Original Article

Nutrition Profile and Quality of Life of Adult Chronic Kidney Disease Patients on Maintenance Hemodialysis in India: An Exploratory Study

Abstract

Background: Malnutrition and suboptimal food intake are common concerns among chronic kidney disease (CKD) patients. Medical nutrition therapy plays a significant role in ensuring the well-being of CKD patients undergoing maintenance hemodialysis (MHD). The present study explored the dietary intake and quality of life (QOL) of CKD patients on MHD. **Materials and Methods:** Adult CKD patients (n = 107, >20 years, 72% male) on MHD were conveniently selected from dialysis centers across India. This cross-sectional exploratory study elicited information on general profile, height, dry body weight, biochemical parameters, food intake, and QOL of the patients. Nutrient intake was compared with Kidney Disease Outcomes Quality Initiative (KDOQI) Guidelines. **Results:** The average energy and protein intake per kg body weight was below the recommendations (energy ~21 kcal/kg vs. 30–35 kcal/kg body weight and protein ~0.7g/kg vs. 1–1.2 g/kg body weight). Majority of them (>75%) had inadequate energy and protein intake. The sodium intake of the participants (3109.42 ± 1012.31 mg) was higher than the suggested limit. The energy and protein intake/kg ideal body weight of female patients was significantly higher than male patients ($p < 0.05$). Overall, their QOL was satisfactory. However, nearly half of them (47%) reported moderate-level problem in the pain and discomfort dimension. **Conclusion:** Patients were not meeting the recommendations especially for energy and protein. Patient-specific customized nutrition counseling along with routine nutrition assessment, follow-up of patients and continued nutrition education, and motivation and support from the medical care team, especially the dietitian is needed for better dietary compliance and overall improvement of QOL.

Keywords: *Chronic kidney disease, Hemodialysis, Renal nutrition, Renal diet, Quality of life*

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Introduction

Chronic kidney disease (CKD) is an emerging issue of public health concern worldwide.[1,2] The global prevalence of CKD (stages 1–5) is 13.4%[3] with the estimated number of individuals affected being 843.6 million.[4] In South Asia, the estimated prevalence of CKD among general population is 14% and in India it is 16%.[5] Studies conducted in different regions of India on varying sample sizes have reported CKD prevalence ranging from 7.5% to 22.7%.[6–8] CKD patients are prone to protein energy wasting because of hyper catabolism, reduced anabolism, loss of protein in dialysate, and anorexia.[9] Globally, the estimated prevalence of malnutrition among individuals affected by CKD is 42.7% with 43.1% prevalence in the maintenance hemodialysis (MHD) group.[10] Studies in India have also reported malnutrition among patients on dialysis[11] with prevalence ranging from 32% to 60.[12–14] Furthermore, the mortality rate increased with severity of malnutrition (mild/moderate to severe).[13] The factors contributing to malnutrition among individuals on MHD include dialysis-induced protein loss and inflammation, suboptimal energy and protein intake, alterations in taste, anorexia, depression, reduced physical functioning, and lack of social and financial support.[15] Another important factor is the quality of life (QOL) of patients which refers to how effectively an individual functions in daily life and their perceived physical, mental, and social well-being.[16] CKD adversely affects the QOL.[17–19] Studies conducted in different regions of India have reported that individuals with CKD have compromised

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QOL especially in the physical, mental, and psychological domains.[20–24] Factors affecting QOL are age, education, socioeconomic status, occupation, income, presence of co-morbidities, and duration of dialysis.[18,19,21–24] Furthermore, food intake, especially a low protein diet (≤0.8 g/kg/day) is also associated with poor QOL and depressive symptoms among CKD patients.[25]

