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Effect of Specific Nutritional Program on Patients with Chronic Renal Failure on Hemodialysis on El-keman Village Luxor Governorate

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ABSTRACT
Background: Chronic renal failure is a universal community health problem. It is important to the patient to be on a specific healthy diet program.
Objective: The present study was conducted to evaluate the effect of a specified nutritional program on the health status of renal patients on hemodialysis.
Patients and methods: This was an interventional study that was conducted in the renal dialysis unit in El-keman village, Luxor Governorate. It included 60 patients with chronic renal failure on hemodialysis. An educational nutritional program was designed for the studied group. The patients were assessed pre- and post-intervention. The collected data were analyzed by using SPSS program version 19 with considering statistical significance when P value < 0.05.
Results: The mean age of the studied participants was 46 years with age ranging from 20-60 years old. Nearly 56.7% of the patients were males and 51.7% of them were of low social class. Regarding the Mini Nutritional Assessment (MNA), there was highly statistically significant difference in MNA score before and after intervention (25.07 versus 22.45 respectively) and there was marked significant reduction in malnutrition percentage after the intervention. Creatinine, urea, AST, ALT and cholesterol significantly decreased after intervention compared to the levels before it. There was highly statistically significant improvement in hemoglobin level after intervention.
Conclusion: It can be concluded that proper nutrition is important for patients on hemodialysis as good nutritional status of the patients affects greatly their quality of life and health status.
Keywords: Specific Nutritional Program / Chronic Renal Failure / Hemodialysis.

INTRODUCTION

Chronic kidney disease (CKD) or chronic renal failure is a universal community health problem. It is defined as a decrease in the renal function from mild damage to moderate and severe chronic kidney failure **(1)**.

It is very important to the patient to be on a specific healthy diet program. Diet is very important for patient care. It is important to have the right amount of protein, calories, fluids, vitamins and minerals each day. The main objective of diet prescription in CKD is to slow chronic renal failure progression and to prevent its metabolic complications such as hypophosphatemia and hyperkalemia. Dietary restriction covers three principal components: potassium, phosphorus and sodium **(2)**.

Hemodialysis is a process where the patient's blood is passed through a dialysis venous catheter, via a dialysis fluid solution in a hemodialysis machine, to be filtered externally then returned to the patient **(3)**.

Hemodialysis is a lifesaving treatment and prolongs life expectancy, but is highly taxing on a patient's overall fitness. Many patients undergoing regular hemodialysis treatments suffer from protein energy wasting, which causes the patients to lose one to three kilos of lean body mass per year. Losing body mass is associated with reduction of the overall well-being and activity of the patient. This is associated with worsening of the nutritional status and consequently increased hospitalizations and mortality among those patients undergoing regular hemodialysis treatments **(4)**.

Dietary modifications depend on the level of renal insufficiency as well as the present nutritional status. High prevalence of malnutrition exists in patients with renal failure. Several surveys have reported protein–calorie malnutrition in up to 40% of this subset of patient population. Malnutrition in renal failure is multifactorial, but inadequate oral intake is considered the major contributing factor **(5)**.

So the present study was carried out to improve the health statues of chronic renal failure patients on hemodialysis by evaluation of the effect of a specified nutritional program on the health status of those patients through the following objectives: 1-To assess the role of program on changing of the nutritional status of chronic renal failure patients on hemodialysis after a Specified Nutritional Program. 2-To apply some biochemical analysis of chronic renal failure patients on hemodialysis before and after a Specified Nutritional Program.

SUBJECTS AND METHODS

The current study was an interventional study that was conducted in the renal dialysis unit in El-keman, village Luxor Governorate during the year 2017-2018. It was selected as a place of study for the following reasons: 1- There are 117 Health Unit in Luxor governorate, 11 of them are approved to be family medicine units and only one of them has Hemodialysis unit (El-keman), 2- The Hemodialysis unit of El-keman have large database of history of patients and medication used, 3- Higher number of

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patients as the unit is serving 60 patients, so it is easy to set the program of nutrition, and 5- Easy to collect chemical samples for evaluating the program.

