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Original article

Assessment of nutritional status and its impact on quality of life of patients on maintenance hemodialysis

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ABSTRACT

Background: Malnutrition and anorexia are frequent complications in patients on maintenance hemodialysis (MHD) significantly affecting their quality of life, resulting in high morbidity and mortality. A study was conducted to assess the association between anorexia, nutritional status and quality of life. **Materials and methods:** 90 patients (55 males and 35 females; age range of 25 to 73 years; mean age 52.62 ± 11.7 years) undergoing twice/thrice weekly MHD for six months and above were assessed for self reported appetite using first three questions of Appetite and Diet Assessment tool (ADAT). Anthropometry and Subjective global assessment – Dialysis Malnutrition Scale (SGA-DMS) to were used to assess the nutritional status, and Health survey for dialysis patients Short Form (SF) -36 questionnaire to assess the health related quality of life. **Results:** Based on SGA-DMS, 54.4 % were moderate to severely malnourished, 31% were mild to moderately malnourished and 14.4% were well nourished. The self reported appetite was fair and poor in 38%, good in 48% and very good in 14% patients. The total mean score of the physical component of quality of life was 40.64 ± 10.79, mental component was 37.57 ± 13.19 and the overall mean quality of life was 39.02 ± 11.9. There was a negative correlation between nutritional status and components of quality of life ($P<0.0001$). **Conclusion:** The poorer the appetite, lower was the anthropometry, poorer was the nutritional status and significantly poorer was the quality of life ($P < 0.0001$). Identification and measures to ameliorate the appetite and nutritional status of the MHD patients would improve their health related quality of life and reduce morbidity and mortality.

KEYWORDS: Nutrition, Anthropometry, Hemodialysis, Quality of life.

INTRODUCTION

Protein-calorie malnutrition is a common co-morbid factor in end-stage renal disease (ESRD) patients on maintenance hemodialysis and is associated with increased morbidity, mortality, hospitalization and lower quality of life [1, 2]. Approximately one third of patients have mild to moderate malnutrition, and 6% to 8% more have severe malnutrition [3].The causes of malnutrition in patients on maintenance hemodialysis are multifactorial. Appetite, i.e., the subjective desire of food ingestion is diminished leading to anorexia which contributes largely to malnutrition and affects quality of life in hemodialysis patients [4, 5]. Loss of appetite may also be related to several factors, such as drug-nutrient interactions, cytokine effects on the central nervous system, depression, poverty, and/or loneliness. In addition, many patients perceive the renal diet to be inflexible, unpalatable, and difficult to understand, all of which may lead to an inadequate intake of energy and protein [6].

Anorexia decreases the protein and energy intake thereby resulting in Protein-energy malnutrition (PEM), results in a significant alteration in the anthropometry, lower the levels of serum albumin and hemoglobin. Apart from anorexia, malnutrition is also contributed by an altered metabolism,

increased catabolism, dietary restriction and as such the dialysis process itself [7].

A strong positive association had been reported between quality of life and nutritional status in diseases with higher incidence of malnutrition like cancer [8]. Although it is well understood the association between dietary intake, nutritional status and increased morbidity and mortality in patients on MHD, few studies have explored the relationship between appetite, nutritional status and health related quality of life of these patients [9, 10]. Hence a cross sectional study was conducted to assess the appetite, the nutritional status and evaluate the association between nutritional status and health related quality of life in patients on maintenance hemodialysis.

MATERIALS AND METHODS

The study was conducted in 90 patients, aged above 18 years, diagnosed with stage V CKD, undergoing twice or thrice weekly maintenance hemodialysis for 6 months and above in the dialysis unit of a tertiary care teaching hospital, after obtaining the approval of the Institutional Ethics Committee and the informed consent of the patients. Patients with inflammatory diseases, uncontrolled DM, smoking history, acute illness, long term therapy with steroids and immunosuppressants, known malignancies, patients on once weekly MHD and patients on enteral or parenteral nutrition were excluded from the study. On initiation, data including demographics, medical history, duration of dialysis, co-morbidities, pre and post dialytic blood pressure, pre and post dialytic BUN, interdialytic weight gain was obtained from patients' cases records and direct history interview of the patients.

