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Original research article

Nutritional status of chronic kidney disease patients attending dialysis center attached to teaching hospital in remote north coastal district of Andhra Pradesh

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Abstract

Introduction: Chronic kidney disease (CKD) is confirmed chronic abnormalities of kidney structure or function, present for > 3 months with implications for health (albuminuria or proteinuria). With increasing prevalence and risk factors, there is progressive loss of kidney function, cardiovascular morbidity and premature mortality, decreased quality of life. In a CKD patient, the problems of malnutrition also encompass the economic status and pattern of diet, in addition to that imposed by the disease per se. Sub optimal nutritional intake is common among the population of CKD and ESRD posing a direct risk for protein malnutrition.

Objectives: To study the socio-demographic profile, the co-morbid conditions and assess the nutrition status of CKD patients undergoing hemodialysis.

Methods: A total of 105 patients participated in the study. A pre-tested semi-structured questionnaire will be administered to the study population. Data regarding socio-demographic profile, dietary practices etc. will be collected. The PG-SGA score and anthropometric measurements like height, weight, BMI, will be used to assess the nutritional status. Other variables like age, gender, socio-economic status, height, weight, BMI, metabolic demand, chronic energy deficiency, nutritional triage etc. are taken into consideration.

Results: Based on the study conducted, education and occupation status were significantly associated with nutrition status of CKD patient. With the higher levels of education, the number of subjects decreased and was found to have suspect/moderate malnutrition. With higher levels of occupation status, the number of subjects decreased and was found to have suspect/moderate malnutrition.

Conclusion: According to the demographic study of CKD patients - low literacy rate, poor income, tobacco use, alcohol consumption, older age are some of the reasons for malnutrition that are independently associated with CKD. Co-morbidities such as hypertension are predictors for chronic kidney disease. Nutritional status is observed to be at baseline with linear progression towards deterioration in > 3/4 patients under study. Thus, malnutrition continues to be an under diagnosed condition in CKD.

Keywords: CKD patients, malnutrition, dialysis, hypertension, proteinuria introduction

Introduction

Chronic kidney disease (CKD) has been recognized as a leading health burden affecting 8% - 16% of the world population [40, 10]. With increasing prevalence and risk factors, there is progressive loss of kidney function, cardiovascular morbidity and premature mortality, decreased quality of life (USRDS) [3, 37].

Kidneys are two bean-shaped organs, each about the size of a fist, located just below the rib cage, one on each side of the spine. Each kidney is made up of about a million filtering units called nephron which is

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the functional unit of kidney. Kidneys perform the function of filtration of nitrogenous and metabolic wastes through the renal system and maintains the metabolism of biochemical especially hemostatics – fluid, electrolyte, acid-base balance [14]. Also kidneys help to maintain blood pressure, activate vitamin D and produce erythropoietin. However, with loss of nephron function, the efficiency of kidney gradually decreases, resulting in accumulation of metabolic wastes and fluids in the body [32]. Any stimuli can induce the loss of these cells, either intrinsic or extrinsic. Extrinsic may include hypertension, diabetes, family history of kidney failure, old age, prolonged drug use such as antibiotics (immunological reaction), NSAIDS (like paracetamol, aspirin, voveran, diclofenac sodium), poisonous mushrooms [7, 38, 16], pollution, malnutrition, poor sanitation, poverty, overcrowding. Intrinsic may include glomerulonephritis and interstitial nephritis, renal tubular disease, renal fibrosis, polycystic disease, gout, renal stones [6].

Chronic kidney disease (CKD) is confirmed chronic abnormalities of kidney structure or function, present for > 3 months with implications for health (albuminuria or proteinuria). Glomerular filtration rate (GFR) is a well-established index of kidney function, determining the urine output, classifies CKD into 5 stages [19], Stage - 1 CKD (GFR: 90 ml/min), stage - 2 CKD (GFR: 60-89ml/min), stage - 3 CKD (GFR: 59–30 ml/min), stage - 4 CKD (GFR: 15–29 ml/ min) and stage - 5 CKD (GFR: < 15ml/min) (KDIGO). The persons with stage 4 and 5 Chronic kidney disease (CKD) have advanced kidney damage with a severe decrease in the glomerular filtration rate (GFR) of < 15 or 15-30 ml/min. If this condition persists for a longer period, it leads to chronic renal failure (CRF). CRF indicates progressive loss of renal function, disrupts the normal function[12], resulting in abnormally low glomerular filtration rate with a high level of urea (uremia) and creatinine level in the blood[11]. This may be the final stage of acute glomerulonephritis and nephrotic syndrome [26, 22]. Chronic kidney disorders have a progressive course in most cases spanning months to years and finally, result in end-stage renal disease (ESRD)[34, 3]. End-stage renal disease (ESRD) is reached as soon as the renal function drops below 10 to 15% of the normal function [24].