Target population included: Patient of CKD on the renal dialysis unit in El-keman village, Luxor Governorate ***with*** age < 60 years old. With the following ***exclusion criteria:*** - Patients with malignancy and hepatic failure and Patients who refused to participate in the study.

The sample size was calculated using Epi info version 7 Assuming [6]. The risk difference in chronic renal failure patients who had subjected to nutritional education program was 25%, at confidence level 95% and power 80%. So the total calculated sample size was 60 patients.

Phases of the study:

I. Pre- intervention phase (duration: 1 Month)

1. Full history was taken: personal (name, age, sex and .....etc), present history of acute illness and past history of chronic disease (diabetes and hypertension or any chronic illness). Then, assessment of the socioeconomic status (SES) of patients was done using socioeconomic status scale for health research in Egypt. This scale includes 7 domains [7].

2. Total assessment of dietary intake by Mini Nutritional Assessment questionnaire (MNA) was done. The MNA was validated against two principal criteria, clinical status and comprehensive nutrition assessment using principal component and discriminated analysis [8].

3. Clinical assessment included:

- Estimation of mid arm circumference and waist circumference by tape measure [9].
- Weight assessment by Electronic balance in the standing position [10].
- Length measurement by length measuring device [10].
- Estimation of water content, bone, muscles and calories required daily using small in body machine [11].
- Blood pressure measuring [12].

4. Laboratory investigation included total blood count (CBC), kidney functions, liver functions, stool analysis, urine analysis and lipid profile [13].

II- Intervention phase (duration: 4 Months)

An educational program was designed for the studied group that included the important role of healthy food in slowing the progression of CKD. It was done in sessions using sign boards and power point presentations. The duration of each session was about 30 minutes for 3 times per week and for one month. The educational program concerned with raising the knowledge about choosing and preparing healthy food and the sources of different macro and micro nutrients that should be supplied or avoided.

STEP 1 Choose and prepare foods with less salt and sodium. To help control patients' blood pressure, patient's diet should contain less than 2,300 milligrams of sodium each day.

STEP 2 Eat the right amount and the right types of protein. To help protect patients kidneys.

STEP 3 Choose foods that are healthy for patient's heart. To help keep fat from building up in patients' blood vessels, heart, and kidneys.

STEP 4 Choose foods with less phosphorus. To help protect bones and blood vessels.

STEP 5 Choose foods that have the right amount of potassium to help nerves and muscles work by the right way.

The specific program varied according to age, sex and patient chemical tests but all patients on dialysis were advised to increase their protein intake and limit the amount of potassium, phosphorus, sodium, and fluid in their diet.

III- Post intervention phase (duration: 2 Months)

After 3 months of intervention, all participants were subjected to clinical and laboratory evaluation similar to the pre intervention assessment.

Pilot study:

Before starting to collect the final data a pilot study was conducted on 10 % of the sample size to test the feasibility of the study, as well as the clarity of the tools and to estimate the time needed to fill each questionnaire. No modification was done in the study tools so the 10% of the sample were included in the study.

Ethical consideration:

All subjects in this study underwent complete personal data after taking informed consent and confidentiality of information about the study.

Administrative design:

Official permission was obtained from the Scientific Ethical Committee of the department. **An approval letter was obtained from Faculty of Medicine, Zagazig University** to hemodialysis unit included the study design. An official permission was obtained also from the institutional review board (IRB No=4404) from the faculty.

Data management

All data were collected, tabulated and statistically analyzed using SPSS version 19 [14]. Continuous Quantitative variables were expressed as the mean ± SD. categorical qualitative variables were expressed as absolute frequencies (numbers) & relative frequencies (percentages). Continuous data were checked for normality by using Shapiro Walk test. Paired t-test was used to compare two groups of normally distributed data before and after intervention. Friedman test was used to compare between more than two groups of qualitative data before and after intervention. Wilcoxon-sign used to compare between two groups of qualitative data before and after intervention.

All tests were two sided and p-value< 0.05 was considered statistically significant.

