19.250
▪ Secondary/Technical	10	47.6	8	38.1	3	14.3	21	26.2	*p* =0.037*
▪ University	17	73.9	6	26.1	0	0.0	23	28.8	
Residence									
▪ Rural	10	62.5	3	18.8	3	18.8	16	20.0	χ^2=1.568
▪ Urban	34	53.1	22	34.4	8	12.5	64	80.0	*p* =0.457
Occupation									
▪ Working	16	53.3	13	43.3	1	3.3	28	35.0	χ^2=6.055
▪ Not working	28	56.0	12	24.0	10	20.0	52	65.0	*p* =0.048*
Income									
▪ Low	9	45.0	6	30.0	5	25.0	20	25.0	
▪ Moderate	34	57.6	19	32.2	6	10.2	59	73.8	χ^2=3.674
▪ High	1	100.0	0	0.0	0	0.0	1	1.2	*p* =0.452

Stage A= Well-nourished Stage B= Moderate Malnutrition Stage C= Severely Malnutrition χ^2 Chi Square Test ***** Statistically significant at $p \leq 0.05$

Table (6): Relationship between the Studied Hemodialysis Patients' Global PG-SGA Stages of Malnutrition and Clinical Data:

Clinical Data	Stages of Malnutrition						Total N=80		Test of Significance
	Stage A (N= 44)		Stage B (N= 25)		Stage C (N= 11)				
	No.	%	No.	%	No.	%	No.	%	
Duration of hemodialysis									
▪ 5 months - < 20 months	19	54.3	10	28.6	6	17.1	35	43.7	
▪ 20 months - <35 months	10	45.0	9	29.0	2	9.5	21	26.3	χ2= 2.335
▪ 35 month - 50 months	15	62.5	6	25.0	3	2.5	24	30	p =0 .674
Frequency of Hemodialysis									
▪ Once	3	75.0	1	25.0	0	0.0	4	5.0	
▪ Twice	6	37.5	8	50.0	2	12.5	16	20.0	χ2=4.193
▪ Three times	35	58.3	16	26.7	9	15.0	60	75.0	p =0.381
Hemodialysis Hours (hours/session)									
▪ 3 hours	2	40.0	3	60.0	0	0.0	5	6.2	χ2=12.752

Table (6): Relationship between the Studied Hemodialysis Patients' Global PG-SGA Stages of Malnutrition and Clinical Data:

Clinical Data	Stages of Malnutrition						Total N=80		Test of Significance
	Stage A (N= 44)		Stage B (N= 25)		Stage C (N= 11)				
	No.	%	No.	%	No.	%	No.	%	
▪ 3.5 hours	16	44.4	10	27.8	10	27.8	36	45.0	p =0.013*
▪ 4 hours	26	66.7	12	30.8	1	2.6	39	48.8	
Problems in eating									
▪ Yes	9	25.0	16	44.4	11	30.6	36	45.0	$\chi2$=27.802
▪ No	35	79.5	9	20.5	0	0.0	44	55.0	p =0.000*
Activity level									
▪ Normal Activity	36	72.0	12	24.0	2	4.0	50	62.5	$\chi2$=18.467
▪ Below Normal Activity	8	26.7	13	43.3	9	30.0	30	37.5	p =0.000*

Stage A= Well-nourished Stage B= Moderate Malnutrition Stage C= Severely Malnutrition
χ^2 Chi Square Test * Statistically significant at $p \leq 0.05$

Table (7): Relationship Between the Studied Hemodialysis Patients' Global PG-SGA Stages of Malnutrition and Dietary Intake Recall:

