Study of Nutritional Status among End Stage Renal Disease Patients on Regular Hemodialysis in Zagazig University Hospitals

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ABSTRACT

Background: The frequency of malnutrition among hemodialysis (HD) cases differs widely depending on the study participants and assessment methods.

Objective: This study aimed to estimation of the prevalence of malnutrition among hemodialysis adult patients in Zagazig University Hospitals by using different methods.

Patients and Methods: At Zagazig University Hospitals, Nephrology Unit, Internal Medicine Department, we conducted our study on 95 patients with end-stage renal disease (ESRD) on regular hemodialysis. All patients underwent a thorough history-taking as well as laboratory investigations.

Results: Mini-nutritional assessment had a statistically significant relationship with gender, body mass index (BMI), and dialysis duration. The mini-nutritional assessment (MNA) score, hemoglobin, hematocrit, serum iron, serum calcium, serum albumin, and high-density lipoprotein (HDL) cholesterol had a statistically significant positive correlation. Low-density lipoprotein (LDL) cholesterol is negatively correlated with the mini-nutritional assessment score. The correlation between Subjective Global Assessment (SGA) and BMI was statistically significant. Among factors significantly correlated to MNA score, only BMI (unstandardized β=0.978, 0<0.001) and serum albumin unstandardized β=1.625, p=0.004) significantly independently correlated with it.

Conclusion: Chronic kidney disease patients who receive hemodialysis on a regular basis are more likely to suffer from malnutrition. Malnutrition becomes more common as people get older and their kidney function deteriorates. The MNA and SGA Score, when used as regular screening tools, revealed a significant risk of malnutrition and can be used during the treatment course and rehabilitation of ESRD patients.

Keywords: End-stage renal disease, Malnutrition, Hemodialysis.

INTRODUCTION

Malnutrition is a condition in which the body's tissues are deficient in essential macronutrients or specific micronutrients. There is an increased risk of both mortality and morbidity in patients with end-stage renal disease (ESRD) who are on hemodialysis (HD) [(1)]**.** Patients with HD are at risk for malnutrition because of a variety of factors. More than half of the malnutrition in hemodialysis patients is caused by anorexia and changed taste sensations in addition to a variety of other conditions, such as intercurrent sickness or hyper-catabolism and diminished anabolism [(2)]**.** An estimated 16 to 62% of HD patients are malnourished, depending on the study participants and diagnostic methods used [(3)]**.** Early identification of malnutrition is critical for providing enough nutritional support, managing the illness effectively, and preventing the negative clinical outcomes associated with it [(4)]**.** Patients on hemodialysis who are protein–energy malnourished and have wasting are more likely to die. Hemodialysis patients' nutritional status cannot be accurately assessed by a single measurement [(5)]. For the following reasons, protein requirements during hemodialysis appear to be insufficient. Dialysis treatment causes nutrients to be lost through the dialysis filter (glucose, amino acids, vitamins and trace elements. Dialysis itself is a catabolic process that causes the breakdown of protein (heparin role, albumin fragmentation, as well as pro-inflammatory cytokines release). To maintain acceptable plasma and cellular amino acid concentrations, for example, muscle proteolysis occurs when blood amino acid levels rapidly decline at the outset of hemodialysis. Long-term muscle loss may be the result of this catabolic process. It has been demonstrated that feeding dialysis patients through regular meals, special liquid feeding, or parenteral medication can reverse this catabolic condition and should be used as frequently as feasible to achieve this goal [(6)]**.** We performed the current study to find out how common malnutrition is among adult hemodialysis patients by employing a variety of assessment methods.

PATIENTS AND METHODS

From January 2021 to July 2021, at Zagazig University Hospitals, Nephrology Unit of Internal Medicine Department, our cross-sectional trial was conducted on 95 patients with end-stage renal disease on regular hemodialysis. All received three weekly HD sessions, each of 4 hours-duration. Zagazig University's Clinical Pathology Department handled the technical aspects.

Ethical approval:

When all participants completed informed permission papers and submitted them to the Research Ethics Committee at Zagazig University, the study was permitted (ZU-IRB#6983). Ethics guidelines for human experimentation were adhered to in line with the Helsinki Declaration of the World Medical Association.