RESULTS

The age of the studied participants ranged between 20 and 60 years with mean of 46 years and more than half of them were at 51-60 years. Regarding sex, 56.7% were males almost half of the studied participants (51.7%) were of low social class (Table 1).

Table (1): Sociodemographic characteristics of the studied participants on hemodialysis on El-keman village, Luxor governorate

	Variable	Studied group (No=60)	
Age (years)	*-Mean ± SD*	46.8 ± 12.5	
	-Range	20 - 60	
		No	**%**
Age group (years)	*- 20-30*	8	13.3
	- 31-40	12	20.0
	- 41-50	6	10.0
	- 51-60	34	56.7
Social class	*-Very low*	4	6.7
	-Low	31	51.7
	-Middle	24	40.0
	-High	1	1.6
Sex	*-Female*	26	43.3
	-Male	34	56.7

There were non-significant differences between the studied participants as regarding MNA scoring before and after intervention in certain items like weight loss during the past 3 months, mobility, psychological stress or acute disease, neuropsychological problems and BMI. However, the difference between them was statistically significant as regarding decreased food intake over the past 3 months which was found to improve significantly after the intervention (Table 2).

Table (2): Screening of MNA* before and after intervention among the studied groups

Variable	Before interventio (No=60)		After intervention (No=60)		Test of significar	P valu
	No	**%**	**No**	**%**		
Decreased food intake over the pa months:					Friedman test	
- Severe	4	6.7	0	0.0	**7.63**	**0.02**
- Mild	34	56.7	26	43.3		
- No	22	36.6	34	56.7		
Weight loss during the past 3 mon					Friedman test	
- >3 kgs						
- Not know	6	10.0	0	0.0		
- 1-3 kgs	6	10.0	6	10.0	6.419	0.092
- No weight loss	21	35.0	25	41.7		
	27	45.0	29	48.3		
Mobility:						
Bed ridden					Wilcoxon sign	
- Able to get out of bed but	0	0.0	0	0.0	test	
- doesn't go out	5	8.3	5	8.3		1.00
- Goes out	55	91.7	55	91.7	0.00	
Psychological stress or acute disea the past 3 months:					Wilcoxon sign	
- Yes	7	11.7	7	11.7	test	
- No	53	88.3	53	88.3		1.00
					0.00	
Neuropsychological problems:						
- Severe dementia or depression	0	0.0	0	0.0	Wilcoxon sign	
- Mild	9	15.0	9	15.0	test	
- No problems	51	85.0	51	85.0		1.00
					0.00	
BMI:(kg/m2)					Friedman test.	
- <19:	2	3.3	2	3.3		
- 19<21	10	16.7	9	15.0	0.180	0.980
- 21-23	17	28.3	19	31.7		
- ≥23	31	51.7	30	50.0		

