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Nutritional Status and Malnutrition Prevalence among Maintenance Hemodialysis Patients

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Abstract

Background*: Malnutrition of patients on maintenance hemodialysis (HD), is frequent and associated with increased risk of mortality and morbidity. Nutritional status is frequently ignored in many dialysis centers while simple methods of nutritional assessment could have a favorable impact on patient management.*

Aims*: To assess the nutritional status of patients undergoing hemodialysis and to assess the severity of malnutrition among those patients.*

Research Design: *A cross-sectional study conducted to assess the nutritional status and prevalence of malnutrition among patients undergoing hemodialysis*

Sample: *A total number of 478 patients from the three dialysis units at general hospitals in Assiut city /Egypt were included in the study*

Method: *Data was collected through the direct and indirect methods which include personal, diet, and health questions, diet and fluid compliance, Subjective Global Assessment (SGA), Anthropometric measurements and Laboratory evaluation.*

Results*: regarding patient fluid guidelines . They were at lowest point of omitting fluid guidelines thus; their deviations from fluid plan were also low. Considering that the possible range of total SGA scores falls between 7-35, Consistent with this result, the majority of patients (85. %) scored were moderate to severe level of malnutrition. The means for anthropometric measure were revealed normal scores. Albumin was at low level, but cholesterol level was at the optimal level. However, haemoglobin concentrations represented by the hematocrit percent revealed a deviated mean from normal values.*

Conclusion*: Most of the patients in this study had moderate to severe level of malnutrition, low albumen and hematocrit. For prevention, diagnosis, and treatment of malnutrition in patients with end stage of renal disease undergoing hemodialysis, continuous educational programs should be organized in order to educate patients with chronic renal failure who are on hemodialysis for correction of malnutrition; in addition, periodic nutrition assessment and provision of a detailed diet plan for each patient is very helpful.*

Keywords*: Hemodialysis patient, Malnutrition, Subjective Global Assessment.*

I. Introduction

End-stage renal disease (ESRD) is one of the main health problems in Egypt. Currently, hemodialysis represents the main mode for treatment of chronic kidney disease stage 5 (CKD5), previously called ESRD or chronic renal failure (Afifi 1999)

According to the most recent Egyptian renal registry in 2008, the prevalence of ESRD is 483 per million population and the total recorded number of ESRD patients on dialysis is 40000. Ninety-eight percent of these patients are on hemodialysis (HD) and are treated using about 3000 machines in just over 600 dialysis units, of which 25% are government run and 75% are private.(Mahmoud et al. 2010).

The presence of protein-energy malnutrition (PEM) is one of the strongest predictors of morbidity and mortality in end-stage renal disease (ESRD) patients receiving maintenance haemodialysis (HD) therapy (de Mutsert et al. 2008).

Malnutrition is considered a marker of poor prognosis in CKD (Shah et al. 2009). Several studies suggest that the prevalence of malnutrition in HDP varies dramatically across the world, ranging from under 10% to over 90% (de Mutsert et al. 2008)

The patients' nutritional status is inversely associated with increased risk of hospitalization and mortality; thus constituting an important risk factor for the outcome of these patients (Pupim, Cuppari et al. 2006) . Therefore, assessing the nutritional status of patients is essential both to prevent malnutrition and to indicate appropriate intervention in malnourished patients, as well as success of dialysis is dependent on adequate nutrition (Segall et al. 2009) .

