Effect of Diet Modification on Selected Renal Function Test, Dietary Intake and Overall Nutrition Status in Selected Hemodialysis Patients

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Abstract:Protein–energy malnutrition (PEM) and anemia is one of the common causes of morbidity and mortality among patients with advanced cshronic kidney disease. This study aims at determining the effect of Diet counseling intervention on selected renal function abnormalities, dietary intake and nutritional status. Experimental design was conducted with one experimental group and one control group. Chronic kidney disease patients undergoing hemodialysis were recruited with their consent. Information pertaining to anthropometric measurements like weight, MUAC, biochemical tests like serum urea, creatinine, albumin, potassium, phosphorous, calcium, iron, dietary intake and nutritional status as assessed before and after an intervention period of 30 days. Nutrient intake among experimental group improved significantly for carbohydrates, protein, fat, potassium, phosphorus ($p<0.01$) as compared to control group after the counseling. A positive improvement was seen in experimental group on serum albumin, calcium and creatinine after the counseling. Nutritional status had improved significantly within the experimental group and also between experimental and control group ($p<0.05$). This indicates the success of the diet counseling intervention on improving biochemical abnormalities, dietary intake and nutritional status. Though the period of intervention was short, a significant positive influence of diet counseling was observed on nutrient intake, biochemical parameters and Nutritional status. This emphasizes the importance of intervening patients with dietary regimen that is tailor-made for them.

Index Terms- Diet counseling intervention, diet intake, hemodialysis, nutritional status, renal function test.

Introduction

According to a recent research, prevalence of CKD in India was observed to be 17.2% with approximately 6% have progressed beyond stage 3 of the disease. Prevalence of cardiovascular disease was 61% and anemia was 42% among CKD patients . With increasing number of CKD patients including those undergoing maintenance dialysis treatment in outpatient dialysis clinics, periodic assessment of dietary intake and comparing dietary intake of dialysis patients with each other may help improve clinical outcomes related to diet. In particular, dietary control of phosphorus and potassium or provision of adequate dietary protein intake may lead to improvement of nutritional status and survival in CKD patients. Malnutrition is a common problem in patients with end-stage renal disease (ESRD) undergoing hemodialysis (HD) and may occur secondary to several factors such as inadequate food intake secondary to anorexia caused by uremic state, altered taste sensation, concurrent illness, emotional distress, impaired ability to procure prepared or mechanically ingested foods, unpalatable prescribed diets. The catabolic response to superimposed illness, the dialysis procedure itself, which may promote wasting by removing nutrients and may promote protein catabolism due to bio-incompatibility, conditions associated with chronic inflammatory state that may promote hyper-catabolism and anorexia, loss of blood due to gastrointestinal bleeding, frequent blood sampling, blood sequestered in hemodialysis and tubing, endocrine disorders of uremia and possibly the accumulation of endogenously formed uremic toxins or the ingestion of exogenous toxins . Based on two meta-analysis, a dietary protein intake of 0.8g/kg bodyweight reduces decline in kidney function but at the same time, optimal level of protein is required to maintain adequate nutritional status , . According to a study done by Gutierrez et al., 2014, diet rich in processed foods and fried foods are associated with mortality and diet rich in fruits and vegetables are protective against mortality. This study aims at assessing the effect of diet modification on selected renal function test, dietary intake and overall nutritional status in selected hemodialysis patients.

Research Design and Methods

Experimental design with one experimental (EG) (n=20) and one control group (CG) (n=20). Samples were recruited by purposive sampling based on the following criteria: CKD-5 patients on hemodialysis between the age group of 20 to 70 years were included in the study. The study was approved by the Institutional Ethics Committee, Kasturba Hospital, Manipal. Baseline information like sociodemography, nutritional status indicators (patient generated-subjective global assessment (PG-SGA), Mid upper Arm

circumference (MUAC)), biochemical assessment (serum albumin, serum creatinine, serum urea, serum phosphorus, serum postassium, serum calcium, serum sodium, hemoglobin), dietary assessment using 24 hour recall and food frequency questionnaire was collected from all patients who were recruited. Participants were randomly assigned to experimental and control group. Experimental group were prescribed with diet modification suitable for their medical condition while control group continued to follow their regular diet. Both groups continued to follow the medical prescription. After a period of one month of intervention, the changes in dietary intake, biochemical tests and anthropmetric measurements were assessed. The data was coded, statistically analysed using SPSS (16.0) and dietary analysis was done using Dietcal (5.0)

Results and Discussion

The baseline information of the participants has been represented in table I(a).