Dietary Intake Recall Items	Stages of Malnutrition						Total N=80		Test of Significance
	Stage A (N= 44)		Stage B (N= 25)		Stage C (N= 11)				
	No.	%	No.	%	No.	%	No.	%	
Dietary Energy Intake (Kcal/day)									
▪ Over requirement	2	40.0	3	60.0	0	0.0	5	6.2	$\chi2$=2.362
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	p =0.307
▪ Inadequate intake	42	56	22	29.3	11	14.7	75	93.8	
Macronutrients:									
Fiber intake (gm/day)									
▪ Over requirement	0	0.0	0	0.0	0	0.0	0	0.0	$\chi2$=NA
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	
▪ Inadequate intake	44	55.0	25	31.3	11	13.8	80	100.0	
Fat intake (Kcal/day)									
▪ Over requirement	1	50.0	1	50.0	0	0.0	2	2.5	$\chi2$=0.522
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	p =0.770
Inadequate intake	43	55.0	24	30.8	11	14.1	78	97.5	
Carbohydrate intake (Kcal/day)									
▪ Over requirement	2	40.0	3	60.0	0	0.0	5	6.2	$\chi2$=2.362
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	p =0.307
▪ Inadequate intake	42	56.0	22	29.3	11	14.7	75	93.8	
Protein intake (gm/day)									
▪ Over requirement	4	57.1	3	42.9	0	0.0	7	8.8	$\chi2$= 1.392
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	p =0.499
▪ Inadequate intake	40	54.8	22	30.1	11	15.1	73	91.2	
Fluid intake (ml/day)									
▪ Over requirement	1	100	0	0.0	0	0.0	1	1.2	$\chi2$=1.510
▪ Adequate intake	8	57.0	5	35.7	1	7.1	14	17.5	p =0.825
▪ Inadequate intake	35	53.8	20	30.8	10	15.4	65	81.2	
Micronutrients:									
Sodium intake (mg/day)									
▪ Over requirement	22	62.9	9	25.7	4	11.4	35	43.8	$\chi2$=21.422
▪ Adequate intake	22	55.0	15	37.5	3	7.5	40	50.0	p =0.000*
▪ Inadequate intake	0	0.0	1	20.0	4	80.0	5	6.2	

Table (7): Relationship Between the Studied Hemodialysis Patients' Global PG-SGA Stages of Malnutrition and Dietary Intake Recall:

Dietary Intake Recall Items	Stages of Malnutrition						Total N=80		Test of Significance
	Stage A (N= 44)		Stage B (N= 25)		Stage C (N= 11)				
	No.	%	No.	%	No.	%	No.	%	
Magnesium intake (mg/day)									
▪ Over requirement	0	0.0	0	0.0	0	0.0	0	0.0	$\chi 2$=NA
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	
▪ Inadequate intake	44	55.0	25	31.1	11	13.8	80	100.0	
Calcium intake (mg/day)									
▪ Over requirement	0	0.0	1	100	0	0.0	1	1.2	$\chi 2$=2.228 p =0.328
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	
▪ Inadequate intake	44	55.7	24	30.4	11	13.9	79	98.8	
Zinc intake (mg/day)									
▪ Over requirement	2	66.7	1	33.3	0	0.0	3	3.8	$\chi 2$=0.510 p =0.775
▪ Adequate intake	0	0.0	0	0.0	0	0.0	0	0.0	
▪ Inadequate intake	42	54.5	24	31.2	11	14.3	77	96.2	
Potassium intake (mg/day)									
▪ Over requirement	1	50.0	1	50.0	0	0.0	2	2.5	$\chi 2$=1.056 p =0.901
▪ Adequate intake	2	66.7	1	33.3	0	0.0	3	3.8	
▪ Inadequate intake	41	54.7	23	30.7	11	14.7	75	93.8	
Phosphorus intake (mg/day)									
▪ Over requirement	3	60.0	2	40.0	0	0.0	5	6.2	$\chi 2$=2.472 p =0.650
▪ Adequate intake	4	57.1	3	42.9	0	0.0	7	8.8	
▪ Inadequate intake	37	54.4	20	29.4	11	16.2	68	85.0	
Iron intake (mg/day)									
▪ Over requirement	1	100	0	0.0	0	0.0	1	1.2	$\chi 2$=2.891 p =0.576
▪ Adequate intake	13	61.9	7	33.3	1	4.8	21	26.2	
Inadequate intake	30	51.7	18	31.0	10	17.2	58	72.5	