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Inclusion Criteria: Patients with end-stage renal disease (ESRD) who were on hemodialysis for more than six months were eligible. Age ≥18 years old. Both sexes were eligible.

Exclusion Criteria: We excluded patients with acute kidney injury. Patients with active infection or malignancy. Patients with primary hyperparathyroidism or other metabolic bone diseases who had been in intensive care or hospital wards for at least four weeks prior to their admission.

Patients' data were collected from the hospital records and all patients were subjected to comprehensive clinical assessment including detailed history taking and physical examination.

Laboratory investigations: Routine laboratory investigations were performed according to Clinical Pathology Department Protocol in Zagazig University Hospitals including: Complete blood picture (CBC), liver function tests (serum albumin), kidney function tests (serum creatinine & serum urea), serum calcium, serum phosphorus, C-reactive protein (CRP), iron indices, serum intact parathormone (iPTH) assay and lipid profile (Total cholesterol, LDL, HDL, Triglycerides).

The Mini Nutritional Assessment (MNA) and subjective global assessment (SGA) were used to assess the nutritional health of the participants:

SGA consisted of a brief history of individual's dietary habits (six months of weight loss, dietary changes, assessment of the body's subcutaneous fat, muscular mass, and fluid balance). PEM or moderate PEM or well-fed are the SGA classifications for the patients. In addition to the BMI, calf and arm circumference, appetite, general and cognitive health, and nutritional issues. MNA included 18 variables. a subjective judgment of PEM (0–30 points) (lower than 17 points means PEM, 17–23.5 points mean at risk for PEM, and when more than 24 points means well nourishment).

Statistical analysis:

Using SPSS software (USA) version 16. Numbers and percentages were used to represent data (percent) or mean ± SD. Different qualitative factors were examined using the Chi square (X^2) test. Kruskall-Wallis Use the Dunn's Post-hoc test for multiple comparisons when comparing data from more than two groups. All statistical comparisons were two tailed P-value ≤ 0.05 indicates significant difference (S), p < 0.001 indicates highly significant difference (HS), while P ≥ 0.05 indicates non-significant difference (NS).

RESULTS

We included 95 patients on regular hemodialysis, their ages ranged from 20 to 77 years with a mean of 48.29 ± 14.06 years. Males represented 47.4% of them. Females represented 52.6%. BMI ranged from 17 to 30 kg/m^2 with mean 23.51± 3.17 kg/m^2. Nutritional status was assessed using SGA and MNA scores. According to SGA, 32.6% were well nourished, 46.3% were moderately nourished and 21.1% were severely unnourished. Regarding MNA score, it ranged from 12 to 28 with a mean of 20.8. Regarding MNA, 18.9% were malnourished, 48.4% were at risk of malnutrition, and 32.6%, were well-nourished **(Figure 1)**.

Mini-nutritional assessment had a statistically significant relationship with gender, BMI, and dialysis duration. Both gender and age have no statistically significant impact on SGA. SGA and BMI have a statistically significant relationship. The Tukey HSD test showed a significant difference between the two groups as shown in **table (1).**

Table (2) showed that Mini-nutritional assessment has no statistically significant relationship with either the length of sessions, the volume of urine produced, or the frequency of sessions. Dialysis duration and MNA score had a statistically significant positive correlation.

There was statistically significant positive correlation between MNA score and serum iron (r=0.203, p=0.049), calcium (r=0.21, p=0.041), serum albumin (r=0.441, p<0.001), and HDL cholesterol (r=0.226, p=0.028). The mini-nutritional assessment score has a statistically significant negative relationship with LDL cholesterol (r=-0.594, p= 0.001). As regards other correlation analysis between MNA score and other study parameters, they are summarized in **table (3). Table (4)** showed that TLC, platelet count, ferritin, serum iron, TIBC, transferrin saturation, total cholesterol, triglycerides and serum calcium or phosphorus had no statistically significant relationship with SGA. CRP was significantly different between moderately nourished and severely nourished patients in a pairwise comparison. Hematocrit, LDL cholesterol, and hemoglobin were all found to differ significantly between the two groups in a post hoc Tukey analysis. Serum albumin and HDL cholesterol levels differed significantly between the severely nourished patients and other groups in a post hoc Tukey analysis.