Medical nutrition therapy with day-to-day dietary management at its core plays a significant role in ensuring the well-being of CKD patients. The primary goal is the maintenance of stable nutrition status and prevention of malnutrition by providing adequate energy, protein, and micronutrients.[26] Few studies conducted in India have reported inadequate dietary intake and nonadherence to prescribed intake, especially protein among adults on MHD.[27–30] Therefore, appropriate dietary counseling with personalized meal plans and ensuring adherence to it is crucial to prevent malnutrition.[26] The prescribed diets should be initiated in a systematic manner and stepped up gradually, especially while transitioning from a protein restricted diet (0.6–0.8 g/kg body weight per day) during nondialysis stage to a higher protein diet in the dialysis stage (1.0–1.2 g/kg body weight per day). Renal patients benefit from nutrition counseling because dietitians provide them with necessary information on food choices, meal preparation, and intake. Patients, when correctly informed and kept motivated by a dietitian, overcome difficulties related to adherence and follow the diet.[31,32] Furthermore, individualized nutrition counseling is also helpful in improving the QOL of CKD patients.[33] Thus, it is important to systematically document the information on nutritional status, food intake, and QOL of CKD patients undergoing dialysis through research studies. Such scientific evidence on dialysis patients from different regions of India would be helpful in identifying the gaps to address in the medical nutrition therapy for improving their nutritional management and QOL. The present study aimed to assess the dietary intake and QOL of adult CKD patients undergoing MHD and attending dialysis centers across India.

Materials and Methods

The present exploratory study was conducted in May, 2022 among CKD patients (>20 years of age) undergoing MHD. A total of 107 patients were selected using convenience sampling from different centers of the NephroPlus Dialysis Network across different states of India (Haryana, Jharkhand, Bihar, Maharashtra, Karnataka, Telangana, and Andhra Pradesh). Ethical clearance for the study was taken from Nephrocare Institutional Ethics Committee (IEC), Telangana-India (IEC registration no. ECR/1532/Inst/TG/2021).

Tools and Techniques

General profile: A proforma was developed to elicit information on the sociodemographic profile of the patients such as age, gender, occupation, type of family, and monthly income.

Anthropometric data: Height and dry body weight (DBW) of the patients were taken to derive their body mass index (BMI). Ideal body weight (IBW) was calculated as per the Hamwi method.[26]

Biochemical data: Values of serum albumin, potassium, phosphorus, calcium, urea, and creatinine were obtained from medical records for a sub-sample (n = 67). Date of first dialysis was also recorded for 80 patients.

Dietary data: A proforma was used to obtain information on dietary habits, meal pattern, frequency of eating food outside home, and consumption of multivitamin and mineral supplements. Furthermore, a qualitative food frequency questionnaire (FFQ) and 24-hour dietary recall (1 weekday) were also administered. The FFQ elicited information on the frequency of consumption of different food categories and items such as cereals, pulses, vegetables and fruits, meat, poultry and fish, milk and milk products, sugar, bakery or fried food, and chocolates. In dietary recall interviews, the patients reported all the food items consumed in the past 24 hours along with their portion sizes.

Quality of life: Euro QoL EQ-5D-3L was used for the assessment of QOL of patients.[34] The self-administered tool assessed information on five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) using a three-level severity scale (no problem, some problems, and extreme problems). In addition, it comprised a self-rated visual analogue scale (EQ VAS) where patients marked a point on the scale to indicate their health status (scale range: worst health, i.e., zero to best health, i.e., 100). EQ-5D-3L index scores were also calculated.

Pretesting: The questionnaires were pretested on 10 patients. Thereafter, necessary modifications were made and the final questionnaires were administered.

Data analyses

Food group and nutrient intakes were calculated using DietCal software based on the Indian Food Composition Database.[35] Outliers were removed and nutrient intakes (n = 106) were compared with Kidney Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guidelines for MHD patients.[26] For micronutrients, it has been suggested in the guidelines that the intake should meet the recommended allowances as for the general population. Assessment of BMI was done as per the World Health Organization Asia Pacific Classification.[36,37] Statistical analyses were done using SPSS version 22.0. Gender differences in energy and protein intake were assessed

using independent samples *t*-test. All results were tested at 5% level of significance.

Results

Sample characteristics

A total of 107 patients in the age range of 21–87 years participated in the study [Table 1]. The mean (SD) age of the participants was 55.04 (14.15) years. Majority of them were male (72%) and were engaged in skilled occupations (65%).