Management of the nutritional aspects of chronic kidney disease (CKD) presents a number of challenges (Al Saran et al. 2011). With the development of a variety of clinically sensitive measures for detecting protein energy malnutrition PEM, studies worldwide have been performed for determining the prevalence of PEM in hemodialysis patient HDP. Several methods have been adopted for evaluating the nutritional status in HDP for malnutrition (MN), such as the subjective global assessment (SGA) (Steiber et al. 2004; Steiber et al. 2007), anthropometric parameters, biochemical blood/urine values, bioelectrical impedance analysis and dual energy X-ray absorptiometry. These methods vary from study to study due to ease of application, expense, availability and practicality. While some techniques may work well in research situations, they are often not practical in clinical situations because they require expensive equipment or too much time. Therefore, this study offers a recommendation for detecting MN economically by combining methods (e.g., SGA, anthropometric measures and biochemical blood/urine values) in a clinical setting (Saxena and Sharma 2004). Nutritional supplementation designed for haemodialysis, improved their nutritional status in the short term study (Roy et al. 2013).

The goal of this study was to determine, with an inexpensive nutritional assessment protocol, the prevalence of MN among HDP in an Assiut hemodialysis unit, located within the Assiut General Hospital in Assiut, Egypt. The protocol consisted of anthropometric measurements, a biochemical blood measurement and the seven-point SGA.

II. Aim of study

This study aims to assess the nutritional status of patients undergoing hemodialysis and to assess the severity of malnutrition among those patients.

III. Material and Method

Research Design:

A cross-sectional study was conducted to assess the nutritional status and malnutrition among patients undergoing hemodialysis.

Settings:

The study was conducted at the dialysis units in General Hospital of Assiut City which included (Assiut University , Menistry of health and Health insurance Hospitals).

Sample:

A convenience sample, compose of all patients (478) undergoing maintenance hemodialysis who agreed to participate in the study and were attended to at the dialysis units in Assiut hemodialysis units, located within the Assiut General Hospital in Egypt.

Tools:

Data collected through direct and indirect methods which include five parts:

Part I: Biosociodemographic Questions

Demographic parameters incorporate sex, age, marital status, education level, employment, income, and number of people living in the same household. The questions pertaining to health status include the number of years the patient has lived with kidney disease, the number of years on hemodialysis, the medications he/she had been taking, and the presence or absence of co-morbid diseases.

Part II: Dietary and fluid adherance was developed by(Vlaminck et al. 2001)

To assess diet and fluid compliance, the validated Dialysis Diet and Fluid Non-Adherence questionnaire was administered. The instrument includes four questions. The first question asks how many days the patient did not follow the diet guidelines in the past 14 days, and the patient responds with a number. In the second question, the items are assessed on a five-point Likert scale (0 = no deviation, 1 = mild deviation, 2 = moderate deviation, 3 = severe deviation, 4 = very severe deviation). Similar questions are posed to the patient regarding fluid guidelines.

Part III: Subjective Global Assessment (SGA) was developed by (Kalantar-Zadeh et al. 1999) :

Total nutritional scoring for each patient, assessed by means of modified quantitative SGA was performed on all dialysis patients using modified SGA-Dialysis Malnutrition Score.

Subjective Global Assessment (SGA) has seven components which are: change in weight, dietary history, gastrointestinal symptoms, functional capacity, co morbidities, and assessment of subcutaneous fat and signs of muscle wasting. Each component has a score between one (normal) to five (very severe).

Scoring System:

a total score between 7 and 35. Patients having score 7-10 are considered as well nourished patients. 11-22 are considered as having mild to moderate malnutrition. Likewise score between 23 and 35 are considered as severely malnourished. The scoring sheet, consist of two parts and seven elements as described above.

Part IV: Anthropometric measurements:

Measurements of body mass index (BMI), (height, body weight and skin fold thickness) were done after completion of the dialysis session. Triceps skin fold (TSF) thickness was measured using skin fold caliper. Mid arm circumference (MAC) was measured using an inch tape. Measurements were performed three times on the non-access arm of each dialysis patient and the average result of the three measurements was registered as the final MAC value. MAMC was calculated using the formula MAMC=MAC-(3.14×TSF). MAMC percentage was calculated with the standard formula (MAMC% = MAC/ 50th 0× 100)0 and interpreted using the following standards (>85% - 0 acceptable; 76-85%- mild depletion; 65-75% -moderate depletion; <75%- severe depletion) (Saxena and Sharma 2004).