There was non-significant association between SGA and either session duration, urine output, frequency of sessions, or dialysis duration as shown in **table (5).** Both MNA and SGA scores agreed that 32.6% of patients had malnutrition. SGA reported that 46.3% had moderate malnutrition while MNA reported that 48.4% at risk. Well-nourished were 21.1% and 18.9% according to SGA and MNA respectively. There was perfect agreement between both scores, among factors significantly correlated to MNA score and among different factors that significantly correlated with MNA score. The only independent factors were BMI (p<0.001) and serum albumin (p=0.004), as shown in **table (6).** There was a significant relationship between MNA score (as the dependent variable) and both the BMI (β = 0.978; p < 0.001) and serum albumin (β = 1.625; p=0.004) by using linear stepwise regression analysis as shown in **table (7).**

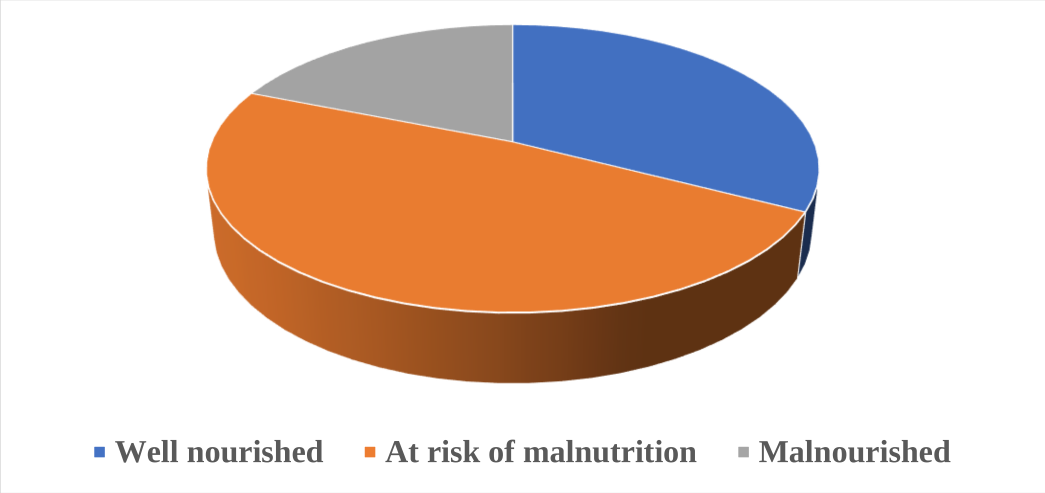

Figure (1): Pie chart showing distribution of the studied patients according to MNA

Table (1): Correlation between MNA score and both demographic data, relation between SGA score for nutritional status and demographic data

Parameters	**Groups MNA score**			**P**	
	Malnourished	**At risk of malnutrition**	**Well nourished**		
	N=18(%)	**N=46(%)**	**N=31(%)**		
Gender: Female Male	 14 (77.8) 4 (22.2)	 22 (47.8) 24 (52.2)	 14 (45.2) 17 (54.8)	0.047*	
			R	P	
Age (years)			-0.013	0.901	
BMI(kg/m2):			0.816	<0.001**	
	Groups SGA Score				
	A (well nourished)	B **(moderately unnourished)**	C **(severely unnourished)**		**P**
	N=31(%)	**N=44(%)**	**N=20(%)**		
Gender: Female Male	 14 (45.2) 17 (54.8)	 21 (47.7) 23 (52.3)	 15 (75) 5 (25)		0.056
	Mean ± SD	**Mean ± SD**	**Mean ± SD**		
Age (years)	49.35 ± 13.56	47.5 ± 13.26	48.4 ±16.91		0.856
BMI (kg/m2):	26.94 ± 1.5	23.05 ±1.56	19.2 ± 1.24		<0.001**
HSD	P_1 <0.001**	P_2 <0.001**	P_3<0.001**		

Table (2): Correlation between MNA score and hemolysis related data among the studied patients