More than half of them (53%) belonged to joint families and around two-thirds of them (68%) had a monthly family income of >₹20,000. The sample comprised a higher percentage of participants with nonvegetarian dietary habit (69%). The mean (SD) duration of dialysis was 3.33 (3.09) years (n = 80). Majority of them consumed 3–4 meals per day (95%) and did not skip any meal (80%). Consumption of multi-vitamins and mineral supplements was observed in two-thirds of them (67%) such as calcium, iron, and folic acid. Furthermore, the mean BMI of the group was 22.95 ± 4.23 kg/m^2 and 35% of them had a normal BMI. Information on biochemical parameters mean (SD) was available on a sub-sample (n = 67): with mean albumin, 3.94 (0.41) g/dl; potassium, 5.34 (1.01) mmol/L; phosphorus, 5.82 (2.04) mg/dl; calcium, 8.55 (0.66) mg/dl; urea, 104.94 (62.49) mg/dl; and creatinine, 8.32 (2.93) mg/dl.

Table 1: General characteristics of the participants (n = 107)

Characteristic		Participants %
Age (years)	20–29	8
	30–39	7
	40–49	13
	50–59	31
	60–69	29
	70–79	10
	80–89	3
Gender	Male	72
	Female	28
Occupation	Unemployed	7
	Housewife	23
	Unskilled	5
	Skilled	65
Family type	Nuclear	47
	Joint	53
Family income per month (₹)	<5,000	4
	5,000–10,000	18
	10,000–20,000	11
	20,000 – 40,000	32
	>40,000	36
Dietary habit	Vegetarian	31
	Non-vegetarian	69
No. of meals consumed	Two	5
	Three	43
	Four	52
Meal skipping	No	80
	Yes	20
Skipped meal (n = 21)	Breakfast	24
	Dinner	24
	Lunch	29
	Tea and snacks	24
Frequency of eating out	Never	59
	Once a week	29
	Twice a week	7
	Thrice a week	6
Consumption of Multivitamin and mineral supplements	No	33
	Yes	67
Body mass index (kg/m^2)[a]	Underweight (<18.5)	14
	Normal (18.5–22.9)	35
	Overweight (23–24.9)	27
	Obese (≥25)	24

[a]World Health Organization Asia Pacific Classification.

Food and nutrient intake

Food groups, such as cereals (especially rice and wheat), milk and milk products, vegetables (other than green leafy vegetables), fruits, fats and oils, sugars and jaggery, were consumed as part of the daily diet by ≥50% of

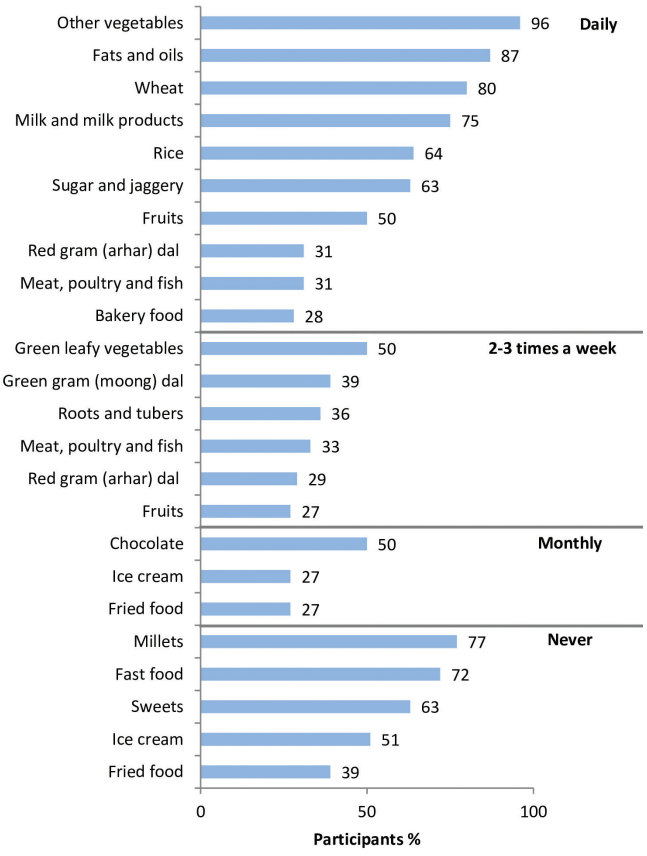


Figure 1: Food items consumed by >25% of the participants in varying frequencies (n = 107).

