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The Prevalence of Malnutrition and Associated Factors Among Hemodialysis Patients at Al-Shifa Medical Complex in Gaza Strip, Palestine

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Abstract

Background and Objectives: Malnutrition is highly prevalent worldwide among hemodialysis patients and is one of the strongest predictors of morbidity and mortality. This study was conducted to estimate the prevalence of malnutrition and to determine the related demographic socioeconomic factors associated with malnutrition indicators among hemodialysis patients at Al-Shifa Medical Complex in Gaza Strip, Palestine.

Methods: This cross-sectional study was conducted among 60 hemodialysis patients (both gender, aged 19-59 years on regular hemodialysis for at least 6 months) receiving care at Al-Shifa Medical Complex in Gaza Strip, Palestine. Patients were assessed using anthropometric indices, physical examination, biochemical tests and a structured questionnaire. Statistical analysis was performed using SPSS version 20.

Findings: Approximately two-thirds of hemodialysis patients showed biochemical malnutrition indicators. These includes hypoalbuminemia 66.7%, low predialysis serum creatinine 65%, low serum cholesterol 61.7% and low body mass index (BMI), where, 45.0% of the patients had BMI less than the recommended BMI (23.8 kg/m²) for hemodialysis patients. Malnourished patients and those with lower serum albumin had significantly higher rate of emergency department visits and number of admission days to the hospitals over a year ($P<0.05$). Furthermore, we found a significant positive association between age, marital status, monthly income and BMI ($P<0.05$).

Conclusions: Our results showed that malnutrition is highly prevalent among hemodialysis patients and closely related to morbidity and mortality. Furthermore, sociodemographic and economic factors contribute to this higher percentage of malnutrition.

Keywords: Chronic kidney disease, Hemodialysis, Malnutrition, Palestine

Background and Objectives

The prevalence of chronic kidney disease (CKD) is rising worldwide.[1] The global patient population with CKD continues to grow at the rate of 7 percent per year due to demographic transition, increase in diseases leading to CKD and increased availability of diagnostic and therapeutic facilities.[2] The most common causes of CKD are diabetes mellitus, hypertension and glomerulonephritis. Together, these cause approximately 75% of all adult cases.[3] CKD constitutes an important health problem in the Palestine. In the West Bank and Gaza Strip, the number of patients on regular dialysis increased from 482 in 2004 to 613 cases in 2005, the most common causes for CKD in Palestine are glomerulonephritis and diabetic nephropathies.[4] Renal failure was reported as the 10th leading cause of death among Palestinian population and composed 4% of leading causes of death in Palestine; it was considered as the sixth leading cause of death among adults aged 20-59 years and the seventh leading cause of death among strikethrough aged 60 years and older.[5] The hemodialysis services in Palestine were initiated in 1972. There are 14 functional hemodialysis centers in Palestine, ten in the West Bank and four in Gaza Strip.[6] According to the Palestinian Ministry of Health in 2011, the number of patients on regular hemodialysis in Gaza Strip was 360.[6] In 2015, there are about 428 patients who are maintained on regular hemodialysis in Gaza Strip; about 240 patients are in the hemodialysis unit at Al-Shifa Medical Complex, which has 36 hemodialysis machines.[7] Protein energy

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malnutrition (PEM) is highly prevalent among patients with advanced CKD and those undergoing maintenance dialysis therapy worldwide. Different reports suggest that the prevalence of this condition varies from roughly 18% to 70% of adult maintenance dialysis patients.[8] In addition, the presence of PEM is one of the strongest predictors of morbidity and mortality.[8] Several studies assessed PEM in hemodialysis patients by using single or combination of methods.[9,10] However, a combination of valid and complementary methods should be performed to assess PEM in hemodialysis patients, since a single method does not provide complete indicators of PEM status. Also, a combination of methods can measure PEM with greater sensitivity and specificity.[8] Several methods have been adapted to evaluate nutritional status in hemodialysis patients for PEM, such as the subjective global assessment, anthropometric measurements, biochemical tests, 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; however, a single accepted best-practical method of PEM detection does not exist. While some techniques may work well in research situations, they are often not practical in clinical situations because they require either expensive equipment or too much time. Therefore, applying multiple methods such as anthropometric indices including dry weight and height, physical examination, biochemical tests and demographic socioeconomic and medical history questionnaire to comprehensive assessment of the nutritional status of patients are warranted. Patients beginning hemodialysis have a high incidence rate of malnutrition; because, their disease has progressed overtime till the end stage organ failure. Malnutrition often exists despite ongoing efforts to optimize dietary regimens and is one of the main risk factors for morbidity and mortality in these patients. To our knowledge, there was no study which have been conducted to investigate the prevalence of malnutrition among hemodialysis patients in Gaza Strip, Palestine. Our study was conducted to estimate the prevalence of malnutrition among hemodialysis patients and to determine the association of sociodemographic and economic factors with malnutrition indicators among hemodialysis patients of age from 19-59 at Al-Shifa Medical Complex in Gaza Strip, Palestine.