Part V: Laboratory evaluation

The following laboratory parameters were measured on all patients after the dialysis session: Serum albumin is obtained, as several studies have demonstrated that albumin is a valid indicator of nutritional status in HDP**.** According to the National Kidney Foundation (NKF), serum albumin equal to or greater than 4 g/dL is the outcome goal for HDP. All albumin values were categorized into either optimal (≥4 g/dL) or sub-optimal (<4 g/dL) (Pereira 2000; Kopple 2001). Also, hematocrete , cholesterol, creatinine and blood urea nitrogen.

Procedure:

An approval for the study was granted before starting the subject's recruitment process. The approval was obtained from the administrators of the selected hospitals. A cover letter that explains the purpose of the study and the study questionnaire was sent to the administrator of these health care institutions.

Explaining the purpose of the study and assuring the confidentiality of all participants, a verbal informed consent was obtained from each participant.

Data were collected in two phases: pre-dialysis and post-dialysis. During the pre-dialysis phase the patient was asked questions from the Personal, Diet, and Health Questionnaire. With the patient's permission, the patient's file was examined to acquire the necessary anthropometric and biochemical data such as height, pre-dialysis weight, and post-dialysis dry weight from the previous dialysis treatment, as well as serum albumin. The second phase of the data collection commenced after dialysis. The 7-point SGA was completed and the anthropometric measurements was obtained.

A pilot study was carried out on ten patients from -patient to ensure the clarity and applicability of the tool or make any modification and those not included in the study.

IV. Results

Biosociodemographic Characteristics:

A total of 478 patients from three dialysis units in Assiut / Egypt were included in the study. As shown in Table 1, the majority of participants were male (62.2%), aged between 35 and 54 years old, married (73.2%), hold a school degree of education (38.9%), unemployed (51.7%), and live in a family consists of 3 to 5 members (44.1%). While all of them suffer from kidney disease, the majority of them was diagnosed with this illness for a duration between 1 to 5 years and likewise have been on hemodialysis over the same duration. Regarding the presence of other chronic illnesses, 59.6% revealed no other illnesses while the rest having other illnesses. In relation to the adherence to the dietary regimen, the majority (76.8%) claimed adherence to the diet plan. (Table 1)

Adherence to fluid and dietary regimen

In this part, participants showed their adherence and non-adherence to fluid and diet plans. As appeared in Table 2, patients revealed minimal deviation from dietary guidelines in the past 14 days, which was also compatible with their perception towards deviation from guidelines (mean 168 out of 4). Similarly, patients were asked about their adherence to fluid guidelines. They were at the lowest point of omitting fluid guidelines thus; their deviations from fluid plan were also low. (Table 2)

Summary of nutritional status

As mentioned before, Subjective Global Assessment (SGA) was used to assess nutritional status. Considering that the possible range of total SGA scores falls between 7-35, patients showed a moderate nutritional level represented by mean of total SGA score (mean= 14.61). Consistent with this result, the majority of patients (81.6%) scored a moderated level of malnutrition when classifying SGA into their nutritional levels, in which this category has allocated SGA scores between 11 and 22. However, 71 patients (14.9%) came in the second rank to reveal good nourishment, thereby, scores of this SGA category fall between 7 and 10. While few of the patients (3.6%) exhibited severe malnutrition as their scores assumed to be between 23 and 35. (Table 3)

Biophysical and biochemical measurements

Patients who involved in the study were subject to a number of biophysical and biochemical measurements as shown in Table 4. The mean for the BMI for all participants was 24.56. While it seems acceptable, TSF, MAC, and MAMC were also measured and revealed normal scores. Regarding biochemical investigations, it was noted that kidney function indicates abnormal scores due to end-stage renal disease. Albumin was at low level, but cholesterol level was at the optimal level. However, haemoglobin concentrations represented by the hematocrit percent revealed a deviated mean from normal values (men: 42-54%, women: 38-46%) indicating poor Erythropoiesis process (the process of red blood cell formation). This physiological process is heavily relying on the concentration of Erhthropoietin hormone supplemented during haemodialysis. (Table 4)