Table 2: Food group and nutrient intake of the participants based on 24-hour dietary recall (n = 106)

Food group	Intake/day Mean ± SD[a] (grams)	Nutrient	Intake/day Mean ± SD[a]
Cereals and millets	118.7 ± 68.3	Energy (kcal), per kg IBW[b]	21.5 ± 7.7
Bread and rolls	5.4 ± 18.5	Energy (kcal), per kg DBW[c]	21.1 ± 7.7
Biscuits	6.7 ± 10.7	Energy (kcal)	1248.4 ± 357.1
Grain legumes	25.2 ± 38.1	Protein (g), per kg IBW[b]	0.7 ± 0.4
Green leafy vegetables	36.5 ± 71.6	Protein (g), per kg DBW[c]	0.7 ± 0.4
Other vegetables	102.4 ± 102.9	Protein (g)	40.3 ± 18.5
Roots and tubers	56.4 ± 76.2	Carbohydrate (g)	166.0 ± 54.5
Fruits	29.7 ± 62.9	Total Fat (g)	44.9 ± 18.2
Condiments and spices	33.9 ± 35.9	Dietary fiber (g)	22.9 ± 9.8
Nuts and oil seeds	7.1 ± 20.0	Thiamine (mg)	0.7 ± 0.3
Sugars	19.3 ± 25.1	Riboflavin (mg)	0.5 ± 0.1
Mushrooms	1.3 ± 6.1	Niacin (mg)	6.5 ± 3.6
Milk and milk products	133.9 ± 133.1	Pantothenic acid (mg)	3.4 ± 1.4
Egg and egg products[d]	24.0 ± 46.7	Pyridoxine (mg)	0.8 ± 0.4
Poultry[d]	32.6 ± 72.7	Biotin (µg)	13.8 ± 15.2
Animal meat[d]	2.9 ± 17.5	Folates (µg)	172.3 ± 82.6
Marine fish[d]	5.4 ± 34.7	Ascorbic acid (mg)	50.8 ± 50.4
Marine shellfish[d]	2.7 ± 16.4	25-hydroxy-D3 (µg)	0.03 ± 0.2
Fresh water fish and shellfish[d]	5.8 ± 38.1	Calcium (mg)	359.2 ± 221.4
Edible oils and fats	22.9 ± 15.4	Iron (mg)	8.4 ± 3.5
Chips	0.3 ± 2.9	Phosphorous (mg)	744.4 ± 302.2
Namkeen	1.9 ± 10.5	Potassium (mg)	1581.2 ± 688.3
Juices	0.9 ± 9.7	Sodium (total) (mg)	3109.4 ± 1012.3
Ready to eat food	0.9 ± 9.7	Sodium (from food) (mg)	186.8 ± 183.5
Miscellaneous food	2.4 ± 7.0	Sodium (from salt) (mg)	2922.6 ± 1026.2
		Zinc (mg)	5.7 ± 2.4
		Oxalate (mg)	118.5 ± 79.2
		Phytate (mg)	870.4 ± 398.1
		Vitamin B_{12} (µg)	0.002 ± 0.01
		Retinol (µg)	91.2 ± 118.7
		Total carotenoids (µg)	4363.9 ± 4714.9
		Vitamin A (µg)	818.5 ± 791.9

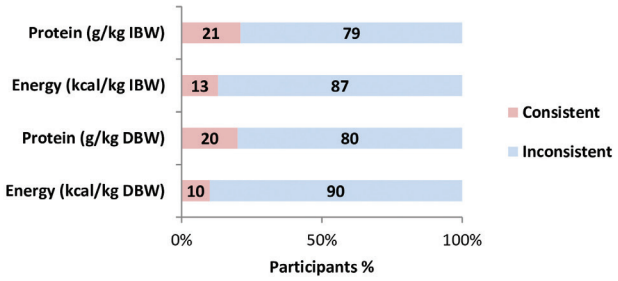
[a]SD: Standard deviation, [b]IBW: Ideal body weight calculated as per Hamwi method, [c]DBW: Dry body weight, [d]Intake among participants with nonvegetarian dietary habit (n = 73 out of 106).