Table I(a) . Baseline Information of Hemodialysis

Baseline information		EG n (%)	CG n (%)
Gender	Male	16(80%)	12 (60 %)
	Female	4 (20%)	8(40%)
Age Group	< 30 years	2 (10%)	3 (15%)
	30- 60 years	13 (65%)	10 (50%)
	> 60 years	5 (25%)	7 (35%)
Medical History	Diabetes mellitus	9(45%)	6(30%)
	Hypertension	12(60%)	14(70%)
MUAC	Severely malnourished	1 (5%)	1 (5%)
	Moderately malnourished	4 (20 %)	7 (35 %)
	Normal	15 (75 %)	12 (60 %)
Physical activity level	No activity	8 (40 %)	7 (35%)
	Very little activity	5 (25 %)	3 (15%)
	Light activity	4 (20 %)	6 (30 %)
	Moderate activity	3(15%)	4 (20 %)

Majority of subjects in both EG (80%) and CG (60%) were males and the remaining were females. About 65 % of EG and 50% of CG belonged to the age group of 30 to 60 years, followed by 25% of EG and 35% of CG were above 60 years and only 10% of EG and 15% of CG were aged < 30 years. About 45% of EG and 30% of CG had diabetes whereas about 60% of EG and 70% of CG were hypertensives. It was seen that majority of the patients in the EG were classified into no activity level that is 8(40%), whereas in the CG which was 7(35%). About 6(30%) in the CG were classified into light activity whereas in the CG it was 4(20%). In the EG, 5(25%) were classified as doing very little activity whereas 3(15%) of CG were classified under this category. Remaining 3 (15%) of EG and 4 (20%) of CG were involved in moderate intensity activities.

Table I(b). Baseline Assessment of Biochemical parameters and nutritional status of Hemodialysis patients

Baseline information			EG n(%)	CG n(%)
Biochemical Assessment		Systolic Pressure (mmHg)	150± 21.8	150.5± 19.3
		Diatolic Pressure (mmHg)	87± 11.7	89.5± 11.5
		Serum Albumin (g/dl)	3.419± 0.7	3.152± 0.8
		Serum Creatinine (mg/dl)	7.765 ± 3.5	6.765± 2.9
		Urea (mg/dl)	85.7±27.5	86.25± 52.7
		Phosphorous (mg/dl)	4.5± 1.9	5.01±1.57
		Potassium (mmol/L)	4.29± 0.8	4.5± 0.7
		Calcium (mg/dl)	7.99± 1.1	8.01± 0.9
		Sodium (mmol/L)	137.75± 6.6	136.45± 5.7
		Hemoglobin (g/dl)	8.86± 1.9	7.97± 1.3
Nutritional status indicators		MUAC (cm)	24.76±2.1	23.65±1.4
	PG-SGA	Requires intervention by dietecian, in conjuntion with nurse or physica=ians as indicated by symptom survey	3 (15%)	2(10%)
		Indicates a critical need for improved symptom management and, or nutrient intervention options	17(85%)	18(90%)

Table I(b) represents baseline biochemical assessment and nutritional status of all subjects. Both the groups had similar mean systolic pressure (150mg/dl) which is higher than normal. Mean Diastolic pressure was also found to have only minor difference between EG (87mg/dl) and CG (89.5mg/dl). As evident from the previous table, most of the subjects had hypertension which reflects on the rise in blood pressure. The mean albumin was 3.4g.dl in EG and 3.15g/sl in the CG which falls in the normal cut-off of 3.5-5.5g/dl. Mean serum creatinine was higher among both the groups (EG=7.765mg/dl; CG=6.765mg/dl). Both groups had almost similar mean serum urea levels (EG=85.7mg/dl; CG=86.25mg/dl). Mean serum phosphorus was 4.5mmol/L among EG and 5.01mmol/L among CG. Mean serum potassium level 4.29mmol/L among EG and 4.5mmol/L among CG. Mean serum calcium was 7.99mg/dl among EG and 8.01mg/dl among CG. Mean sodium was 137.75mmol/L among EG and 136.45 mmol/L among CG. Mean hemoglobin was 8.86g/dl among EG and 7.97g/dl among CG. It is evident from the mean values of various biochemical tests that serum creatinine, urea was found to higher than the normal, whereas serum calcium was slightly lower than normal range (8.6-10mg/dl). Mean hemoglobin was very low (13.17g/dl). All other parameters like mean serum albumin, phosphorus, sodium were falling within normal cut-offs.

