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Assessment of Nutrient Intake and its Association with Protein Energy Wasting in Haemodialysis Patients

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ABSTRACT

Background: Protein Energy Wasting (PEW) is one of the complications associated with HD, a multi-factorial, maladaptive metabolic state characterized by loss of body protein mass and energy reserves, which is a major cause of morbidity and mortality amongst these patients. Adequate nutrient intake in dialysis patients is, therefore, a challenge due to poor appetite, and anorexia because of the build-up of uremic toxins. Therefore, this study aims to assess PEW and nutrient intake consumption in the HD population to add to the Indian database.

Methods: The study adopted a cross-sectional design conducted at a tertiary care hospital in Mumbai, India. A total of 54 chronic haemodialysis patients were recruited for the study through convenience sampling. Post dialysis session, measurement of weight was recorded. An interviewer-administered questionnaire was used to record the patient details.

Results: The nutrient intake on dialysis day was observed to be lower as compared to non-dialysis day. Only 5% of patients were diagnosed with PEW. A significant correlation between Energy, Protein on dialysis, and non dialysis day, along with Carbohydrate, Sodium, and Potassium intake (p-value 0.001) was observed.

Conclusion: The present study found that nutrient intake of Energy, Protein, CHO, Fats, Sodium and Potassium were lower on dialysis day as compared to non dialysis day. Majority of the patients were well nourished and only 5% of patients were Protein Energy Wasted.

Keywords: Protein Energy Wasting (PEW), Nutrient intake, Haemodialysis, Appetite, Diet.

INTRODUCTION

The incidence of End-stage kidney disease and Chronic Kidney Disease is a rising concern in developing countries. Average crude and age-adjusted incidence rates were 151 and 232 per million population, according to a study conducted by GK Modi et al, 2006. Diabetic Nephropathy was found to be the commonest cause of ESKD **[1]**. On the other hand, the prevalence of CKD stage 3 has increased by 6.3%, surprisingly with the prevalence of diabetes in the Indian population being low. In India, diabetes, and hypertension today account for 40–60% cases of CKD **[2]**.

Due to the progression of the disease and the treatment method, chronic kidney disease patient receiving haemodialysis-based renal replacement therapy (RRT) experiences a number of complications. Patients on maintenance haemodialysis (MHD) have several nutritional de arrangements due to the loss of body proteins and metabolic disorders **[3]**. As malnutrition is a strong predictor of mortality in MHD patients, it is essential to assess their nutrient intake to manage these patients **[4].**

Protein Energy Wasting (PEW) commonly observed in MHD patients, is a multi-factorial, maladaptive metabolic state

characterized by loss of body protein mass and energy reserves, which is a major cause of morbidity and mortality amongst these patients. PEW. Protein-energy wasting is diagnosed if three characteristics are present (low serum levels of albumin, transthyretin, or cholesterol), reduced body mass (low or reduced body or fat mass or weight loss with reduced intake of protein and energy), and reduced muscle mass (muscle wasting or sarcopenia, reduced mid-arm muscle circumference), as proposed by ISRNM criteria **[5]**.

MATERIALS & METHODS

The study adopted a cross-sectional design conducted at a tertiary care hospital in Mumbai, India. The recruited patients were from 30-65 years of age group who had been receiving HD maintenance therapy for at least three months at the time of the study. A total of 54 patients were recruited for the study. Convenience sampling method was applied.

Inclusion criteria was patients willing to participate in the study on Maintenance Haemodialysis since minimum 3 months.

Exclusion criteria included hospitalized dialysis patients and patients with Acute Kidney Injury (AKI), Chronic Kidney Disease (CKD) stage 1-4, pregnant or lactating women, subjects consuming alcohol and subjects on medical management or conservative management were excluded.

An interviewer-administered questionnaire was used to collect data from participants. Socio-demographic details such as Anthropometric measurements, Biochemical parameters, 24-hour diet recall, Semi-quantitative Food Frequency Questionnaire were recorded.

Anthropometric measurements included Post-dialysis weight, triceps skinfold thickness (TSF) using LANGE Skinfold Caliper and MAMC using the formula MAMC = MAC-TSF (all measured in cm).

Biochemical parameters such as serum potassium, serum albumin, Serum cholesterol, Serum ferritin, Serum sodium, Serum phosphorus, Serum urea/ BUN, and Transthyretin were recorded Protein Energy Wasting (PEW) was diagnosed using ISRNM criteria.

STATISTICAL ANALYSIS

All data were analyzed using SPSS version 20. Descriptive statistics of continuous variables are presented as mean (standard deviation). In the case of categorical variables, data were presented in terms of count and percentage. Paired and unpaired t-tests and chi-square tests were used for statistical analysis as applicable. A p-value of less than or equal to 0.05 was considered statistically significant.