Table 3: Gender differences in energy and protein intake (n = 106)

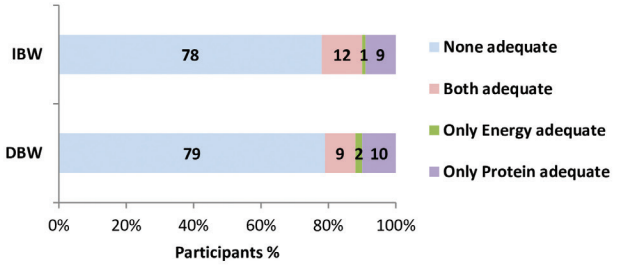
	Mean ± SD[a]		p-value[b]
	Male (n = 76)	Female (n = 30)	
Energy (kcal/kg IBW[c]/day)	20.02 ± 7.32	25.30 ± 7.59	0.001[e]
Protein (g/kg IBW[c]/day)	0.65 ± 0.33	0.82 ± 0.38	0.024[e]
Energy (kcal/kg DBW[d]/day)	20.42 ± 7.77	22.65 ± 7.33	0.179
Protein (g/kg DBW[d]/day)	0.66 ± 0.36	0.76 ± 0.45	0.243
Energy (kcal/day)	1258.02 ± 375.40	1233.90 ± 310.58	0.660
Protein (g/day)	40.58 ± 18.91	39.64 ± 17.79	0.816

[a]SD: Standard deviation, [b]As per independent samples *t*-test, [c]IBW: Ideal body weight calculated as per Hamwi method, [d]DBW: Dry body weight, [e]Values significantly different at $p < 0.05$.

the participants [Figure 1]. Bakery food products were consumed by more than one-fourth of the participants (28%) daily. Green leafy vegetables, pulses (such as green gram dal and red gram dal), roots and tubers, and meat, poultry, and fish were consumed two to three times per week by nearly one-third of the sample. The average daily intake (SD) of main food groups was: cereals and millets 118.7 (68.3) g, legumes 25.2 (38.1) g, milk and milk products 133.9 (133.1) g, egg and egg products 24.0 (46.7) g, poultry 32.6 (72.7) g, green leafy vegetables 36.5 (71.6) g, other vegetables 102.4 (102.9) g, roots and tubers 56.4 (76.2) g, and fruits 29.7 (62.9) g [Table 2]. The average daily energy and protein intake per kg IBW and DBW of the group was nearly 21 kcal and 0.7 g, respectively. Further, gender differences were also assessed and it was observed that the energy and protein intake per kg IBW of female participants was significantly higher than male



a Consistent: energy ≥30kcal/kg body weight /day, protein ≥1 g/kg body weight/day
Inconsistent: energy <30kcal/kg body weight /day, protein <1 g/kg body weight/day



b None adequate: Energy <30kcal/kg/day and Protein <1 g/kg/day;
Both adequate: Energy ≥30kcal/kg/day and Protein ≥1 g/kg/day;
Only Energy adequate: ≥30kcal/kg/day; Only Protein adequate: ≥1 g/kg/day

Figure 2: (a and b) Adequacy of energy and protein intake (n = 106). IBW: ideal body weight, DBW: dry body weight.