Methods

Study Design and Sampling Technique

This cross-sectional study was conducted in 2015 among a representative sample of Palestinian hemodialysis patients. Equal numbers of males and females were included in the study. Subjects were randomly selected using the systemic random sampling method. The total sample size was calculated according to Epi Info program, 2008 as 240 patients, with an expected frequency of 30%, a worst acceptable frequency of 20%. The sample size equals 60 patients at 95% confidence level. We recruited 60 patients with end stage renal disease, aged 19-59 years on regular hemodialysis for at least six months receiving care at Al-Shifa Medical Complex in Gaza Strip, Palestine. This hospital had the biggest dialysis center in Gaza Strip with 36 machines and more than 240 patients. Patients with other types of acute illness, such as pneumonia, acute myocardial infarction or septicemia, patients with depression, patients <19 and >59 years old and patients on hemodialysis for <6 months were excluded from the study.

Assessment of Anthropometric Measurements

Height was measured in all patients (cm), with the patients bare footed and head upright, with a measuring rod attached to the balanced beam scale, the height was reported to the nearest 0.5 cm. Dry weight in dialysis patients is the weight at the end of dialysis treatment. Weight (kg) was measured using standard scale (Seca): the scale was placed on a hard-floor surface, patients was asked to remove their heavy outer garments, and weight was measured and recorded to the nearest 0.1 kg. The BMI was calculated by dividing weight in kilograms by the square of height in meters. BMI was classified into two categories according to the National Kidney Foundation cutoff points.[8]

Biochemical Analysis

After 12 hours, fasting, predialysis venous blood samples were collected from all patients in the dialysis unit at Al-Shifa Medical Complex, by well-trained and experienced nurses. Venous blood (4.0 mL) was drawn into vacationer tubes and was used for blood chemistry analysis. Serum was separated immediately and the extracted serum was investigated for (albumin g/dL, creatinine mg/dL and cholesterol mg/dL). Mindray BS-300 chemistry analyzer instrument was used for blood chemistry analysis. The laboratory tests were analyzed in private licensed laboratory.

Physical Examination

Predialysis blood pressure (BP) was measured from left arm (mm Hg), by mercury sphygmomanometer, three readings on different days; while the patient seated, after relaxing for at least 15 minutes in a quiet environment, empty bladder and the average of three measurements

was recorded. BP was classified according to the American Heart Association (AHA) cutoff points.[11]

Interview Questionnaire

Comprehensive information on patients was collected using a structured questionnaire. Patients were personally interviewed on their demographic socioeconomic backgrounds and medical history data. Pilot study was carried out on ten patients to enable the researcher to examine the tools of the study in term of acceptability, applicability and time frame. Questionnaire and data collection process was modified according to the result of the pilot study. The data was collected by some qualified data collectors (5 nurses) who were given explanation and training by the researcher about the study: its purpose, objectives, procedures and how to distribute and collect the questionnaires with respect to confidentiality.

Statistical Analysis

All statistical analyses were performed using statistical package for social science (SPSS) version 20. Descriptive data were expressed as mean and standard deviation (SD). The chi-square test was used to examine difference in the prevalence of different categorical variable. *P* value less than 0.05 was considered as statistically significant.

Ethical Considerations

The study protocol was approved by the Ethics Committee of Al Azhar University of Gaza and by the Palestinian Health Research Council (Helsinki Ethical Committee of Research). Written informed consent was also obtained from each participant.