Comparing SGA total score with demographics

As a main study inference, SGA was also compared to different demographical characteristics of the patients. The first comparison was applied to the type of hospital where the study was conducted. There was a statistical difference between these settings in which the mean of SGA was lower in the health insurance hospital compared to other settings (Table 5). Regarding gender, female participants showed a significantly higher SGA scores than male patients showing a statistical difference ($p<0.001$). In relation to age categories, older patients (55 years old and more) had the highest SGA scores compared to younger participants. However, it was evident that SGA scores increase while age increases (Table 5). Similarly, SGA scores were significantly higher in those patients with longer past history of kidney disease and longer duration of haemodialysis, which also increased gradually over time (Table 5). The last comparison was conducted based on the commitment to the dietary regimen. Patients who claimed adherence to the dietary regimen for renal disease scored significantly lower SGA score than those who did not. (Table 5)

V. Discussion

There is an increasing incidence and prevalence rate of patients on hemodialysis worldwide. In Egypt, the estimated number of patients with ESRD almost doubled, from 18,000 in year 2000 to 33,693 in 2009 (Mohamed 2009).

Malnutrition is common and associated with increased morbidity and mortality in hemodialysis patients (Kalantar-Zadeh et al. 2003). In this study, we investigated the nutritional status in patients on HD at the dialysis units of general hospital in Assiut city, based on adherence and non-adherence to fluid and dietary plans, biophysical, biochemical measurement and Subjective Global Assessment (SGA).

In relation to the adherence to the dietary regimen, the majority of patients claimed adhering to the dietary guidelines in the past 14 days**.** Similarly, patients were asked about their adherence to fluid guidelines. They were at the lowest point of omitting fluid guidelines thus; their deviations from fluid plan were also low.

It has been reported that 28-78% of HD patients fail to adhere to prescribed diet and limiting fluid intake (Vlaminck et al. 2001; Durose et al. 2004). The non-adherence in current study may be related to several factors such as a rigid and complex diet that affected patient's food preferences and altered lifestyle, patient's perception of the usefulness of therapeutic diet was outweighed by the traditional beliefs, and patient did not ask questions about the diet or fluid restrictions either because he/she was embarrassed or did not have enough knowledge to know what to ask. Also diet and fluid non-adherence in this study may be due to the low educational level of the patients as they may not have understood the dietary and fluid restrictions and the significance of those restrictions. As these patients were poor and lived with more than three family members, their ability to cook and follow a restricted diet may have placed a burden on the patient's family who may not recognize the significance of following a special diet. In addition, since information about the diet and fluid restrictions is communicated verbally without written instructions the patients may have forgotten the details of the diet and fluid prescription contributing to lack of adherence. The absence of a dietitian at this center may be a factor in the high number of patients not adhering to their diet and fluid restrictions, as consistent and frequent nutrition education and counseling is not provided to these patients.

Regarding biochemical investigations it was noted that hemoglobin concentrations represented by the hematocrit percent revealed a deviated mean from normal values.

Observational data from the United States Renal Data System (USRDS) (Xia et al. 1999) suggested that dialysis patients with hematocrit (Hct) > 39%, which is "normal" in the general population, had better outcomes than dialysis patients in the Hct target range of 33%-36% recommended by the 1997 National Kidney Foundation (NKF) and Dialysis Outcomes Quality Initiative (DOQI) guidelines (Levin et al. 1997)**.** On the other hand (Hsu et al. 2001) concluded that a decrease in hematocrit is apparent even among patients with mild to moderate renal insufficiency.