*MNA: Mini Nutritional Assessment

Table (3): MNA assessment before and after intervention among the studied groups

Variable	Before intervention (No=60)		After intervention (No=60)		Test of significan	P Valu
	No	%	No	%		
Lives independently:					Wilcoxon sign test	
-Yes	60	100.0	60	100.0	0.00	1.00
Take more than 3 drugs per day:					Wilcoxon sign test 0.00	1.00
-Yes	44	73.3	44	73.3		
Pressure sore or skin ulcers:					Wilcoxon sign test	
-Yes	10	16.7	4	6.7	2.449	0.01
Full meals eaten daily by the patient:					Wilcoxon sign test	
-Two	1	1.7	0	0.0	1.008	
-Three	59	98.3	60	100.0		0.317
Consumption markers for protein intake:					Wilcoxon sign test	
At least one serving of dairy products:	50	83.3	54	90.0	2.236	0.02
-Yes						
Two or more serving of legumes or eggs per week:					Wilcoxon sign test 3.00	
-Yes	40	66.7	48	80.0		0.003
Meat, fish or poultry every day:					Wilcoxon sign test	
-Yes	31	51.7	41	68.3	3.162	0.002
Two or more servings of fruit or vegetables per day:					Wilcoxon sign test	
-Yes	43	71.7	51	85.0	2.828	0.005
Fluids consumed per day:					Friedman test	
-Less than 3 cups	23	38.3	25	41.7	2.00	0.157
-3 to 5 cups	27	45.0	25	41.7		
-More than 5 cups	10	16.7	10	16.6		
Mode of feeding:					Wilcoxon sign test	
-Unable to eat without assistance:	0	0.0	0	0.0	2.236	
-Self-fed with difficulty:	16	26.7	11	18.3		0.02
-Self-fed without any problem:	44	73.3	49	81.7		
Self-view of nutritional status:					Friedman test	
-Being malnourished:	2	3.4	0	0.0	17.00	
-Uncertain of nutritional status:	38	63.3	25	41.7		<0.001
-Having no problem:	20	33.3	35	58.3		
Health status:					Friedman test	
-Not as good:	2	3.4	0	0.0	1.00	
-Don't know:	20	33.3	23	38.3		0.317
-As good:	33	55.0	32	53.3		
-Better:	5	8.3	5	8.4		
MAC:(mid arm circumference)						
-<21 cm:	3	5.0	2	3.3	Friedman test	
-21-22 cm:	20	33.3	21	35.0	1.00	0.317
->22 cm:	37	61.7	37	61.7		
Calf circumference:					Wilcoxon sign tes	
-<31 cm:	14	23.3	12	20.0	1.414	0.157
-≥31 cm:	46	76.7	48	80.0		

*MNA: Mini Nutritional Assessment

Table (3) showed non-significant differences between the studied participants as regarding MNA assessment before and after intervention in certain items like; lives independently, taking more than 3 drugs per day, full meals eaten daily by the patient, fluids consumed per day, health status, mid arm circumference (MAC) and calf circumference. However, the difference between them was statistically significant as regarding presence of pressure sore or skin ulcers, consumption of at least one serving of dairy products, meat, fish or poultry every day and mode of feeding. However there was a highly statistical significant difference with the remaining items.

Table (4): Scoring of MNA before and after intervention among the studied groups

Variable	MNA score before (no=60)		MNA score after (no=60)		Test of significanc	P value
	No	%	No	%		
Nutrition level:						
-Normal nutrition:	27	45.0	44	73.3	**Sign test**	
-At risk o malnutrition	26	43.3	16	26.7	**4.707**	**<0.001**
-Malnourished	7	11.7	0	0.0		
Mean score MNA: Mean± SD	60	22.45 ± 4.33	60	25.07 ± 2.72	**Paired test 9.031**	**<0.001**

MNA: Mini Nutritional Assessment

Table (4) represented highly statistically significant difference in nutrition level measured by MNA scoring system before and after intervention. It was noticed that those with malnutrition significantly decreased after intervention as regarding normal nutrition and their frequency was found to be significantly increased after intervention compared to before it (73.3% versus 45% respectively). By Comparing MNA score before and after intervention among the studied group, there was highly statistically significant difference in MNA score as (25.07 versus 22.45 respectively).

Table (5): Comparing kidney function tests and hemoglobin levels before and after intervention among the studied group

Variable	Before intervention (no=60)	After intervention (no=60)	Paired t-test	P-value
Creatinine(mg/dL) *Mean ± SD*	8.02 ± 2.52	6.69 ± 1.20	5.99	**<0.001**
Urea(mg/dL) *Mean ± SD*	80.7 ± 11.04	71.6 ± 9.77	9.04	**<0.001**
Hemoglobin(g/dL) *Mean ± SD*	9.16 ± 2.37	9.88 ± 1.92	7.292	**<0.001**

Regarding kidney function tests before and after intervention among the studied group (table 5), creatinine and urea levels were found to be statistically significantly decreased after intervention (8.02, 80.7 versus 6.69, 71.6 respectively). In addition, highly statistical significant improvement in hemoglobin was observed after intervention (9.88 versus 9.16 respectively).