The dialysis adequacy (Kt/V) was determined from pre and post dialytic BUN levels and the pre and post dialysis weights as described by Daugridas JT [11]. The normalized protein catabolic rate (nPCR) was estimated using a simple formula [12]: nPCR (g/kg/day) = (0.0136 × [Kt/V × ([predialysis BUN + post dialysis BUN] ÷ 2)]) + 0.251. The Urea reduction rate (URR) was calculated using the formula [13]: 100 (1- post BUN/pre BUN). The assessment of appetite was done by using the first three questions of the Appetite and Diet Assessment Tool [14] (ADAT), nutritional status by anthropometry and Subjective Global Assessment-Dialysis Malnutrition [15] (SGA-DMS) and health related quality of life by Health Survey for dialysis patients Short Form-36 [16] questionnaire. The responses for ADAT, SGA-DMS and QOL questionnaires were obtained from the patients by the interviewer after explanation of these tools.

PARAMETERS ASSESSED

I. Anthropometric Indices - measurements were performed between 10-20 minutes after termination of dialysis session.

1. Body mass index (dry body weight in kg/ height in m^2) [17]. Dry body weight is the weight obtained by the end of dialysis without causing hypotension and /or cramps.

2. Mid arm circumference (MAC) was measured with a plastic tape on the non dialysis access arm for three times and average result of the three measurements is to be taken as final measurement [18].

3. Triceps skin fold thickness (TSF) was measured with a conventional skinfold caliper (Herpenden caliper) on the non-dialysis access arm using standard techniques for three times and average result of the three measurements is to be taken as final measurement [19].

4. Mid arm muscle circumference (MAMC) is a measure for muscle mass in the body measured together with the triceps skinfold assuming that the measured muscle circumference is representative for the rest of the body. It was calculated using the following equation [19]: MAMC (cm) = MAC - 3.1415 × triceps skinfold thickness

5. Mid arm muscle area (MAMA) is an estimation of the area of the bone and muscle portions of the upper arm. It was calculated using the formula [20]:

$$\text{MAMA} = \frac{[\text{Midarm circumference (cm)} - (3.14 \times \text{TSF cm})]^2}{4\pi} - 10 \text{ (males) or } - 6.5 \text{ (females)}$$

This formula corrects the upper arm area for fat and bone. Average values for the mid arm muscle area are 54± 11 cm^2 for men and 30 ± 7 cm^2 for women. A value < 75% of this standard (depending on age) indicates depletion of lean body mass.

6. Mid arm fat area (MAFA) [20]: MAFA = (MAC × TSF)/2 – $\pi(TSF)^2/4$

7. Lean body mass (LBM) is an estimation of difference between the total body mass (weight in kg) and weight of the body fat. LBM was obtained using the formula [21]:

LBM in kgs (men) = (1.10 × Weight (kg)) – 128 × (Weight ^{2}/ (100 × Height (m))^2)

LBM in kgs (women) = (1.07 × Weight (kg)) – 148 × (Weight ^{2}/ (100 × Height (m))^2)

8. Ideal Body weight (IBW) was calculated using Devine formula [22]:

IBW in kgs (men) = 50 kg + 2.3 kg * (Height (in) - 60)

IBW in kgs (women) = 45.5 kg + 2.3 kg *(Height (in) - 60)

9. Total body water (TBW) gives the Urea volume of distribution. It is calculated from the formula by Watson [23]:

Male TBW (liters) =2.447 - (0.09156 x age) + (0.1074 x height) + (0.3362 x weight)

Female TBW (liters) = -2.097 + (0.1069 x height) + (0.2466 x weight)

Appetite and Diet Assessment Tool (ADAT) is a 44 item, self-administered questionnaire divided into three sections. Section 1 includes questions about the patient's general level of appetite, recent changes in dry weight, dietary compliance, need for assistance with food shopping and meal preparation, common food practices and the patient's perceptions of food enjoyment and diet satisfaction. The answers to the appetite questions are scored as 1. Very good, 2.Good, 3. Fair, 4. Poor and 5. Very poor based on Likert five point grading scale. The study patients were made to

answer the first three questions of the ADAT and the appetite levels of the study patients were graded based on their response. Based on their appetite status, patients were categorized in to three groups namely ***very good, good and fair, poor and very poor.***