Results

Demographic Socioeconomic Characteristics of the Study Population

A total of 60 hemodialysis patients aged 19-59 years old; on regular hemodialysis for at least 6 months (50% male, 50% female) were included in this study. All patients were from Gaza city. Table 1 presents the distribution of the study population by sex in relation to the demographic socioeconomic variables. Our findings demonstrate that the mean age (years) for patients is 46.87±12, the majority of the patients (80%) were unemployed and most patients (81.7%) were married. With respect to the educational level, only (20%) of the patients had university level of education. Large percentage of patients (58.3%) with a large family size (more than 5 members). Also, the collected data demonstrated that most of the patients (63.3%) had a family income of less than 1000 NIS per month, most of the patients (73.3%) were not satisfied

Table 1. Distribution of the Study Population by Sex in Relation to the Demographic Socioeconomic Variables

Variables		Male (n = 30)		Female (n = 30)		Total (n = 60)		*P* Value
		No.	%	No.	%	No.	%	
Age (y) Mean ± SD: 46.87±12	< 30	4	50.0	4	50.0	8	13.4	0.172
	30-44	4	28.6	10	71.4	14	23.3	
	45-59	22	57.9	16	42.1	38	63.3	
Job	Yes	9	69.2	4	30.8	12	20.0	0.117
	No	21	44.7	26	55.3	48	80.0	
Marital status	Married	26	53.1	23	46.9	49	81.7	0.317
	Unmarried	4	36.4	7	63.6	11	18.3	
Education level	Illiterate	3	30.0	7	70.0	10	16.7	0.236
	Elementary	3	33.3	6	66.7	9	15.0	
	Secondary	16	55.2	13	44.8	29	48.3	
	University	8	66.7	4	33.3	12	20.0	
Family number	≤5	11	44.0	14	56.0	25	41.7	0.639
	6-10	14	51.9	13	48.1	27	45.0	
	>10	5	62.5	3	37.5	8	13.3	
Monthly income (NIS)	<1000	20	52.6	18	47.4	38	63.3	0.412
	1000-2000	6	37.5	10	62.5	16	26.7	
	>2000	4	66.7	2	33.3	6	10.0	
Income meets the needs	Yes	6	37.5	10	62.5	16	26.7	0.243
	No	24	54.5	20	45.5	44	73.3	
BMI (kg/m²) Mean ± SD: 25.83±6.7	BMI ≥23.8 kg/m²	15	45.5	18	54.5	33	55.0	0.436
	BMI <23.8 kg/m²	15	55.6	12	44.4	27	45.0	

Abbreviations: SD, standard deviation; BMI, body mass index.
Descriptive statistics, crosstabs, the chi-square test was used to examine difference in the prevalence of different categorical variable. *P* value less than 0.05 was considered as statistically significant.

with their income and reported that, their income did not meet their basic needs. In addition, BMI was classified according to the National Kidney Foundation cutoff point, which recommends that, the body mass index (BMI) of hemodialysis patients should be maintained in the upper 50th percentile, which would be 23.6 to 24.0 kg/m² for men and women. The midpoint of this range (23.8 kg/m²) is considered the best range for survival in hemodialysis patients.[8] The results showed that 45.0% of the patients had BMI less than the recommended BMI (23.8 kg/m²) for hemodialysis patients. Furthermore, no significant association was found between demographic socioeconomic factors and gender ($P > 0.05$).

Biochemical Indicators of Malnutrition Among the Study Population

The National Kidney Foundation Guidelines on CKD recommends that: Serum albumin (<4 g/dL), serum creatinine (<10 mg/dL) and serum cholesterol (<165 mg/dL) as clinically valid indicators in assessing the prevalence of malnutrition in hemodialysis patients.[8] Table 2 represents the study population by sex in relation to biochemical indicators of malnutrition. The obtained results show that the majority of the patients (66.7%) had serum albumin <4.0 g/dL, 65.0% with serum creatinine <10 mg/dL and 61.7% with serum cholesterol <165 mg/dL. These values are lower than the recommended standards for hemodialysis patients, and indicate the prevalence of malnutrition among hemodialysis patients at Al-Shifa Medical Complex in Gaza Strip, Palestine. In addition, no significant association was found between biochemical indicators of malnutrition and gender ($P > 0.05$).