Stage A= Well-nourished Stage B= Moderate Malnutrition Stage C= Severely Malnutrition
χ^2 Chi Square Test ***** Statistically significant at $p \leq 0.05$

***References*:**

- Aboudeif, N., Amin, E., Tayel, D., & Mohamed, N. (2018). Modification of Computer-based Dietary Analysis Software with Egyptian Food Composition Database and Evaluation of the New Software Compared to Traditional Dietary Analysis Method for Sample of Egyptian Adults. [Unpublished doctoral dissertation].High Institute of Public Health, Alexandria University. Egypt.
- Akhlaghi, Z., Sharifipour, F., Nematy, M., Safarian, M., Malekahmadi, M., Barkhidarian, B., & Norouzy, A. (2021). Assessment of nutritional status in maintenance hemodialysis patients: A multicenter cross-sectional study in Iran. *Seminars in Dialysis*, *34*, 77–82. https://doi.org/10.1111/sdi.12917
- Akter, M., & Alam, F. (2020). Food intake pattern and nutritional status of hemodialytic patients. *Asian Journal of Medical and Biological Research*, *6*(4), 746–753. https://doi.org/10.3329/ajmbr.v6i4.51242
- Azzeh, F., Turkistani, W., Ghaith, M., Bahubaish, L., Kensara, O., Almasmoum, H., Aldairi, A., Khan, A., Alghamdi, A., Shamlan, G., Alhussain, M., Algheshairy, R., Alshahrani, A., Qutob, M., Alazzeh, A., & Qutob, H. (2022). Factors associated with the prevalence of malnutrition among adult hemodialytic patients: A two-center study in the Jeddah region, Saudi Arabia. *Medicine*, *101*(40), 1–7. https://doi.org/10.1097/MD.0000000000030757
- Caruana, L., Nichols, L., & Lambert, K. (2022). Malnutrition, symptom burden and predictive validity of the patient-generated subjective global assessment in central Australian haemodialysis patients: A cross sectional study. *Nutrition and Dietetics*, *79*(5), 555–562. https://doi.org/10.1111/1747-0080.12763
- Desbrow, B., Bauer, J., Blum, C., Kandasamy, A., McDonald, A., & Montgomery, K. (2005). Assessment of nutritional status in hemodialysis patients using patient-generated subjective global assessment. *Journal of Renal Nutrition*, *15*(2), 211–216.
- Elbakary, M., Okasha, K., Gawaly, A., & Negm, M. (2019). Subjective global assessment for nutritional assessment of patients on regular hemodialysis at dialysis unit at Tanta University hospital. *The Medical Journal of Cairo University*, *87*(5), 3023–3029. https://doi.org/10.21608/mjcu.2019.59355
- Elrefaey, N., Awad, W., & Abdelaziz, T. (2021). Assessment of nurses' safety practices in relation to intravenous iron administration for patients undergoing hemodialysis. *Egyptian Journal of Health Care*, *12*(2), 1491-1501. https://doi.org/10.21608/ejhc.2021.191029
- Gebretsadik, G., Mengistu, Z., Molla, B., & Desta, H. (2020). Patients with chronic kidney disease are not well adhered to dietary recommendations: A cross-sectional study. *BMC Nutrition*, *6*(1), 1–7. https://doi.org/10.1186/s40795-020-00333-y
- Joukar, F., Moradi, Z., Hasavari, F., Roushan, Z., Sedighi, A., & Asgharnezhad, M. (2019). Malnutrition in hemodialysis patients and predicting factors: A cross-sectional study. *Nephro-Urology Monthly*, *11*(3), 1–7. https://doi.org/10.5812/numonthly.86586
- KDOQI. (2020). KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *American Journal of Kidney Diseases*, *76*(3), 1–107.
- Khalil, K., Saied, S., Atlam, S., & El-Saleet, G. (2021). Assessment of nutritional status of chronic renal failure patients on hemodialysis in Damanhour National Medical Institute in El-Beheira Governorate, Egypt. *Journal of Advances in Medicine and Medical Research*, *33*(23), 264–275. https://doi.org/10.9734/jammr/2021/v33i2331210
- Mali, N., Ge, J., Su, F., Li, C., & Fan, W. (2022). Review of risk factors of malnutrition in maintenance hemodialysis patients. *Archives of Nephrology and Urology*, *5*(01). https://doi.org/10.26502/anu.2644-2833049
- Maurya, N., Arya, P., & Sengar, N. (2019). Dietary intake and nutritional status in hemodialysis patients. *Int. Res. J. Pharm*, *10*(4), 102–105. https://doi.org/10.7897/2230-8407.1004132
- Moore, L. (2020). Dietary assessment in kidney disease. In J. Burrowes, C. Kovesdy, & L. Byham-Gray (Eds.), *Nutrition in kidney disease* (3rd ed, pp. 95–121). Springer Nature Switzerland.
- Moustakim, R., Mziwira, M., Mohammed, E., & Belahsen, R. (2020). Assessment of nutritional status, dietary intake and adherence to dietary recommendations in hemodialysis patients. *GSC Advanced Research and Reviews*, *3*(2), 9–19. https://doi.org/10.30574/gscarr.2020.3.2.0030
- Prasad, N., & Sinha, A. (2019). Subjective global assessment (SGA) of malnutrition. In V. Preedy & V. Patel (Eds.), *Handbook of famine, starvation, and nutrient deprivation* (pp. 643–663). Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-319-55387-0_116/TABLES/2
- Racha, A., Kanthala, M., Komuravelly, S., Eggadi, V., Bandaru, S., & Prasad, R. (2020). Assessment of