Subjective Global Assessment – Dialysis Malnutrition Score (SGA-DMS) - a fully quantitative scoring system consisting of seven features: weight change, dietary intake, gastrointestinal symptoms, functional capacity, co morbidity, subcutaneous fat and signs of muscle wasting. Each component has a score from 1(normal) to 5 (very severe). Thus the malnutrition score (sum of all seven components) is a number between 7(normal) to 35 (severely malnourished). Therefore, a lower score denotes tendency towards normal nutritional status. A higher score however is considered to be an indicator of the presence of malnutrition elements that is the higher the nutritional score the stronger the tendency towards protein – calorie malnutrition. . A score of 7 to 10 were considered as ***well nourished***, 11 to 20 as ***mild to moderately malnourished*** and 21 to 35 as ***moderate to severely malnourished***.

Health Survey for Dialysis Patients – Short Form 36 (SF 36)

The SF 36 consists of 36 items categorized under eight scales of self reported health status as Physical functioning, role functioning/ physical, bodily pain, general health, vitality, social functioning, role functioning/emotional and mental health. These scales are scored from 0 to 100, with higher scores indicating better function. Two normalized scores representing overall total physical component and total mental component are calculated using 1 to 5 scales of physical and 6 - to 8 scales of mental functioning respectively.

Statistical Analysis

The analysis was performed using SPSS 16.0 version. Categorical variables were expressed as frequency and percentage and Continuous variables were expressed as mean ± standard deviation. One way ANOVA and post hoc Tukey test were performed to examine the significant differences in anthropometry, appetite and quality of life with respect to nutritional status. The correlation between the nutritional status based on SGA-DMS and the components of quality of life was assessed by Pearson's correlation. A P value of < 0.05 was considered statistically significant.

RESULTS

The study was conducted in 90 patients (55(61%) males and 35(39%) females) undergoing twice/thrice weekly maintenance hemodialysis. The age range of the study population was 18 to 73 years and the mean age was 52.62 ± 11.7 years. Majority of the patients were in the age range of 46 to 55 (39%) and above 55 years (42%). Dialysis vintage of the study population was found to be 20.99 ± 12.08 months. The mean interdialytic weight gain was found to be 3.11 ± 1.19 kgs.

The mean pre and post dialytic systolic blood pressure was 149.17 ± 12.05 and 134.78 ± 11.45 mm Hg and the mean pre and post dialytic diastolic blood pressure was 88.72 ± 6.07 and 82.22 ± 6.4 mmHg respectively. The pre and post dialytic BUN was 120.19 ± 36 and 40.16 ± 12.23 mg/dL respectively. The mean dialysis adequacy (Kt/V) was found to be 1.38 ± 0.09 and mean normalized protein catabolic rate (nPCR g/kg/day) was 1.76 ± 0.46. The mean Urea reduction rate was found to be 66.36 ± 2.38.

The SGA-DMS scores showed that 49 (54.4 %) patients were moderate to severely malnourished with a score range of 21 to 35 (mean score 25.55 ± 3.8), 28 (31%) patients were mild to moderately nourished with a score range of 11 to 20 (mean score 14.50 ± 3.23) and 13 (14.4%) patients were well nourished with a score range of 7 to 10 (mean score 8.92 ± 1.15) (Table 1).

Table: 1 Nutritional status assessment based on SGA-DMS

Nutritional status	SGA- DMS Score Range	Mean SGA-DMS Score ± SD	No. of Patients (N=90)	
			n	%
Well nourished	7 to 10	8.92 ± 1.15	13	14.4
Mild to moderately malnourished	11 to 20	14.50 ± 3.23	28	31.1
Moderate to severely malnourished	21 to 35	25.55 ± 3.8	49	54.4

Table 2 depicts that there was no statistically significant difference ($P > 0.05$) in the age, dialysis vintage, interdialytic weight gain, ultrfiltration, dialysis adequacy and urea reduction ration of the study population with respect to their nutritional status. Based on the ADAT scores, the appetite was found to be very good for13 (14.4%) patients of which 3 were severely malnourished, 5 patients were moderately nourished and 5 were well malnourished.