Medical History of the Study Population

The distribution of the study population by sex in relation to medical history variables is shown in Table 3. Our findings demonstrate that, 38.3% of the patients visited the emergency department (1-5 times) during the last year, large percentage of patients (45%) were admitted to the hospital within the last year, 25% of them spent 1-10 days in the hospital. Table 3 also shows that 26.7% of the patients have been on dialysis for more than 5 years; duration of hemodialysis sessions lasted for 4 hours for most patients (80%). Most of the patients (78.3%) had 3 hemodialysis sessions per week, 75.0% of hemodialysis patients had hypertension (73.3% of male, 76.6% of female). No significant association was found between medical history variables and gender ($P > 0.05$).

Association of Malnutrition Indicators With Demographic Socioeconomic Variables

Table 4 presents the association of malnutrition indicators (serum albumin, creatinine, cholesterol and BMI) with demographic socioeconomic variables among hemodialysis patients. We found a significant positive relationship between BMI and age of the patients ($P < 0.001$, $r = 0.489$). A significant positive relationship was also observed between BMI and marital status ($P < 0.001$, $r = 0.437$), and monthly income ($P = 0.018$, $r = 0.080$). No significant correlation was found between BMI and patient's gender, job status, educational level, family number ($P = 0.436$, 0.925, 0.067 and 0.979 respectively). Furthermore, no significant association was found between serum albumin, creatinine, cholesterol and demographic socioeconomic factors ($P > 0.05$).

Correlation between Malnutrition Indicators and Medical History Variables

Table 5 shows the correlation between malnutrition indicator (serum albumin, creatinine, cholesterol and BMI) and medical history variables. A significant negative relationship was found between albumin and number of visits to emergency department over a year ($P = 0.009$, $r = -0.277$), and the number of admission days to hospitals over a year ($P = 0.002$, $r = -0.184$). On the contrary, no significant correlation was found between albumin and length (years) of hemodialysis; duration of hemodialysis sessions (hours) and number of hemodialysis sessions

Table 2. Distribution of the Study Population by Sex in Relation to Biochemical Indicators of Malnutrition

Variables	Mean ± SD		Males		Females		Total		*P* Value
			No.	%	No.	%	No.	%	
Serum albumin (g/dL)	3.86 ± 0.39	<4.0	18	45.0	22	55.0	40	66.7	0.273
		≥4.0	12	60.0	8	40.0	20	33.3	
Serum creatinine (mg/dL)	9.43 ± 2.1	<10	16	41.0	23	59.0	39	65.0	0.058
		≥10	14	66.7	7	33.3	21	35.0	
Serum cholesterol (mg/dL)	179.98 ± 60	<165	22	59.5	15	40.5	37	61.7	0.063
		≥165	8	34.8	15	65.2	23	38.3	

Abbreviation: SD, standard deviation.
Descriptive statistics, crosstabs, the chi-square test was used to examine difference in the prevalence of different categorical variable.
P value less than 0.05 was considered as statistically significant.

Table 3. Distribution of the Study Population by Sex in Relation to Medical History Variables

Variables		Male		Female		Total		*P* Value
		No.	%	No.	%	No.	%	
No. of visit to emergency department over a year	No. visit (0)	15	44.1	19	55.9	34	56.7	0.236
	1-5 times	14	60.8	9	39.2	23	38.3	
	6-10 times	1	33.3	2	66.7	3	5.0	
Admission days to the hospitals over a year	No admission (0)	14	42.4	19	57.6	33	55.0	0.723
	1-10	9	60.0	6	40.0	15	25.0	
	11-30	5	62.5	3	37.5	8	13.3	
	31-90	2	50.0	2	50.0	4	6.7	
Length of hemodialysis (y)	>6 months but <1	3	75.0	1	25.0	4	6.7	0.284
	≥1 year but <2	1	12.5	7	87.5	8	13.3	
	≥2 years but <3	10	50.0	10	50.0	20	33.3	
	≥3 years but <5	7	58.3	5	41.7	12	20.0	
	>5	9	56.2	7	43.8	16	26.7	
Duration of hemodialysis sessions (h)	3	2	50.0	2	50.0	4	6.7	0.747
	3.5	5	62.5	3	37.5	8	13.3	
	4	23	47.9	25	52.1	48	80.0	
Hemodialysis sessions per week	2 times	6	50.0	6	50.0	12	20.0	0.600
	3 times	23	48.9	24	51.1	47	78.3	
	4 times	1	100	0	0.0	1	1.7	
Blood pressure (mm Hg)	Normal	8	53.3	7	46.7	15	25.0	0.766
	Hypertension	22	48.9	23	51.1	45	75.0	

Descriptive statistics, crosstabs, the chi-square test was used to examine difference in the prevalence of different categorical variable. *P* value less than 0.05 was considered as statistically significant.