CKD being clinically asymptomatic, most people may not experience any symptoms until their kidney disease is advanced. However, some people noticed to have fatigue, trouble concentrating, poor appetite, trouble sleeping, muscle cramping at night, swollen feet and ankles, puffiness around eyes, dry, itchy skin, and need to urinate more often, especially at night.

The major complication of CKD is Osteodystrophy leading to anaemia. This particularly occurs following failure to control Calcium and Phosphorus levels due to disturbance in two metabolic functions i.e. activation of Vitamin D and action of parathyroid hormones [23, 9]. The symptoms of Osteodystrophy manifest in the form of bone pain, various bone deformities, gait, tiredness, breathlessness on exertion, bleeding due to abnormal platelet function. CKD also affects the nervous system which leads to muscle twitching, burning sensation in extremities and convulsions.

In the management of ESRD, there may be a possibility of a kidney transplant in the near future. Dialysis is performed when there is > 95% loss of kidney function in both kidneys. It is an artificial procedure by which waste products (including salt and excess fluid) are removed from the blood, maintaining a safe level of blood chemicals such as Na, K & Cl and controlling blood pressure [29]. There are two main types of dialysis - hemodialysis, and peritoneal dialysis. In hemodialysis, the blood is purified outside the body via an automated machine, and in the process of peritoneal dialysis, the blood is filtered through the peritoneal membrane located in the abdomen. The common characteristic adoption of both types of dialysis is the removal of the wastes and excess fluids from the body [13].

Many of the major medical problems of public health importance, including chronic kidney disease, have either a nutritional basis or at least an important nutritional contribution. Suboptimal nutritional intake is common among the population of CKD and ESRD posing a direct risk for protein malnutrition. The nutritional status of an individual depends on three factors - availability of food in the market, access to food within the available budget and absorption of food from the gut. Malnutrition, present in 42% – 77% of the ESRD population in developing countries, is strongly associated with morbidity, mortality, impaired physical performance and impaired quality of life [2].Various vital functions are endangered in the setting of malnutrition [35]. We find a convergence of two types of malnutrition in India – over nutrition and under nutrition. In the scenario of an Indian CKD patient, the problems of malnutrition also encompass the economic status and pattern of diet, in addition to that imposed by the disease per se. Although the obesity epidemic has been on the rise, nonetheless, India continues to rank 15 among the countries with the highest hunger situation [36]. There is scarcity of renal dietary services to issue appropriate dietary advice to CKD patients in India. Thus, there is an imminent need for nutritional counselling by a trained renal dietician in order to prevent the complications of malnutrition and to provide important nutritional information to CKD patients.

This is because several concerns were raised regarding a high prevalence of CKD in Srikakulam, where more than 13 thousand people, suffering from diseases related to kidney, were screened in the Uddanam area alone. The WHO has identified Uddanam as one of the three places where kidney diseases are prevalent. The other two places are Sri Lanka and Nicaragua. It is estimated that 4,500 patients died in the last 10 years while about 34,000 people are currently suffering from kidney diseases in these areas.

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One can find at least one patient in each family hailing from places like Uddanam, Ramakrishnapuram, Sinooru, Vajrapu Kotturu, Lohalibanda, Limbugam, Gollapalem (Mandasa), Gollamakannapalli and Mamidipalli (Palasa). These regions are considered to be the hot-spots of CKD. Local surveys conducted point towards some possible causes that could contribute to the disease, but no systematic epidemiological studies were conducted and no published data are available. Under these circumstances, the present study was undertaken to assess the nutritional status of CKD patients attending a dialysis centre attached to a teaching hospital in the remote North Coastal district of Andhra Pradesh.

Review Of Literature

BalajiGummidi *et al*., (2020)[5] conducted a multistage cluster random sampling to determine the kidney function abnormalities and risk factor profile of CKD among 2419 patients from 40 clusters comprising 67 villages of Uddanam region of Srikakulam district. Older age, male sex, tobacco use, hypertension, and family history of CKD were independently associated with CKD. Compared with those with higher eGFR, those with eGFR < 60 ml/min/1.73m2 were older, were more likely to be uneducated, manual laborers/farmers, or tobacco users, and were more likely to have hypertension, a family history of CKD, a diagnosis of heart disease, and a lower body mass index.