There were 43(47.8%) patients with Good and fair appetite, of which 16 were severely malnourished, 19 were moderately malnourished and 8 were well nourished. The appetite was found to be poor and very poor for 34 (37.8%) patients, of which 30 were moderate to severely

malnourished and 4 patients were mild to moderately malnourished. There was a statistically significant difference in appetite based on the nutritional status of the study population (P<0.001) as shown in Table 3.

The anthropometric indices of the study population based on their nutritional status are described in table 3. There was no difference between the mean height and body surface area of the patients based on their nutritional status. The mean dry body weight, lean body mass, ideal body mass and total body water were found to be higher in well nourished patients than the moderately and severely malnourished patients but the differences were not statistically significant. The mean body mass index, triceps skin fold thickness, mid arm circumference, mid arm muscle circumference, mid arm muscle area and mid arm fat area were also higher in well nourished patients than the malnourished patients and the difference was statistically significant (P<0.05).

Table: 2 Baseline characteristics and nutritional status of study population

Characteristics	Mean ± SD			P value
	Well nourished (n=13)	Mild to moderately malnourished (n=28)	Moderate to severely malnourished (n=49)	
Age (years)	56.15 ± 10.02	53.14 ± 12.18	51.39 ± 11.7	0.415
Dialysis Vintage (months)	20.08 ± 13.24	19.93 ± 11.12	21.84 ± 12.45	0.771
Interdialytic weight gain (kg)	3.05 ± 1.32	3.05 ± 1.13	3.11 ± 1.22	0.926
Ultrafiltration (L)	3.55 ± 0.65	3.72 ± 0.58	3.64 ± 0.74	0.751
Kt/V	1.36 ± 0.09	1.39 ± 0.09	1.38 ± 0.09	0.478
nPCR (g/kg/day)	1.87 ± 0.40	1.77 ± 0.50	1.72 ± 0.45	0.599
Urea Reduction Ratio	66.23 ± 2.22	66.78 ± 2.67	66.15 ± 2.26	0.528

P < 0.05 was considered significant

Table 3 - Appetite Vs nutritional status among study population

APPETITE	Nutritional status			Total (N=90)		P value
	Well nourished (n=13)	Mild to moderately malnourished (n=28)	Moderate to severely malnourished (n=49)	n	%	
Very good	5	5	3	13	14.4	< 0.0001**
Good & Fair	8	19	16	43	47.8	
Poor & Very poor	0	4	30	34	37.8	

P < 0.001 was considered highly significant

Table 5 depicts the mean scores of the quality of life components of the study population based on their nutritional status. The mean scores of the physical components physical functioning, role physical, bodily pain, general health and vitality and the mental components namely Social functioning, role emotional and mental health were significantly lower for patients who were severely malnourished than the malnourished and well nourished patients. The mean score of the total mental component was also found to be 50.392 ± 6.49, 42.268 ± 9.38 and 31.475 ± 12.95 and the mean score of the total physical component was found to be 52.008 ± 4.73, 44.296 ± 7.97, 35.53 ±10.26 respectively for the well nourished, mild to moderately malnourished and moderate to severely malnourished patients.

Table :4 Anthropometry Vs nutritional status of study population

Anthropometric indices	Mean ± SD.			P value
	Well nourished (n=13)	Mild to moderately malnourished (n=28)	Moderate to severely malnourished (n=49)	
Height (cm)	157.15 ± 10.30	157.64 ± 7.65	158.22 ± 9.59	0.918
Dry body weight (kg)	57.71 ± 10.03	55.06 ± 8.02	51.87 ± 11.89	0.157
Body Mass Index (kg/m^2)	23.34 ± 3.39	22.11 ± 2.59	20.63 ± 3.59	0.02*
Body surface area (m^2)	1.58 ± 0.170	1.55 ± 0.137	1.72 ± 0.449	0.386
Mid arm circumference (cm)	22.25 ± 2.27	21.49 ± 1.94	18. 65 ± 4.27	< 0.0001**
Mid arm muscle circumference	18.46 ± 1.53	18.05 ± 1.47	15.82 ± 3.23	< 0.0001**
Triceps Skin fold thickness	12.01 ± 2.67	10.96 ± 1.92	9.27 ± 3.47	0.004*
Mid arm muscle area	27.35 ± 4.5	26.09 ± 4.18	20.59 ± 8.23	< 0.0001**
Mid arm fat area	12.42 ± 3.89	10.99 ± 2.78	8.56 ± 4.79	0.004*
Lean Body mass (kg)	46.85 ± 6.31	45.68 ± 6.97	42.27 ± 9.17	0.141
Ideal body mass (kg)	55.04 ± 8.43	54.38 ± 9.33	53.71 ± 6.49	0.782
Total body water	31.92 ± 3.87	31.896 ± 4.41	30.44 ± 5.46	0.381