After collecting baseline information, experimental group were prescribed diet modification and control group continued to follow their regular meal pattern. After a period of 30 days, improvement in biochemical parameters, nutritional status indicators and dietary intake was recorded and analyzed. There was loss to follow-up of 3 participants from EG and 2 participants from CG as they were not interested in continuing with the study.

Table II represents comparison of mean biochemical values of experimental group before and after intervention among Hemodialysis patients

Table II. Comparison of mean biochemical values of experimental group before and after intervention among Hemodialysis patients

Biochemical parameters		Mean ± SD	P value	95% CI
Serum albumin (g/dl)	Pre	3.47± 0.69	0.002**	(-0.34, -0.09)
	Post	3.69± 0.65		
Serum creatinine (mg/dl)	Pre	8.46± 3.37	<0.001**	(1.06, 2.92)
	Post	6.47± 3.2		
Phosphorous (mg/dl)	Pre	4.75± 1.95	0.232^{NS}	(-0.38, 1.46)
	Post	4.21± 1.01		
Potassium (mmol/L)	Pre	4.41±0.85	0.822 ^{NS}	(-0.37, 0.3)
	Post	4.44±0.06		
Calcium (mg/dl)	Pre	7.94± 1.12	0.0028**	(-0.47, -0.03)
	Post	8.19± 1.22		
Hemoglobin (g/dL)	Pre	9.01± 1.98	0.741^{NS}	(-0.78, 0.56)
	Post	9.11±1.83		

** Significant at 1% level, NS not significant

The mean serum albumin level of experimental group before intervention was 3.47g/dl which showed a significant increase to 3.69g/dl (p=0.002). Mean serum creatinine was 8.46mg/dl before intervention which significantly decreased to 6.47mg/dl after intervention (p<0.001). Mean serum calcium increased significantly from 7.94mg/dl to 8.19mg/dl (p<0.0028) after intervention. Mean serum phosphorus, potassium and hemoglobin showed minor difference (p>0.05).

Table III. Comparison of mean biochemical values of experimental and control group after intervention among Hemodialysis patients

Biochemical parameters	**group**	**Mean ± SD**	**p value**	**95% CI**
Serum albumin (g/dl)	EG	3.69 ± 0.65	0.257 ^{NS}	(-0.19, 0.72)
	CG	3.5 ±0.51		
Serum creatinine (mg/dl)	EG	6.5 ± 3.2	0.920 ^{NS}	(-1.07, 3.07)
	CG	6.6 ± 3.2		
Phosphorous (mg/dl)	EG	4.21± 1.01	0.084 ^{NS}	(-1.2, 1.47)
	CG	4.99 ± 1.53		
Potassium (mmol/L)	EG	4.44± 0.60	0.590 ^{NS}	(-0.69, 0.27)
	CG	4.57 ± 0.74		
Calcium (mg/dl)	EG	8.19 ± 1.22	0.588 ^{NS}	(-0.66, 0.62)
	CG	8.00± 0.85		
Sodium	EG	138.18±4.11	0.443 ^{NS}	(-59.05, 180.55)
	CG	137±4.8		
Hemoglobin	EG	9.11 ± 1.83	0.741 ^{NS}	(-0.12, 1.9)
	CG	8.42±1.83		

NS not significant

It is evident from table III that although there is no statistically significant difference between experimental and control group with respect to serum albumin, serum creatinine, serum calcium, serum potassium, serum sodium and hemoglobin, there is a positive improvement seen in experimental group as compared to control group. Hemoglobin of EG was high as compared to CG.

Table IV. Comparison of mean indicators of nutritional status among experimental and control group before and after intervention

Nutritional Status Indicators		EG	CG	95% CI	p value
MUAC	Pre	24.76±2.1	23.65±1.4	(-0.031, 2.531)	0.056 NS
	Post	25.05±2.5	23.6±1.3	(-0.042, 2.542)	0.041*
	95% CI	(-1.02, 0.46)	(-0.026, 0.12)		
	p value	0.43 NS	0.191 NS		
PG-SGA	Pre	12.8±4.2	13.7±5.4	(-3.99, 2.18)	0.558 NS
	Post	8.9±3.8	13.55±4.5	(-7.3, -2)	<0.001**
	95% CI	(3.35,4.45)	(-7.39, 1.04)		
	p value	<0.001**	0.728 NS		