RESULT

A total of 54 chronic hemodialysis patients were recruited for the study. The sample consisted of 62% males and 38% females. Among the total study participants 2 patients did not give consent to participate in the study, 2 patients were excluded due to AKI, and the second, was admitted to the hospital for a nephrectomy (n=50).

Majority of the patients i.e. 76% followed thrice-a-week dialysis, 22% twice a week and only 2% came for dialysis four times a week. Causes of developing ESKD were hypertension (HTN) 86%, followed by diabetes 54% and Cardiovascular disease 18%. Other reasons reported by patients were chronic diseases 12% which included hypothyroidism, uremic cardiomyopathy, Acute Coronary Syndrome, Gout & Gastritis.

The current study analyzed nutrient intake on dialysis and non-dialysis day, Protein Energy Wasting along with their correlation.

Baseline demographic characteristics

Table 1 represents demographic details and anthropometric measurements as mean values.

Table 1.

Characteristics (n=50)	Mean (SD)
Age (yrs)	52 (8.5)
No. of family members	4 (1.7)
Monthly family income (Rupees)	45,000-60,000 (0.82)

Table 2 represents demographic details and anthropometric measurements in males and females as mean values.

Table 2.

Characteristics (n=50)	Mean (SD)	
	Male N= 31	Female N= 19
Weight (kg)	67.5 (17.0)	65 (12.0)
Height (cm)	162 (9.5)	156 (7.5)
BMI (Kg/m^2)	24.9 (5.2)	23.8(5.6)
MAMC (mm)	9.2 (12.4)	20.7 (27.0)
TSF (mm)	12.9 (4.5)	17.8 (8.0)

Abbreviations: BMI-Body Mass Index, MAMC- Mid Arm Muscle Circumference, TSF- Tricep Skinfold Thickness

Anthropometric Measurements

The mean BMI of patients was 24.9 (5.27) Kg/m^2, under the category of at risk for obesity and co-morbidities according to the Asian cut-off values **[6]**. Results show higher MAMC in females than males. The mean TSF in females was seen to be higher in females than males i.e. 12.9 (4.5) mm and 17.8 (8.0) mm. An Independent sample t-test was applied for the association of MAMC and TSF with gender. It was found that both MAMC and TSF were positively correlated with higher values in the female gender.

Biochemical parameters

Table 3. Depicts biochemical parameters obtained from the patient's medical reports and compared with the normal values. The results indicated elevated levels of serum potassium and serum urea/ Bun. Pre BUN values were considered for majority of the patients (n=45) as only 2 patients post BUN values were recorded in the patient's laboratory value sheet. Post-BUN values for the two patients were 10 mg/dl and 11.6 mg/dl respectively.

Table 3.

Biochemical marker	In present study	Reference range
Serum cholesterol	168.40 (51.7)	<200 mg/dl
Serum albumin	3.74 (0.4)	<3.8 g/dl
Serum calcium	8.25 (1.5)	8.5 to 10.5 mg/dl
Serum potassium	7.98 (19.2)	3.5 to 5.5 mEq/L
Serum ferritin	201.50 (142.1)	>200 ng/ml
Serum sodium	136.02 (3.6)	135-145 mEq/L
Serum phosphorus	4.55 (1.4)	3.4 to 4.5 mg/dl
Serum urea/ BUN	58 (20.2)	5 to 20 mg/dl

Dietary data

The sample consists of 66% non-vegetarians, 22% Lacto-vegetarians, 8% vegetarians, and only 4% lacto-ovo vegetarians. To assess their overall fat consumption, questions on daily oil intake, fried food consumption frequency, etc were asked. About 48% consumed 15g of visible fat, 30% exceeded the daily limit for consumption i.e 25g/d, and only 2% consumed 30g/d, the remaining consumed less than 15g/d.

Nutrient intake analysis was carried out using 24 hour diet recall, depicted in Fig 1. and Fig 2.

It was observed that Energy, Protein, CHO, Fat, Sodium and Potassium consumption were slightly higher on non dialysis day as compared to dialysis day. The daily nutrient intake on dialysis and non dialysis day is represented as mean (Std. deviation) values in table no. 4

Table 4.

Nutrients	Dialysis day	Non dialysis day
Energy (kcal)	874 (280.0)	912 (245.7)
Protein (g)	28.18 (16.4)	32.98 (16.7)
CHO (g)	117.48 (37.4)	122.36 (39.3)
Fats (g)	33.72 (13.4)	36.88 (13.2)
Sodium (mg)	3602.28 (1470.8)	3764.54 (1397.9)
Potassium (mg)	797.21 (397.1)	865.75 (301.8)

Fig 1.