Parameters	**Groups**			**Test**	
	Malnourished	**At risk of malnutrition**	**Well nourished**	χ^2	**p**
	N=18(%)	**N=46(%)**	**N=31(%)**		
Session duration: 4 hours 4.5 hours	 0 (0) 18 (100)	 1 (2.2) 45 (97.8)	 0 (0) 31 (100)	0.048	0.827
UOP: No Yes	 17 (94.4) 1 (5.6)	 43 (93.5) 2 (6.5)	 29 (93.5) 2 (6.5)	0.04	0.842
Sessions(/w) 2/W 3/W 4/W	 0 (0) 17 (94.4) 1 (5.6)	 1 (2.2) 45 (97.8) 0 (0)	 0 (0) 31 (100) 0 (0)	MC	0.347
			R	P	
Dialysis duration			0.236	0.022*	

Table (3): Correlation between MNA score and laboratory data among the studied patients

	MNA	
	R	**p**
TLC	-0.094	0.367
Platelet count (mcL)	-0.114	0.27
Hematocrit (g/dl)	0.57	<0.001**
S. ferritin (nmol/L)	0.147	0.155
CRP (mg/L)	-0.236	0.021*
TIBC (mg/dL)	-0.119	0.251
Transferrin saturation	0.191	0.064
Phosphorus (mg/dL)	0.071	0.496
PTH (ng/L)	0.1	0.333
S. creatinine (mg/dL)	0.081	0.436
BUN (mg/dL)	0.05	0.631
Total cholesterol (mg/dL)	-0.082	0.428
Triglycerides (mg/dL)	-0.123	0.235

Table (4): Relation between SGA score for nutritional status and laboratory data

Parameters	**Groups**			**p**
	A (well nourished)	**B (moderately unnourished)**	**C (severely unnourished)**	
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	
TLC	6.8±1.3	7.1±1.6	7.5±1.4	0.796
Platelet count (mcL)	204±49.8	224.5 ± 52.8	241.5 ±58.6	0.356
S. ferritin (nmol/L)	95±20.1	82.5±16.3	29.5±5.9	0.175
S. iron (µmol/L)	60 ±13.4	65 ± 14.8	51 ± 11.8	0.07
CRP (mg/L)	8 ± 1.6	4.69 ±0.92	13.42 ± 2.8	0.004*
Pairwise	P_1 0.843	P_2 0.003*	P_3 0.081	
TIBC (umol/L)	275 ±65.4	270 ± 59.3	310.5±74.9	0.471
Transferrin saturation	22.13 ±4.4	25.85±5.6	17.35±3.2	0.087
BUN (mg/dL)	60.4±9.6	63.6±10.3	60.25 ±9.3	0.751
S. creatinine (mg/dL)	9.67 ±2.3	10.48 ±2.3	8.6 ±1.8	0.107
PTH (ng/L)	347.5±74.1	313.2±45.3	152.55±34.6	0.296
Hemoglobin (g/dL)	13.2 ± 1.47	10.91 ± 1.68	7.73 ± 1.14	<0.001**
HSD	P_1 <0.001**	P_2 <0.001**	P_3<0.001**	
Hematocrit (g/dl)	37.35 ± 5.58	32.0 ± 5.5	24.05 ± 5.13	<0.001**
HSD	P_1 <0.001**	P_2 <0.001**	P_3<0.001**	
S. albumin (mg/dL)	4.05 ± 0.43	3.98 ± 0.34	3.58 ± 0.58	<0.001**
HSD	P_1 0.763	P_2 0.002*	P_3 0.001**	
T. cholesterol (mg/dL)	154.64 ± 34.49	164.05 ± 37.23	155.6 ± 26.21	0.442
Triglycerides (mg/dL)	130.68 ± 31.48	138.07 ± 33.95	140.25 ± 31.08	0.513
LDL.C (mg/dL)	100.1 ± 8.18	116.39 ± 12.14	123.65 ± 9.07	<0.001**
HSD	P_1 <0.001**	P_2 0.029*	P_3<0.001**	
HDL.C (mg/dL)	38.16 ± 6.14	37.61 ± 6.42	32.25 ± 4.41	0.015*
HSD	P_1 0.949	P_2 0.026*	P_3 0.021*	
Phosphorus (mg/dL)	4.64 ± 1.26	5.16 ± 1.61	4.24 ± 0.73	0.074
Calcium (mg/dL)	8.84 ± 0.93	8.72 ± 0.89	8.37 ± 0.89	0.199