Table (6): Comparing liver function tests and cholesterol before and after intervention among the studied group

Variable	Before intervention (no=60)	After intervention (no=60)	Paired t-test	P-value
AST(U/L) *Mean ± SD*	24.21 ± 6.82	21.85 ± 5.58	**5.951**	**<0.001**
ALT *(U/L) Mean ± SD*	24.63 ± 6.54	20.71 ± 6.51	**10.78**	**<0.001**
Cholesterol (mg/dL) *Mean ± SD*	157.8 ± 46.8	140.3 ± 35.2	**5.408**	**<0.001**

As regarding liver function tests (LFT) and cholesterol levels there were statistical significant improvements in LFT and cholesterol levels after intervention (Table 6)**.**

DISCUSSION

The current study showed that there were no statistical significant differences between the studied participants regarding MNA screening before and after intervention in certain items like weight loss during the past three months, mobility, psychological stress or acute neuropsychological problems and BMI. However, the difference between them was significant regarding decreased food intake over the past three months, which was found to improve significantly after the intervention. Similar findings were found by **Abd Allah *et al.*** [15] who reported that the majority of the patients (72.2%) had no changes in their weight as regard pre -dialysis and post-dialysis session weight. However the current results differ with the results of **Kadhim *et al.*** [16] who reported that the proportion of low physical quality of life was 53.3% before health education nutritional program compared to the patients after such program (60%), which indicated average physical quality of life. While only 3.3% of them reported low physical quality of life. Also, they reported that the highest percentage for average psychological quality of life was 50% and the lowest percentage (6.7%) was within high psychological quality of life before health education nutritional program compared to the patients after such program (53.3%) indicating average psychological quality of life, and the lowest percentage (10%) reported low psychological quality of life.

Regarding MNA assessment before and after intervention, there were non-significant differences between the studied participants in certain items like lives independently, taking more than three drugs per day, full meals eaten daily by the patient, fluids consumed per day, health status, MAC and calf circumference. However, the difference between them was significant regarding presence of pressure sore or skin ulcers, consumption of at least one serving of dairy products, meat, fish or poultry every day, mode of feeding and highly significant differences with the remaining items. These findings were in accordance with **Abd Allah *et al.*** [15] who found that there were significant improvement in all areas of dietary practices among patients before and after the intervention especially regarding proper use of fat, salt, animal proteins, canned food and soda (76.8%, 75.6%, 77.8%, 70% and 65.6% respectively), while the patients had satisfactory dietary practice in post-test compared to pre-test (31.1%, 34.4%, 18.9%,21.1% and 20% respectively) ($p<0.001$). Similar findings with the above mentioned present study findings regarding the factors underlying the effectiveness of the nutritional intervention are reported by **Elliot *et al.*** [17] in their study in the United States vthat revealed a similar success in modulating hemodialysis patients' dietary practices. Moreover, nurse-led educational interventions for hemodialysis patients in China and in Australia demonstrated success in improving the dietary practices of these patients as reported by **Shi *et al.*** [18] and **Sandlin *et al.*** [19]**.** However, the above mentioned results disagree with the finding represented by **Mitch & Remuzzi** [20] who found that patients suffering from CKD can show confidence reduction and risk of injuries as a result of substantial contribution of wasting of body muscles and limitation in their physical performance. The main abnormality that can present in muscles function is a measurements reduction in speed of walking and the "timed and up and go" testing.

The factors that led to success of the present study intervention were similar to those mentioned by **Van Camp *et al.*** [21] in a study in Belgium which included education and behavior reinforcement. Similarly, a study in Taiwan demonstrated the effectiveness of the use of different educational media in improving the knowledge and perceptions of end stage renal disease patients [22]**.** Support for the current findings were reported also by **Condé *et al.*** [23] that health nutritional program can promote long-term benefit in preventing and monitoring care to patients with CRF. In addition, **Bellizzi *et al.*** [24] are in agreement with the present study findings that indicated integrated program of diet for patients with dialysis, which consisted of very low-protein diet (0.3-0.4g/kg/day), and accomplished for six days a week with ketoacids, essential amino acids and severe restriction of sodium and water in addition to one hemodialysis session per week.