malnutrition in patients with chronic kidney disease undergoing hemodialysis. *Journal of The Egyptian Society of Nephrology and Transplantation*, *20*(3), 179–185. https://doi.org/10.4103/jesnt.jesnt_7_20

- Saglimbene, V., Su, G., Wong, G., Natale, P., Ruospo, M., Palmer, S., Craig, J., Carrero, J., & Strippoli, G. (2021). Dietary intake in adults on hemodialysis compared with guideline recommendations. *Journal of Nephrology*, *34*(6), 1–9. https://doi.org/10.1007/s40620-020-00962-3
- Sahathevan, S., Khor, B., Ng, H., Gafor, A., Daud, Z., Mafra, D., & Karupaiah, T. (2020). Understanding development of malnutrition in hemodialysis patients: A narrative review. *Nutrients*, *12*(10), 1–30. https://doi.org/10.3390/nu12103147
- Sualeheen, A., Khor, B., Balasubramanian, G., Sahathevan, S., Ali, M., Narayanan, S., Chinna, K., Daud, Z., Khosla, P., Gafor, A., & Karupaiah, T. (2019). Habitual dietary patterns of patients on hemodialysis indicate nutritional risk. *Journal of Renal Nutrition*, *30*(4), 1–11. https://doi.org/10.1053/j.jrn.2019.09.010
- Susetyowati, S., Djarwoto, B., & Faza, F. (2017). Nutrition screening tools as predictor of malnutrition for hemodialysis. *Saudi Journal of Kidney Diseases and Transplantation*, *28*(6), 1307–1313.
- Tallman, D. (2020). Impact of Dietary Patterns on Health Outcomes in African American Maintenance Hemodialysis Patients [Doctoral dissertation, Wayne State University]. ProQuest.
- Zaki, D., Mohamed, R., Mohammed, N., & Abdel-Zaher, R. (2019). Assessment of malnutrition status in hemodialysis patients. *Clinical Medicine and Diagnostics*, *9*(1), 8–13. https://doi.org/10.5923/j.cmd.20190901.02