- HSD: honestly significant difference

Table (5): Relation between SGA score for nutritional status and hemodialysis data

Parameters	Groups			Test	
	A (well nourished)	B **(moderately unnourished)**	C **(severely unnourished)**	**χ²/F**	**p**
	N=31(%)	**N=44(%)**	**N=20(%)**		
Duration of session:					
4 hours					
4.5 hours	0 (0)	1 (2.3)	0 (0)	0.026	0.873
	31 (100)	43 (97.7)	20 (100)		
UOP:					
No	29 (93.5)	41 (93.2)	19 (95)	0.031	0.859
Yes	2 (6.5)	3 (6.8)	1 (5)		
sessions(/w)					
2/W	0 (0)	1 (2.3)	0 (0)		
3/W	31 (100)	43 (97.7)	19 (95)	MC	0.114
4/W	0 (0)	0 (0)	1 (5)		
	Median(range)	**Median(range)**	**Median(range)**	KW	p
Dialysis vintage:	8 (0.5 – 25)	9 (0.67 – 23)	2.5 (0.83 – 28)	7.798	0.02

Table (6): Agreement of SGA and MNA in diagnosis of malnutrition

	sGA	MNA	Kappa	P
	N=95(%)	**N=95(%)**		
Well nourished	20 (21.1)	18 (18.9)		
Moderately unnourished/at risk	44 (46.3)	46 (48.4)		
Severely unnourished/ malnutrition	31 (32.6)	31 (32.6)	0.967	<0.001**

Table (7): Linear stepwise regression analysis of factors significantly associated with MNA score

	B	**Std. Error**	**Beta**			**Lower Bound**	**Upper Bound**
BMI (kg/m^2)	.978	.080	.753	12.272	<0.001**	.820	1.136
S.albumin (g/L))	1.625	.548	.182	2.966	0.004*	.537	2.713

DISCUSSION

The low nutritional status of patients with chronic kidney disease (CKD) can lead to poor clinical outcomes and quality of life as well as death **[7]**. Dietary status of individuals with CKD has been linked to mortality in several investigations, employing approaches like anthropometric measurements and biochemical evaluation **[8].**

Our study was conducted on 95 patients on regular hemodialysis from nephrology unit in Zagazig University Hospital. The age of patients ranged from 20 to 77 years with mean 48.29 years, males represented 47.4% of them and BMI ranged from 17 to 30 kg/m^2 with mean of 23.51 kg/m^2. In our study we found that, dialysis duration ranged from 0.5 to 28 years with mean 8.23 year. In a study by **Omari *et al.*** **[9]** found median dialysis age was three years, There were 59.2% of dialysis patients who had been on dialysis for lower than four years, and only 40.8% of HD patients who had been on dialysis for more than four years. Similarly, **Rezeq *et al.*** **[3]** reported that 37.9% of those with end-stage renal disease (ESRD) had been afflicted for more than five years.

In our study regarding the cause of renal failure, 48.4% of patients were hypertensive, 10.5% had drug-induced renal failure, 10.5% were diabetics and 8.4% had renal stones. About 99% of patients had duration session for 4 hours, 6.3% had UOP. Similarly, **Omari *et al.*** **[9]** reported the presence of at least one chronic comorbid condition (e.g., hypertension or diabetes) in more than 90% of individuals with end-stage renal disease.

Our study showed that 60% of patients were receiving alphacalcidol, 10.5% were receiving iron supplementation and 96.8% of patients were receiving calcium respectively. About 98% received Epirex, of them 48.4% and 43% received it twice a week and once a week respectively. In a study of **Omari *et al.*** **[9],** 60.9% of patients used four or more prescriptions, while 39.1% took fewer than four medications, according to the data collected.