Considering that the possible range of total SGA scores falls between 7-35, patients showed a moderate nutritional level represented by mean of total SGA score (mean= 14.61). Consistent with this result, the majority of patients (85. %) scored a moderated to sever level of malnutrition**.**

A results of study by (Yang et al. 2007), patients were divided into a well-nourished group and a malnourished group based on SGA, and the characteristics of each group was represented that twenty-six patients (52%) were well-nourished, whereas 24 patients (48%) were malnourished. In Addition (Espahbodi et al. 2014) stated that among 105 patients, 98 (93.33%) patients consisted of 56 males and 42 females had mild to moderate malnutrition and 3 (2.86%) women had severe malnutrition. Also a study by (Tayyem et al. 2008) and concluded that clinically, the combined prevalence of malnutrition in the present study (moderately malnourished and severely malnourished), at approximately 62% in both groups of study participants, indicates the urgent need for a strict nutritional and dietary counseling program, to help and advise patients on the most basic ways to improve their nutritional status and to better assess the quality of their hemodialysis. This makes it necessary to assess the nutritional status of renal failure patients periodically and take measures to prevent protein energy malnutrition.

Regarding gender and SGA scores, female participants showed a significantly higher SGA scores than male patients showing a statistical difference**.** A significant difference was detected between male and female HDP in the original SGA grades, as a higher proportion of males (76.2%) were malnourished when compared to 48.9% malnourished females (Tayyem and Mrayyan 2007) **.**

In relation to the age categories, older patients had the highest SGA scores compared to younger participants. However, it was evident that SGA scores increase while age increases. A study by (Yang et al. 2007) reveled that there were no statistically significant differences in age, height, weight, gender distribution, causes of hemodialysis, duration of hemodialysis, between the well-nourished group and the malnourished group on the other hand (Espahbodi et al. 2014) did not find any significant association between SGA score and patients' age**.** (Burrowes et al. 2002) compared the nutritional status of 3 groups of HD patients of different age groups and observed that patients older than 50 years presented inadequate calorie and protein intake, lower levels of nutritional markers, and higher co morbidity indices in relation to younger patients.

We found also that the mean of SGA was significantly lower in the health insurance hospital compared to public or university settings. This difference in the severely malnourished category in our study may be explained in terms of economics and education. Typically, less educated participants were also found to be at a lower socioeconomic level. Hence, these individuals were more likely to be reliant on public treatment facilities. These participants may not have been very fastidious regarding their diets, and more importantly, their economic position adversely affected their ability to procure the proper types of food necessary for their diets

Based on the commitment to the dietary regime, this results showed that patients who claimed adherence to the dietary regimen for renal disease scored significantly lower SGA score than those who did not. This results supported by results of study conducted by (Mohsen et al. 2013) and revealed that improvements of the physical examination and laboratory findings could be attributed to the intervention, including dietary counseling. This could help the patients in controlling the fluid intake, which would have a positive effect on the general health.

VI. Conclusion

The nutritional status in patients on HD needs more attention. Regular periodic assessment of nutritional status based on the MS allows implementation of preventive interventions, such as nutritional counseling or psychosocial interventions, as well as the use of dietary supplements, in order to decrease patients' mortality and morbidity.

In conclusion, SGA of the nutritional status appears to be simple to use and correlates strongly with other parameters of nutrition in hemodialysis patients. This assessment

tool is also beneficial for hemodialysis patients who are at a greater risk of nutrition-associated mortality.

VII. Recommendation

We recommend that for prevention, diagnosis, and treatment of malnutrition for patients with ESRD undergoing hemodialysis, continuous classes should be organized in order to educate patients with chronic renal failure who need hemodialysis about correct nutrition; in addition, periodic nutrition consultations with a dietician and the provision of a detailed diet plan for each patient is very helpful. Conducting similar studies periodically to follow up the nutritional status of patients and the success rate of interventions as well as conducting studies to assess other methods and markers, which evaluate nutrition more accurately.