*Significant at 5% level, ** significant at 1% level, NS not significant

Table IV represents the comparison of mean indicators of nutritional status among experimental and control group before and after intervention. Mean MUAC of EG was 24.76cm which slightly increased to 25.05. However it did not show a statistically significant difference. The MUAC of CG remained stagnant after the intervention period. The MUAC of EG (25.05cm) as compared to CG (23.6cm) was significantly higher ($p<0.05$). This indicates the efficacy of the intervention. There was a significant decrease in the PGSGA score among EG during the intervention period from 12.8 to 8.9 as compared to an insignificant decrease among the CG (13.7 to 13.55) ($p>0.05$). At the end of intervention period EG (8.9) has a significantly lower PGSGA as compared to CG (13.55) ($p<0.001$). Lower the PGSGA score better is the nutritional status requiring less nutritional intervention.

Table V (a). Comparison of mean Nutrient intake of experimental and control group after intervention among Hemodialysis patients

Nutrient Intake	EG	CG	p value
Energy (Kcal)	1284.34 ± 235.57	1105.45± 401.42	0.120NS
Carbohydrate (g)	182.56 ± 33.56	150.55 ± 26.72	0.004**
Protein (g)	35.68 ±9.519	26.13 ± 8.65	0.003**
Fat (g)	45.24 ± 8.43	37.40 ±5.76	0.003**
Phosphorus (mg)	880.78 ±228.06	701.71 ±277.12	0.004**
Potassium (mg)	707.36±229.81	561.83 ±187.87	0.048*

*Significant at 5% level, ** significant at 1% level, NS not significant

Table V (a,b) compares the mean/median nutrient intake of EG and CG after the intervention period.

The mean energy intake of EG was 1284.34 kcal which was higher as compared to the CG (11.5.45kcal). However statistically there was no significant difference ($p>0.05$). mean carbohydrate intake of EG was almost 32g higher than CG ($p=0.004$). Protein intake of EG showed a mean difference of almost 10g as compared CG ($p=0.003$). mean intake of fat also was significantly higher in EG (45.24g) as compared to CG (37.4g) ($p=0.003$). Mean intake of serum potassium (EG=707.36mg; CG=561.83mg) ($p=0.048$) and phosphorus (EG=880.78mg; CG=701.71mg) ($p=0.004$) was also significantly higher among EG as compared to CG.

Table V(b). Comparison of median Nutrient intake of experimental and control group after intervention among Hemodialysis patients

Nutrient Intake	EG	CG	P Value
Calcium (mg)	410.46 (317.96, 589.14)	271.30 (151.26, 376.46)	0.006**
Iron (mg)	7.49 (5.89, 9.73)	5.17 (4.41, 7.13)	0.023*
Vitamin C (mg)	67.00 (62.83, 91.82)	59.72 (57.40, 69.50)	0.021*
Vitamin A (mcg)	102.25 (79.50, 92.87)	79.50 (79.50, 92.87)	0.082 NS
Total Dietary Fiber (g)	12.52 (10.26, 16.73)	13.73 (10.51, 17.79)	0.754NS

*Significant at 5% level, ** significant at 1% level, NS not significant

It was observed that post calcium intake in the experiment group had a median of 410.46(317.96, 589.14) which was higher than that of the control group that is 271.30(151.26, 376.46) which showed highly significant difference (p=0.006). Iron intake in the experiment group had a median of 7.49 (5.89, 9.73) which was higher than that of the control group that is 5.17 (4.41, 7.13) with a statistical significant difference. Similarly, vitamin C intake also was found to be significantly higher among EG (67.00 (62.83, 91.82)) as compared to CG 59.72 (57.40, 69.50) (p=0.021). Vitamin A showed a marked increase among EG as compared to CG however there was no statistically significant difference between them. Total dietary fiber of both groups showed no statistical significance.

Conclusion

In conclusion, Diet modification has positively impacted on the nutrient intake, nutritional status and biochemical abnormalities. The Experimental group showed a clear advantage over control group by showing an improvement on nutrient intake which thereby influences the biochemical parameters and overall nutritional status. This indicates the success of the diet counseling intervention on improving biochemical abnormalities, dietary intake and nutritional status. Though the period of intervention was short, a significant positive influence of diet counseling was observed on nutrient intake, biochemical parameters and Nutritional status. This emphasizes the importance of intervening patients with dietary regimen that is tailor-made for them. It is also important to initiate the diet modification in the earlier stages of the disease in order to prevent morbidity and mortality.

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