In our study we found a statistically significant correlation between mini-nutritional assessment

(MNA) and gender. There was statistically significant positive correlation between MNA score and BMI (p value<0.001). Similarly in the study of **Koor *et al.* [10]**, there was a correlation between the MNA score, and the BMI appeared in both sexes. Similarly, **Ekramzade *et al.* [11]** found that malnourished hemodialysis patients had a lower BMI than their well-nourished counterparts. In contrast to our study, **Rogowski *et al.* [12]** revealed that a significant positive association was found between BMI exclusively in the case of female participants in the MNA scale.

In our study we found that there was statistically non-significant correlation between MNA score and age. In contrast, **Tawfik *et al.* [13]** compared to younger- and middle-aged patients and found that senior hemodialyzed chronic renal failure patients had a considerably greater rate of malnutrition.

In our study, we found statistically significant association between MNA score and dialysis time. Similarly, **Koor and colleagues [10]** and **Brzosko and colleagues [14]** established a link between the length of dialysis treatment and the likelihood of malnutrition in patients. Similar results are confirmed by **Freitas and colleagues [15]** who showed a substantial association between prolonged HD duration and a low nutritional state.

In our study we found that a statistically non-significant correlation between SGA and either gender or age. Similarly, **Rezeq *et al.* [3]** revealed no significant difference in SGA score based on gender (P = 0.303) and age (P = 0.054). In contrast to **Omari *et al.* [9]** that patients aged more than 60 years were found to be considerably more likely to be malnourished than those who were below 60 years (P =0.010).

In our study, we found a statistically significant positive correlation between mini-nutritional assessment (MNA) score and hemoglobin, hematocrit (p value <0.001), serum iron, serum calcium, serum albumin, and HDL cholesterol. There was statistically significant negative correlation between mini-nutritional assessment score and LDL cholesterol. Similarly, **Tawfik *et al.* [13]** revealed a significant decrease in HB level (p value 0.006), decrease of HCT level (p value 0.010), serum albumin (p value < 0.001), total protein level (p value < 0.001), creatinine level (p value < 0.001), residual renal function (p value 0.048), phosphate level (p value 0.005) and total cholesterol level (p value 0.011) among hemodialysis patients with malnutrition.

In our study, we found statistically non-significant correlation between SGA and TLC, platelet count, serum ferritin, serum iron, TIBC, transferrin saturation, total cholesterol, triglycerides and serum calcium & phosphorus. There was statistically significant relation between SGA and CRP (p=0.004), hemoglobin (p value<0.001), albumin, hematocrit (p value < 0.001), serum albumin (p value < 0.001), LDL (p value < 0.001) and HDL (p=0.015). These results are agreed with **Rezeq *et al.*[3]** who stated that no significant correlation was found between SGA score and calcium level (P=0.883), albumin (P =0.282), and phosphate level (P = 0.419). However, significant positive correlation was found between SGA core and hemoglobin level (P = 0.019; r = 0.227).

In our study we found that insignificant link existed between the mini-nutritional evaluation and alphacalcidol, weekly doses of Epirex and calcium, or iron supplements (statistically not significant). Using Epirex was associated with an increased risk of developing SGA. It was utilized by all patients with an A or B score, while just 10% of those with a C score received it.

In our study, both scores agreed that 32.6% of patients had malnutrition. SGA reported that 46.3% had moderate malnutrition while MNA reported that 48.4% were at risk. Well-nourished were 21.1% and 18.9% according to SGA and MNA respectively. There was perfect agreement between both scores. Similarly, **Oluseyi and Enajite [16]** discovered a 29% prevalence of malnutrition in hemodialysis patients. The study of **Tawfik *et al.* [13]** demonstrated a high frequency of malnutrition among the patients of Minia University's Hemodialysis Unit (40 percent).

CONCLUSION

In hemodialyzed patients, malnutrition is a prevalent occurrence. Several risk factors were associated with development of malnutrition among hemodialysis patients. In our study we found that several risk factors are associated with development of malnutrition including decline in kidney function, duration of hemodialysis and age but low BMI and low serum albumin levels were independent risk factors for malnutrition development. Early detection of malnutrition among hemodialyzed patients by using different malnutrition assessment modalities could improve outcome by reducing both morbidity and mortality related to malnutrition.

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