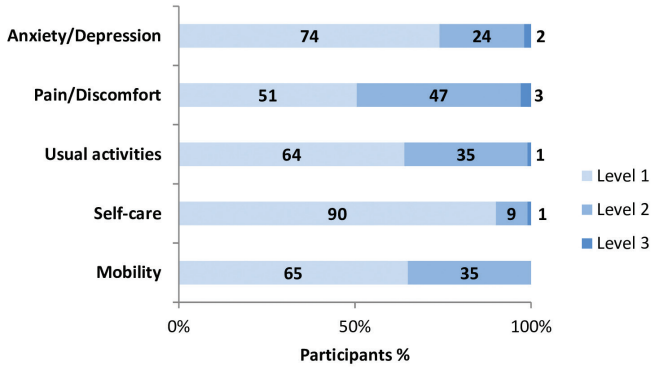
participants ($p < 0.05$) [Table 3]. In case of vitamins and minerals, the average daily intake (SD) from diet only was: vitamin C 50.8 (50.4) mg, vitamin A 818.5 (791.9) µg, iron 8.4 (3.5) mg, calcium 359.5 (221.4) mg, sodium 3109.4 (1012.3) mg, potassium 1581.2 (688.3) mg (40.5 ± 17.65 mEq) and phosphorus 744.4 (302.2) mg [Table 2].

Consistency with recommendations

The average daily energy and protein intake based on the IBW and DBW of the group was below the KDOQI recommendations (energy, 30–35 kcal/kg body weight/day and protein, 1–1.2g/kg body weight/day).[26] Majority of the participants had inadequate energy (<30 kcal/kg body weight/day) and protein intake (<1 g/kg body weight/day) [Figure 2]. The average sodium intake of the participants (3109.42 ± 1012.31 mg) was also higher than the suggested limit i.e. <2300 mg/day. The recommended intake of ascorbic acid is 90 mg/day for men and 75 mg/day for women. The observed mean intake of the group was lower (53.4 ± 54.7 mg for men and 44.3 ± 37.5 mg for women). The average intake of calcium, iron, folic acid, vitamin C and vitamin B_{12} was below the estimated average requirements for Indians.[38] However, 67% of patients were on multivitamin and mineral supplementation, which could have provided additional micronutrients. The detailed dosage was not reported by the study participants.

Quality of life

The mean (SD) EQ VAS and EQ-5D-3L index scores were 86.65 (11.76) and 0.69 (0.14), respectively which indicates that the overall QOL of the participants was satisfactory. Figure 3 shows the percentage of participants in each



Level 1: No problem, level 2: some problems, level 3: extreme problems

Figure 3: Quality of life of the participants (n = 107).

dimension for different levels of EQ-5D QOL. Nearly half of the participants (47%) had level 2 problem (i.e. moderate pain or discomfort) in the pain and discomfort dimension. Mobility and usual activities were the next two frequently reported dimensions in which more than one-third of the participants (35%) had level 2 problem (i.e. some problems in walking and performing usual activities). Majority of the participants (90%) had no problems with self-care and more than two-thirds (74%) reported not being anxious or depressed. Extreme problems in any of the dimensions were reported by very few participants (≤3%).

Discussion

In India, the prevalence of malnutrition among patients on dialysis ranges from 32% to 60%.[12–14] The prevalence of patients on chronic dialysis is estimated to be 129 per million population.[39,40] The Global Burden of Disease studies have shown an increase in mortality from diabetes-related CKD over the past years.[41] Also, CKD prevalence is two times higher in individuals with diabetes and hypertension in South Asia.[5] NFHS-5 India (2019–2021) has also reported a rising burden of noncommunicable diseases (NCDs) (such as high or very high blood sugar level and hypertension) and related risk factors (high BMI and waist-to-hip ratio).[42] Rise in prevalence of these NCDs and related risk factors will contribute to CKD burden in India. Studies conducted in different regions of India have also reported a rise in CKD prevalence.[6–8,43–45] Furthermore, CKD patients, especially on dialysis, are prone to malnutrition[11–14] with a compromised QOL.[20–24]

The study has some limitations. The patients were selected using convenience sampling from different centers of the NephroPlus Dialysis Network. Dialysis patients from India have diverse socioeconomic and educational profiles and vary in terms of primary caregiver characteristics, access to healthcare facilities and dialysis units. Therefore, the observations cannot be claimed to be representative of the study population. The 24-hour dietary recall was conducted for only 1 day, so the generalizability is somewhat questionable. Also, the dietary recalls conducted by trained interviewers may have recall bias. The study did not elicit

detailed information on the dosage of supplements taken by two-thirds of the study participants. So, there could be some underreporting of micronutrients in these patients as the study reported nutrient intake based on dietary recall only. Furthermore, the study population was skewed, i.e., a higher percentage of men (70%) and participants from high-income group belonging to urban areas who may have better health-seeking behavior.