P < 0.05 was considered significant

Table :5 Mean Scores of QOL components and nutritional status

QOL Components	Mean ± SD			P Value
	Well nourished (n=13)	Mild to moderately malnourished (n=28)	Moderate to severely malnourished (n=49)	
Physiscal functioning	51.29 ± 5.13	43.16 ± 9.99	30.91 ± 13.51	< 0.0001**
Role physical	48.02 ± 4.41	42.88 ± 7.17	33.93 ± 11.91	
Bodily pain	51.42 ±7.25	42.57 ± 9.83	32.60 ± 11.01	
General health	50.49 ± 9.64	43.93 ± 8.94	33.62 ± 8.73	
Vitality	47.68 ± 5.00	44.15 ± 7.20	37.55 ± 10.19	
Social functioning	49.40 ± 7.59	40.66 ± 8.35	30.40 ± 12.49	
Role emotional	49.31 ± 9.84	39.93 ± 10.64	28.14 ± 11.91	
Mental health	47.56 ± 4.60	41.94 ± 5.91	28.76 ± 12.97	
Total Physical component	52.008 ± 4.73	44.296 ± 7.97	35.53 ±10.26	
Total Mental component	50.392 ± 6.49	42.268 ± 9.38	31.475 ± 12.95	
Overall SF36 SCORE	51.306 ± 5.60	43.350 ± 8.35	33.253 ± 11.39	

P < 0.001 was considered highly significant

The total mental component scores were lower than the total physical component scores in all the patients. The overall mean quality of life score was 51.306 ± 5.60 for well nourished, 43.350 ± 8.35 for mild to moderately malnourished and 33.253 ± 11.39 for moderate to severely malnourished patients. There was a statistically significant difference in the QOL of patients based on their nutritional status indicating that better their nutritional status higher was their health related QOL (P< 0.0001). This observation was further corroborated by a significant negative correlation between SGA-DMS and the total physical component (r = - 0.757; P<0.0001; Figure 1) , total mental component (r = - 0.735; P<0.0001; Figure 2), and the overall quality of life (r = - 0.767; P<0.0001; Figure 3).