Regarding the MNA, there was highly statistically significant difference in MNA score before and after intervention. As regards normal nutrition, their frequency was found to be significantly increased after intervention (73.3% versus 45% respectively). This provides a further confirmation of the success of the nutritional intervention and improvement of health status of the patients. The effectiveness of the program could be attributed to the fact that it was custom-tailored to the needs identified among these CKD patients.

In concordant with our results, **Abd Allah *et al.*** [15] study on 90 elderly patients on regular hemodialysis received the diet therapy program showed that the dietary knowledge of the hemodialysis patients showed statistically significant improvements after the intervention. Also, total satisfactory practice increased from 67.8% in post-test compared to 23.3% in pre-test ($p<0.001$). Additionally, a study ESRD patients undergoing dialysis in Giza, Egypt demonstrated a significant improvement in their nutritional knowledge following nutritional counseling sessions [25]**.** In agreement with this, a similar success of an educational program in improving chronic renal disease patients' dietary habits was reported in Brazil [26]**.**

There were highly statistically significant reduction in creatinine and urea level after intervention, in addition to statistically significant improvement in hemoglobin level after intervention.

Dietary protein in excess of daily requirements

is degraded to urea, other nitrogenous waste products, acid, phosphate and sulfate. These waste products accumulate in patients with uremia leading to muscle catabolism, bone loss and vascular calcification. It also leads to metabolic acidosis. These pathophysiological changes are of immense significance in patients admitted in dialysis units and ICU with numerous critical states [(5)]. It has been shown that adequate correction of acidosis slows the rate of loss of kidney function. Dietary protein restriction also was reported to slow the rate of progression of chronic renal failure in various studies. But very low protein diets supplement results in ketoacids and hydroxyacids. Essential amino acids may be particularly effective at slowing the rate of loss of renal function [(27)]. Many foods that contain high amounts of phosphorus also contain high amounts of protein, so many scientific societies recommended lowered protein intake in order to reduce the amount of phosphorus consumed. One gram of protein has about 15mg of phosphorus and about 30% to 70% of it is absorbed in the intestine [(28)].

While, the use of a protein-restricted diet in patients with advanced CKD receiving dialysis treatments has been controversial because a dietary regimen with low protein intake is thought to result in malnutrition and may decrease survival rate. On the other hand, in some studies, low protein intake has been shown to be beneficial for patients with end-stage kidney disease, which in return directly relates to higher survival rates [(29)].

There were highly statistically significant differences in AST, ALT and cholesterol levels before and after intervention. AST, ALT and cholesterol significantly decreased after intervention compared to levels before it. The present study reported elevated liver enzymes in patients with chronic kidney disease before intervention and this agrees by **de Oliveira Liberato *et al*.** [(30)]. who revealed that the aminotransferase levels in the patients who were undergoing hemodialysis was found to be higher. On the other hand, **Fabrizi *et al.*** [(31)], reported lower ALT levels in patients who were undergoing hemodialysis compared to patients with CKD who were undergoing conservative treatment, which demonstrated that the ALT serum levels were reduced concomitantly with the progression of renal dysfunction. However, **Saunders *et al.*** [(32)], revealed that it is important that nutrition is provided in appropriate amounts at appropriate stages of the clinical course of the kidney disease as there is evidence that careful nutritional support is very beneficial and improves the patient outcomes including liver enzymes (ALT & AST).

CONCLUSION AND RECOMMENDATIONS

The implementation of specific nutritional program for chronic kidney disease patients on hemodialysis was found to be effective in improving their nutritional and health statuses and consequently their laboratory findings as kidney function tests (Creatinine & urea), liver function tests (AST & ALT), hemoglobin and cholesterol levels. So, it is recommended to apply the specific nutritional program for these patients with more efforts in educating them as a part of their management plan especially those with dietary problems and abnormal anthropometric measures. Diet therapy programs must be a priority on management of those patients under regular hemodialysis because of their positive effects on health status and consequently their quality of life.

Competing interests

The authors declare that they have no competing interests.

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