Thus, the present study aimed to provide information on the dietary intake and OQL of CKD patients on MHD. Energy and protein intake of 30–35 kcal and 1–1.2 g per kg body weight per day has been suggested for MHD patients.[26] The results showed that participants had inadequate intake of energy (~21 kcal/kg), protein (~0.7g/kg body weight), and some of the other nutrients such as calcium, iron, folic acid, vitamin C, and vitamin B_{12}. The findings observed in the present study are consistent with other researches that have reported inadequate energy and protein intake among HD patients.[27,29,30] In a study conducted in Kenya among MHD patients, average energy and protein intake of 14.73 kcal and 0.43g per kg body weight, respectively, was observed.[46] Similarly, in three more studies, a suboptimal intake of energy and protein was reported.[47–49] Out of these three studies, two also reported high sodium intake (>2000 mg/day) by the participants which was also a finding of the present research (3109.4 mg/day).[47,48] In few studies conducted in India, MHD patients were unable to meet the energy and protein recommendations.[27,29,30] In the present study, >75% participants were not meeting the energy and protein recommendations. The findings corroborate with other researches where nearly 60%–77% were consuming energy and protein less than the recommended amounts.[15,29,47,49] Though we had a small proportion of women in our study population, their intake of energy and protein intake per kg IBW/day was higher than men. Sharma *et al*.,1999 also reported that energy intake was lower in men.[29]

Assessment of QOL of life in the current study indicated that overall QOL of the participants was satisfactory as inferred by the EQ VAS and EQ-5D-3L index score. A similar observation was also made by one other Indonesian study where nearly two-thirds (67.7%) of the patients reported good QOL.[19] In the present study, more than 1/3rd of the participants faced moderate level problem in pain, discomfort, mobility and usual activities. Inadequate QOL in physical and psychological/mental domains was observed in few other Indian studies as well.[20–24] However, in the present study, the domains of anxiety/depression and self-care dimensions measured under the QOL were the least affected in >70% participants.

The findings of this study confirm that inadequate food and nutrient intake is a significant concern among MHD patients. Poor energy and protein intake due to anorexia[49] can further contribute to malnutrition in patients and affect their QOL. In addition, patients do not always receive proper nutrition counseling, face difficulty in adhering to various dietary and fluid recommendations and translating the recommendations into smart food choice and interesting diets.[17,47,50] They should be counseled regarding the dietary modifications needed from the early stages of dialysis.[29] Patient-specific dietary counseling, regular nutrition status assessment, monitoring, and evaluation of patient's adherence to counseling will facilitate proper nutritional management and identification of areas that need attention.[47,50,51] Furthermore, regular nutrition education, encouragement, and motivation of the patients and their families should be done to ensure adherence to dietary advice so that they can have a healthy life with improved quality. Further research studies can be conducted to enquire the patients regarding reasons for their suboptimal food intake and problems with adherence with dietary advice. Studies with comprehensive nutrition assessment of MHD patients involving screening for malnutrition, and dietary intake, diversity, and appetite assessment are needed.[26,47,50] Scientific data obtained through studies conducted on a representative sample will help in designing patient-specific strategies focused on enhancing the nutritional status and diet of MHD patients.

Conclusion

Patients were not meeting the recommendations especially for energy and protein. Patient specific customized nutrition counseling along with routine nutrition assessment, follow-up of patients and continued nutrition education, and motivation and support from the medical care team especially the dietitian is needed for better dietary compliance and overall improvement of QOL.

Acknowledgements

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Conflicts of interest

There are no conflicts of interest.

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