Table 4. Association of Malnutrition Indicators (Albumin, Creatinine, Cholesterol and BMI) with Demographic Socioeconomic Variables

Variables		Albumin <4.0 g/dL, ≥4.0 g/dL	Creatinine <10 mg/dL, ≥10 mg/dL	Cholesterol <165 mg/dL, ≥165 mg/dL	BMI ≥23.8 kg/m², <23.8 kg/m²
		P Value	*P* Value	*P* Value	*P* Value
Age (y)	< 30 30-44 45-59	0.405	0.149	0.137	0.001 r-value = 0.489
Gender	Male Female	0.273	0.058	0.063	0.436
Job	Yes No	0.375	0.718	0.055	0.925
Marital status	Married Unmarried	0.238	0.421	0.221	0.001 r-value = 0. 437
Education level	Illiterate Elementary Secondary University	0.898	0.435	0.640	0.067
Family number	<5 5-10 >10	0.643	0.139	0.331	0.979
Monthly income (NIS)	<1000 1000-2000 >2000	0.978	0.187	0.956	0.018 r-value = 0.080
Income meets the needs	Yes No	0.409	0.713	0.603	0.907

Abbreviation: BMI, body mass index.
Descriptive statistics, crosstabs, the chi-square test was used to examine difference in the prevalence of different categorical variable. *P* value less than 0.05 was considered as statistically significant.

Table 5. Correlation between Malnutrition Indicators (Albumin, Creatinine, Cholesterol and BMI) and Medical History Variables

Variables		Albumin <4.0 g/dL, ≥4.0 g/dL	Creatinine <10 mg/dL, ≥10 mg/dL	Cholesterol <165 mg/ dL, ≥165 mg/dl	BMI ≥23.8 kg/m², <23.8 kg/m²
		P Value	P Value	P Value	P Value
No. of visit to emergency department over a year	No. visit (0) 1-5 times 6-10 times	0.009 r-value =- 0.277	0.503	0.221	0.038 r-value =- 0.200
Admission days to the hospitals over a year	No admission 1-10 days 11-30 days 31-90 days	0.002 r-value =- 0.184	0.155	0.615	0.440
Length of hemodialysis (y)	>6 months but <1 ≥1 year but <2 ≥2 years but <3 ≥3 years but <5 >5	0.237	0.090	0.411	0.208
Duration of hemodialysis sessions (h)	3 h 3.5 h 4 h	0.544	0.788	0.257	0.222
Hemodialysis sessions per week	2 times 3 times 4 times	0.360	0.319	0.495	0.528
Blood pressure (mm Hg)	Normal Hypertension	0.206	0.639	0.443	0.653

Abbreviation: BMI, body mass index.
Descriptive statistics, crosstabs, the chi-square test was used to examine difference in the prevalence of different categorical variable. *P* value less than 0.05 was considered as statistically significant.

per week (*P*=0.237, 0.544, 0.360, respectively). According to the BMI, a significant negative correlation between number of visits to emergency department over a year and BMI was found (*P*=0.038, *r*=- 0.200). Furthermore, no significant association was observed between BMI and number of admission days to hospitals over a year, length of hemodialysis, duration of hemodialysis sessions and number of hemodialysis sessions per week (*P*=0.440, 0.208, 0.222, 0.528, respectively). Moreover, serum levels of creatinine and cholesterol had no significant association with medical history variables (*P*>0.05).