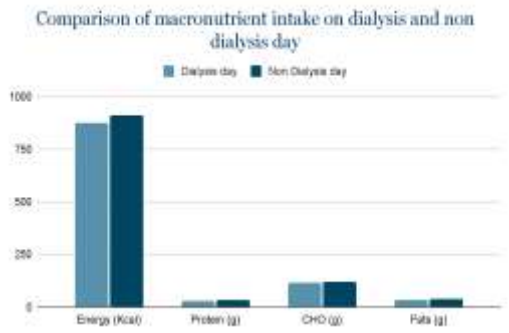


Fig 2.

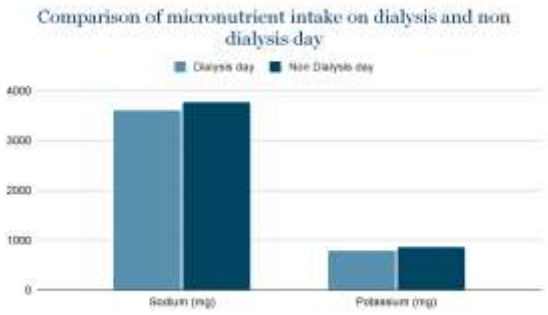
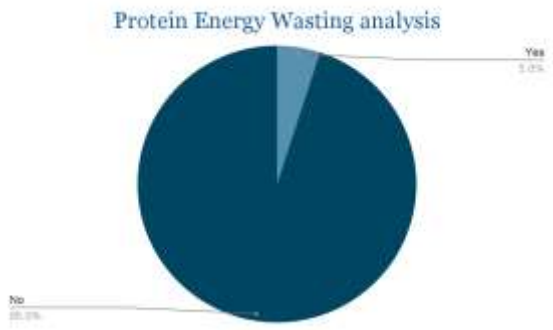


Fig no. 3 Depicts the percentage of patients diagnosed with PEW according to the ISRNM criteria. Results showed majority of the patients were well nourished and not Protein Energy Wasted. Only 5% were diagnosed with PEW with moderate muscle mass and energy store depletion.

Fig 3.



Semi-quantitative Food Frequency

A semi-quantitative FFQ with unusual food groups was administered to the patients in order to understand their consumption of uncommon food items particularly in dialysis patients. Food items consumed over the past month were recorded.

Pulses and legumes which are a rich source of potassium are usually limited in these patients diet, were seen to be never or rarely consumed by the majority. A considerable percent consumed egg, chicken ad mutton 1-2 times a week. Milk products and animal fat like ghee and butter were seen to be consumed 1-2 times a week by 30 to 40%. Junk food intake was rarely consumed by the majority of the patients. Green leafy vegetables and roots/tubers rich in Potassium were rarely or never consumed as per recommendations.

Association of nutrient intake and PEW

Table no.5 represents the association between nutrient intake and PEW.

An independent sample t test was applied to study the association between the two. The results revealed a positive association, suggesting that higher protein intake on non dialysis day may increase the incidence of PEW.

Table 5.

Nutrient intake	t test
Energy	-.547
Protein (g) dialysis day	-1.253
Protein (g) non dialysis day	.645
Carbohydrates	-.402
Fats	-.240
Sodium	-1.905
Potassium	-.844

DISCUSSION

As dialysis patients commonly experience poor appetite or nausea, we recorded their nutrient intake on dialysis and non-dialysis day. It was found that all the nutrients including Energy, Protein, Carbohydrates, Fats, Sodium, and Potassium intake were slightly lower on dialysis day as compared to non-dialysis day. These findings are similar to a study conducted by *Manju Sharma et al., 1999* **[7]**. We observed that most of the calories seemed to be derived from carbohydrates rather than from protein and fats. Protein sources for vegetarians was observed to be derived from cereals and vegetables rather than from milk products and pulses, which suggests low BV protein intake.

Protein-energy wasting (malnutrition) is commonly associated with patients on chronic haemodialysis as identified in this study. Patients were diagnosed with PEW using the ISRNM criteria. It was observed that only 5% were Protein Energy Wasted and the majority of the patients were well nourished but with higher fat mass percentage as evidenced by higher mean TSF value i.e. 14.7 (6.4) mm. Higher BMI in HD patients is associated with lower mortality rates, as also observed in our study where the mean BMI of patients was 24.94 (5.2) kg/m^2 **[8].**

CONCLUSION

The present study found that nutrient intake of Energy, Protein, CHO, Fats, Sodium and Potassium were lower on dialysis day due to disturbed schedule and the time spent on travelling to the dialysis centre.

A positive association between protein consumption on non dialysis day with PEW was found.

Declaration by Authors

Ethical Approval: Ethics Committee approval was sought from the Inter System Biomedical Ethics Committee (ISBEC) prior to data collection.

The participants were explained in detail about the study by providing a participant information sheet and written informed consent was obtained.

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Conflict of Interest: The authors declare no conflict of interest.

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