Figure:1 SGA –DMS Vs Total physical component of QOL in study population

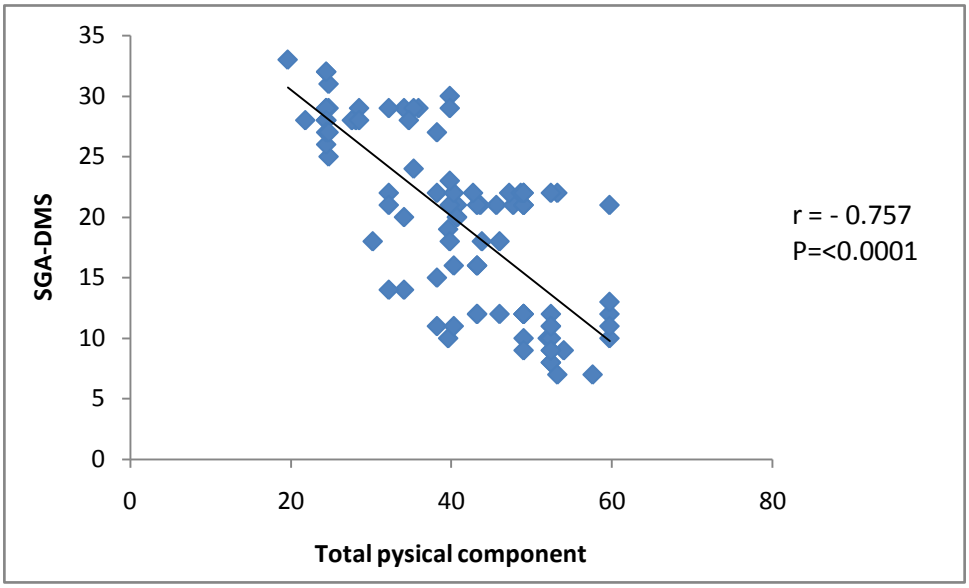


Figure:2 SGA –DMS Vs Total mental component of QOL in study population

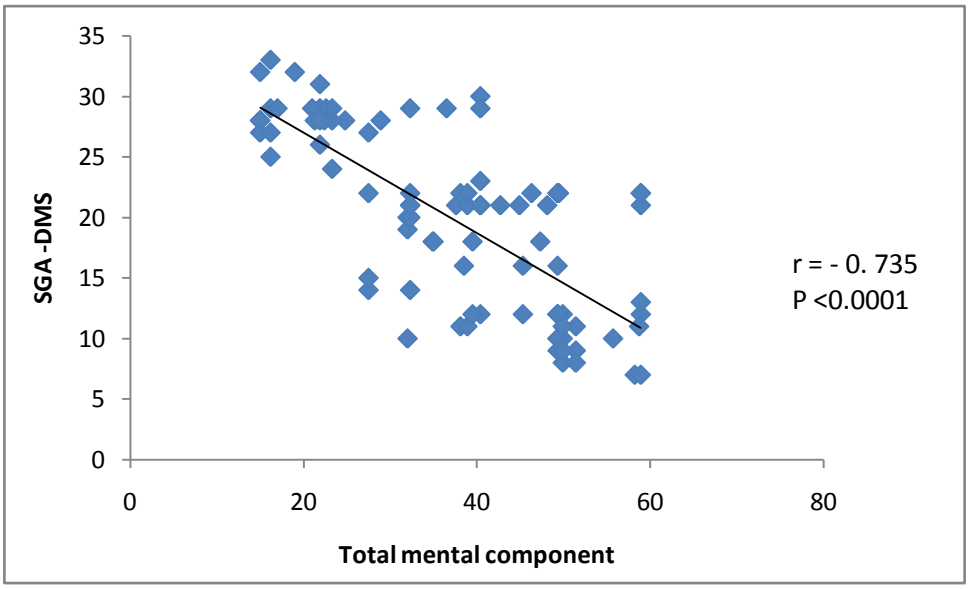
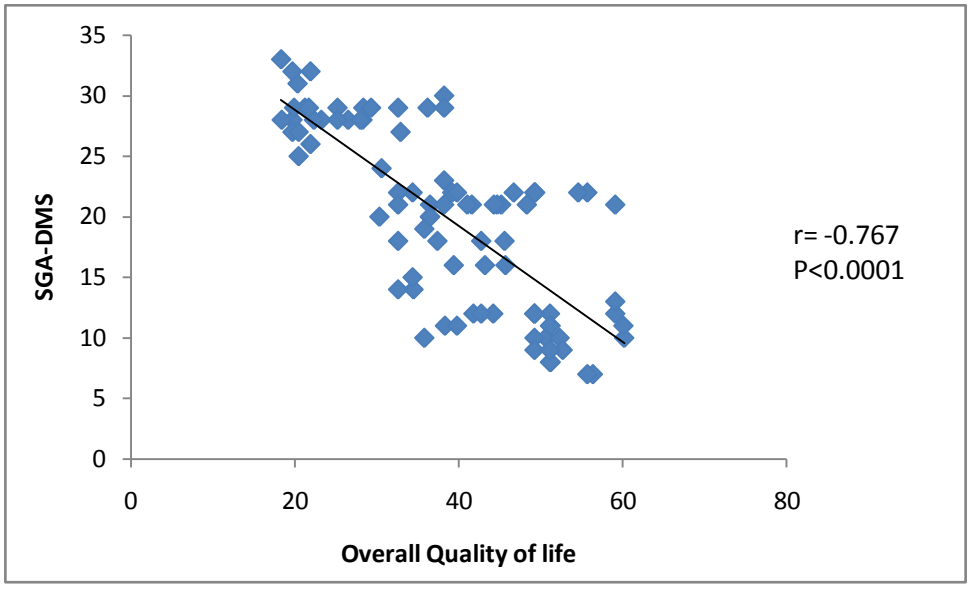