Discussion

To the best of our knowledge, this is the first report, which quantifies the prevalence of malnutrition and its sociodemographic and economic factors among hemodialysis patients at Al-Shifa Medical Complex in Gaza Strip, Palestine. Malnutrition is common among hemodialysis patients and is closely related to morbidity and mortality.[8] Therefore, assessment of nutritional status and appropriate nutrition interventions with hemodialysis patients play a key role in everyday nephrological practice. This study demonstrated that approximately two-thirds of hemodialysis patients at Al-Shifa Medical Complex in Gaza Strip, Palestine had biochemical malnutrition indicators. These include hypoalbuminemia (66.7%), low predialysis serum creatinine (65%), low serum cholesterol (61.7%) and 45.0% of the patients had BMI less than the recommended BMI (23.8 kg/m²) for hemodialysis patients. The National Kidney Foundation does not support the use of one single measure to assess the prevalence of malnutrition as it is not a comprehensive approach of indicating malnutrition. In addition, no single ideal measure of nutritional status exists, serum albumin levels may be used to indicate visceral protein status. Also the measurement of serum albumin level is inexpensive, easy to perform, and widely available. Studies involving patients with renal failure have established the connection between low levels of serum albumin and malnutrition. Serum albumin was obtained to assess the nutritional status of hemodialysis patients, as several studies have demonstrated that albumin is a valid indicator of nutritional status in hemodialysis patients.[9,12] The National Kidney Foundation Guidelines on CKD recommends that a predialysis serum albumin equal to or greater than the lower limit of the normal range (approximately 4.0 g/dL) is the outcome goal for hemodialysis patients.[8] Several studies found that hemodialysis patients with low albumin

levels were malnourished.[12,13] The results of our study showed that 66.7% of hemodialysis patients had malnutrition. Malnutrition is usually classified when serum albumin level is less than 4.0 g/dL, which is similar to most reported studies.[14,15] In 2006, researchers assessed 61 hemodialysis patients from 3 hospitals in Saudi Arabia to determine their nutritional status. According to this study nutritional status was indicated by using a 3-day food record, anthropometric measurement of BMI and biochemical measurements of albumin, hemoglobin and hematocrit. The researchers concluded that, 60% of hemodialysis patients had significantly lower serum albumin levels than normal value, classifying them as malnourished which agrees with the results of our study.[9] Furthermore, the results of this study showed a significant inverse proportion between serum albumin level and number of visits to the emergency department over a year, and number of admission days to the hospitals over a year, suggesting that those patients with hypoalbuminemia are at high risk of morbidity. Many studies show that hypoalbuminemia is presented frequently in hemodialysis patients and correlated strongly with morbidity and mortality.[8] Furthermore, creatinine serves as a useful measure indicating skeletal muscle mass (somatic protein status). Individuals with low predialysis serum creatinine (<10 mg/dl), should be evaluated for PEM and wasting of skeletal muscle.[8] The results of our study showed that 65.0% of hemodialysis patients were malnourished based on predialysis serum creatinine level. Additionally, serum cholesterol is a valid and clinically useful marker of protein energy nutritional status of hemodialysis patients; hypocholesterolemia is associated with chronic protein energy deficits, individuals with less than 150 to 180 mg/dL or declining serum cholesterol levels should be investigated for possible nutritional deficits.[8] In our study, 61.7% of patients had serum cholesterol less than 165 mg/dL. This finding also supports the high prevalence of malnutrition among hemodialysis patients. Different reports suggest that the prevalence of malnutrition varies from roughly 18% to 70% of hemodialysis patients.[8] Our results lie within this range. Variation in the prevalence of malnutrition among hemodialysis patients may be attributed to the different methods employed to assess nutritional status. When single method is applied, the prevalence of malnutrition could vary widely since one method does not accurately estimate malnutrition. So the combination of different methods would identify malnutrition with greater sensitivity. Therefore, the percentage of malnourished patients would be more accurate. Moreover, BMI is generally used to assess body fat mass.[8] The National Kidney Foundation recommends that, the BMI of hemodialysis patients should be maintained in the upper 50th percentile, which would be 23.6 to 24.0 kg/m² for men and women. The midpoint of this range (23.8 kg/m²) is considered the best range for survival in hemodialysis patients.[8] The present study showed that 45.0% of the patients had BMI less than the recommended BMI (23.8 kg/m²) for hemodialysis patients. A result that suggests a high risk of mortality. Our results found a significant inverse proportion between the number of visits to emergency department over a year and BMI. This suggests that the patients with low BMI are at high risk of morbidity. Several studies, have suggested that the effect of obesity in patients with end stage renal disease undergoing maintenance dialysis is paradoxically in the opposite direction, showing that a high BMI is associated with improved survival.[16] Port et al in a large hemodialysis population study (45967 patients) confirmed the association between BMI and survival: patients with the lowest BMI had a 42% higher mortality risk than patients with the highest BMI.[17] Overweight patients have an increase in adipose tissue and are therefore, less likely to suffer from energy deficits. For this reason, underweight patients on hemodialysis might be more likely to fall ill or tend to recover more slowly from illness than the normal or overweight patients.[18] The results of our study supports these findings. With respect to demographic socioeconomic factors, equal numbers of males and females were included in the study, the present study showed a significant association between BMI and age of the patients. Age is playing an important role in the nutritional status, as the age of the patients increased, the percent of BMI is also increased according to it. Older patients are more susceptible age group for increased BMI and that could be due to difficulties in exercising regularly (due to CKD associated bone disease), also older patients tend to have sedentary life styles. One study that was carried out among adults aged 30-65 years in rural and urban communities of the West Bank found that obesity was associated with older age.[19] As it has been shown above, patients with the lowest BMI had a higher morbidity and mortality risk than patients with the highest BMI. The present study showed that, young hemodialysis patients were at greater risk of morbidity and mortality. Hoogeveen et al showed that younger patients with low BMI had a substantially elevated risk for death.[20] Moreover a significant association was also observed between BMI and marital status. In general, married men and women are more likely to be overweight and obese than never married individuals.[21] Similar results were seen in our study, and that could be due to the fact that people after marriage would be more close to their homes rather than