Table 1: Patients Bio-socio-demographic Characteristics (n=478)

Type of Hospital	Assiut University	293 (61.3%)
	Menistry of Health	83 (17.4%)
	Heath Insurance	102 (21.3%)
Sex	Male	299 (62.6%)
	Female	179 (37.4%)
Age	18 -34 years	102 (21.3%)
	35- 54 years	218 (45.6%)
	55 years and above	158 (33.1)
Marital Status,	Married	350 (73.2%)
	Not married	128 (26.8%)
Level of education	None	157 (32.8%)
	Primary education	186 (38.9%)
	University and above	135 (28.2%)
Employment	Employed	231 (48.3%)
	Unemployed	247 (51.7%)
Family member	Less than 3	117 (24.5%)
	3-5 persons	211 (44.1%)
	More than 5	150 (31.4%)
Duration of having kidney disease	Less than 1 year	109 (22.8%)
	1-5 years	206 (43.1%)
	5 years and more	163 (34.1%)
Duration of haemodialysis	Less than 1 year	92 (19.2%)
	1-5 years	220 (46.0%)
	5 years and more	166 (34.7%)
Associated chronic illness	Yes	193 (40.4%)
	No	285 (59.6%)
Following a dietary regimen	Yes	367 (76.8%)
	No	111 (23.2%)

Table 2: Mean and Stander Deviation (SD) of Patient related to Adherence to Fluid and Dietary Regimen (n=478)

Items	**Mean**	**SD**
How many days during the past 14 days you didn't follow your dietary guidelines?	1.66	1.18
To what extent you believe your deviation from the dietary guidelines?	1.68	1.19
How many days during the past 14 days you did not follow your fluid guidelines?	1.73	1.26
To what extent you believe your deviation from the fluid guideline?	1.71	1.24
Scores for questions ranged from 0-No Deviation, 1- Mild, 2-Moderate, 3-Severe, 4-Very Severe		

Table 3: Summary of Subjective Global Assessment (SGA) (n=478)

Items	**No.**	**%**
Well nourished	71	14.9%
Moderated malnutrition	390	81.6%
Severe malnutrition,	17	3.6%
Total SGA score, mean, SD**14.61 ±3.86**		
Total	**478**	**100%**

Table 4: laboratory results investigation for patient on hemodialysis (n=478)

	mean	**SD**
Body mass index (BMI)	24.56	3.78
Triceps skin fold thickness (TSF)	9.71	2.78
Mid-arm circumference,(MAC)	24.65	5.18
Mid-arm muscle circumference (MAMC)	20.91	6.65
Blood urea nitrogen (mg/dL)	127.10	20.21
Serum creatinine (mg/dL)	5.89	3.67
Serum Albumin (g/dL)	3.28	0.86
Hematocrit (%)	30.67	4.67
Cholesterol (mg/dL)	81.32	17.47

Table 5: Comparing SGA total score with demographics (n=478)

	mean	SD	df	F	Sig.
Type of hospital					
Assiut University	14.88	3.66	2	11.849	<0.001
Ministry of Health	15.50	3.82			
Health Insurance	13.13	3.10			
Sex					
Male	14.07	3.58	1	15.702	<0.001
Female	15.50	4.14			
Age					
18 -34 years	13.26	3.32	2	14.592	<0.001
35- 54 years	14.39	3.62			
55 years and above	15.78	4.19			
Duration of having kidney disease					
Less than 1 year	13.26	3.37	2	14.774	<0.001
1-5 years	14.41	3.61			
5 years and more	15.75	4.14			
Duration of haemodialysis					
Less than 1 year	12.76	3.0	2	20.186	<0.001
1-5 years	14.47	3.69			
5 years and more	15.81	4.08			
Following a dietary regimen					
Yes	13.91	3.77	1	4.625	0.032
No	14.81	3.87			

SGA: Subjective Global Assessment, SD: Standard deviation, df: degree of freedom, F: F statistic

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