Figure: 3 SGA –DMS Vs Total mental component of QOL in study population



The mean QOL score of total physical component was found to be 52.308 ± 6.23 for 13 patients with very good appetite, 44.559 ± 7.50 for 28 patients with good and fair appetite and 31.215 ±7.95 for 49 patients with poor and very poor appetite. Similarly the mean QOL score of total mental component was 51.446 ± 7.17, 42.520 ± 9.52 and 25.991 ± 9.48 and the overall mean QOL score was found to be 51.843 ± 6.47, 43.566 ± 8.25 and 28.320 ± 8.39 for patients with very good, good and fair, poor and very poor appetite respectively. There was a statistically significant difference in the health related QOL of patients based on their appetite (P < 0.001) as explained in table 6.

Table: 6 Appetite Vs Quality of life of study population

Quality of life	Appetite			P value
	Very good (n=13)	Good & Fair (n=28)	Poor & Very poor (n=49)	
Total physical component	52.308 ± 6.23	44.559 ± 7.50	31.215 ±7.95	< 0.0001**
Total mental component	51.446 ± 7.17	42.520 ± 9.52	25.991 ± 9.48	
Overall QOL	51.843 ± 6.47	43.566 ± 8.25	28.320 ± 8.39	

P < 0.001 was considered highly significant

DISCUSSION

Malnutrition still remains a serious concern in patients on maintenance hemodialysis. Various studies have reported a wide prevalence of protein energy malnutrition (PEM) in patients on chronic hemodialysis and its association with poor quality of life [24, 25]. The present study had demonstrated a prevalence of moderate and severe malnutrition in 31% and 54% of patients respectively, which is concordant to the literature. Age, duration of dialysis and interdialytic weight gain had no significant association with the nutritional status. Similarly there was no significant difference in the dialysis adequacy, normalized protein catabolic rate, Urea reduction ration and Ultrafiltration based on the nutritional status.

Malnutrition in CKD arises due to varied reasons including poor appetite and dietary restrictions. Inflammation and uremia are considered to be the key factors for anorexia in CKD patients on MHD. The present study demonstrated a significant difference in the appetite of the patients based on their nutritional status, indicating a strong correlation between appetite and nutritional status, similar to that of the results given by Kalantar Zadeh et al., [7] and Burrowes D, et al [14].

Assessment of nutritional status in CKD patients involves a combination of measures rather than a single measure. These measures range from least expensive anthropometric measurements like BMI, arm circumferences and skin folds, ideal and lean body mass, and clinical tools like SGA-DMS to more expensive techniques like Bio electrical Impedance and Dual energy X-ray absorptiometry. Commonly, anthropometric assessment by measurement of circumferences and skin folds of upper limbs at single sites, particularly the triceps, are used to assess the long term changes in nutritional status due to accessibility and ease in clinical practice. The probability of inter and intra observer

variability in anthropometric assessments can be overcome by the use of a single trained observer, appropriate equipment and standardized protocols [26]. In the present study, the anthropometric indices were significantly lower in malnourished patients in comparison to the well nourished patients, showing a strong correlation thus similar to other reports [27].

Nutritional status is likely to influence physical function, emotional well being and overall quality of life in HD patients, and it also appears from observational studies that there is a strong independent relationship between malnutrition, quality of life and mortality risk in HD patients [25, 28]. The present study also observed that there was a significant decline in the physical and the mental components of the SF 36 QOL scores with a decrease in appetite and nutritional status of the patients.

This finding is of clinical significance since QOL is a strong predictor of morbidity and mortality in MHD patients and the importance of health related quality of life has been increasingly recognized by the healthcare providers. But till date, the assessment of QOL still remains a research domain rather than being a routine practice in clinical arena. The assessment of patients' physical functioning and emotional well being could help the health care providers to assess the functional capacity of the patients, recognize the symptoms of mental illnesses like depression, insomnia and facilitate the provision of effective therapeutic intervention.

CONCLUSION

The study suggests that periodic assessment of appetite and nutritional status of patients undergoing maintenance hemodialysis and provision of appropriate therapeutic intervention would be of greater impact in improving the health related quality of life of these patients.

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