going outside compared to single adults. However, single adults known to be more active. With respect to employment, the majority of the patients (80%) were unemployed. Furthermore, large percentage of patients (58.3%) with a large family size (more than six members). Also, the collected data demonstrated that most of the patients (63.3%) had a family income of less than 1000 NIS per month. On the other hand, most of the patients (73.3%) were not satisfied about their income and reported that, their income did not meet their basic needs. In addition, our results showed a significant association between BMI as one of malnutrition indicator and monthly income level, suggesting that patients with low economic status were at greater risk for malnutrition. It should be noticed that poverty and low economic status directly affects the nutritional status of any community in terms of nutritional deficiencies,[22] which agreed with the results of our study. People with low income are more susceptible to under nutrition than those with high income. That was approved in the study which was conducted in an urban, suburban and rural areas in Vietnam. High prevalence of underweight was observed in the rural and suburban populations which are low income populations and overweight was observed in the urban population which are high income group.[22] With respect to the educational level, the present study showed that, 48.3% of hemodialysis patients had secondary school, 20% had university education, 15% of patients had elementary education, and 16.7% were illiterate. On the contrary, no significant correlation was found between BMI as a malnutrition indicator and patients educational level. Komatsu et al showed that, individuals with no education, classified as illiterate, had a higher prevalence of malnutrition than individuals with higher education.[22] The current study results did not match this relationship. Knowledge deficit regarding the nutritional care for hemodialysis patients in Gaza Strip put high and low educated patients at the same risk for malnutrition. The main limitations of the present study include its cross-sectional design, the causal relationship could not be fully determined. The main strength of this study was being the first study, which estimate the prevalence of malnutrition among hemodialysis patients at Al-Shifa Medical Complex in Gaza Strip, Palestine.

Conclusions

We conclude that malnutrition among hemodialysis patients at Al-Shifa Medical Complex in Gaza Strip, Palestine which is closely related to morbidity and mortality. In addition, demographic socioeconomic factors could contribute to a higher percentage of malnutrition. Therefore, preventive interventions must be considered seriously.

Abbreviations

(BMI): body mass index; (CKD): chronic kidney disease; (PEM): Protein energy malnutrition; (BP): blood pressure; (AHA): American Heart Association.

Authors' Contributions

AHB, SH, KD jointly designed the study. AHB, KD were involved in data collection and analysis. AHB, SH, KD made the major contribution towards revision of the manuscript. All authors read and approved the final manuscript.

Competing Interests

The authors declare no competing interests.

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