Yu-Yin Kao *et al*., (2020)[39] conducted a hospital based study to examine the socio-demographic factors and clinical factors associated with psychological disorders in CKD. This study included 187 patients with unplanned HD. Mean age of the study participants at baseline was 60 years, including 90 females and 97 males. Most participants were married (n = 120, 64.2%) and had religious beliefs (n = 109, 58.3%); however, the unemployment rate reached 66.3%. Moreover, 35.8% participants were educated up to elementary level, while 42.3% patients had secondary education, and only 15% graduated above the college level. The etiologies of CKD among participants were diabetic nephropathy (n = 91, 48.7%), renal diseases (n = 52, 27.8%) and hypertensive nephrosclerosis (n = 25, 13.4%), and undetermined (n = 19, 10.2%).

Kristen Sgambat *et al*., (2019)[33] conducted a study on malnutrition in different phases of CKD in children. Nutritional disorders including malnutrition, PEW, obesity and metabolic syndrome, affect children across the entire spectrum of CKD, dialysis, and transplant. They negatively impact patient outcomes by increasing morbidity and mortality and increasing the risk of infection, hospitalization, and length of stay, which leads to increased health-care costs, poor cognition, and decreased quality of life.

Fatin Izzaty Mohd Shahrin *et al*., (2019)[15] conducted a cross sectional study on elderly patients undertaking hemodialysis. Mean age of the subjects was 67±7 years old. Majority of the patients were from the Malay (62.5%) and Muslim (64.3%) communities. Approximately 77.6% of the patients were married and most had of them received a secondary education (47.3%). Almost all of the patients (96.4%) were either unemployed or retired while the employed patients (3.6%) worked in private sector. A large proportion (82.1%) of the patients did not have any income and were financially supported either by their children or grandchildren.

Rikkaz *et al*., (2018)[30]conducted a descriptive cross sectional study on patients undertaking hemodialysis. In this study, 45.4% patients had normal nutritional status 52% had mild to moderate and 2.6% had severe malnutrition. Mean Malnutrition-Inflammation Score (MIS) was 9.4±4.8. Among the socio-economic demographic factors there was statistically significant relationship between educational level and nutrition status (P=0.039). Among the hemodialysis (HD) patients, duration of CKD (P=0.003), length of time on dialysis (P=0.01), dialysis count (P=0.009), and BMI (P=0.016) had significant correlation with nutritional status.

Mariette J Chartier (2018) conducted a cohort study to determine the CKD prevalence using administrative health and laboratory data. The Manitoba CKD Cohort consisted of 55,876 people with CKD. Of these, 18,342 were identified using administrative health data, 27,393 with laboratory data, and 10,141 people were identified in both databases. The CKD prevalence was 5.6% using the standard definition, 10.6% using only people captured by the laboratory data and 10.6% using the capture-recapture method. Of the identified cases, 46% were at high risk of progression to end-stage kidney disease (ESKD), 41% were at low risk and 13% were not classified, due to unavailable laboratory data. High risk cases had a higher burden of co-morbid conditions.

Aims & Objectives

- To study the socio-demographic profile of chronic kidney disease patients undergoing hemodialysis.
- To assess the nutrition status of the study population.
- To study the co-morbid conditions associated with study population.

Materials and Methods

Study Design: hospital based cross-sectional study.

Study Setting: Dialysis center in the Government General Hospital, Srikakulam, Andhra Pradesh. It is a teaching hospital, affiliated to Dr.YSR University of Health Sciences (formerly Dr.NTR University of

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Health Sciences), Vijayawada.

Study Period: two months (July and August 2021)

Study Methods: a pre-tested semi-structured questionnaire is presented to the study population. Data regarding the socio-demographic profile, dietary practices, etc. is collected. The PG-SGA score and anthropometric measurements like weight, height, BMI, will be used to assess the nutrition status.

Study Variables: age, gender, socio-economic status, weight, height, BMI, metabolic demand, chronic energy deficiency, nutritional triage etc are taken into consideration.

Study Population: All the registered CKD Patients undertaking dialysis at dialysis center and who are willing to participate in the study.

Exclusion criteria:
- Those of the patients who are not willing to participate are excluded from the study.
- Due to COVID-19 pandemic, all the patients were screened for COVID prior to dialysis. Those who were positive were excluded from the study.

Study Tools: Weighing scale, measuring tape, PG-SGA assessment tool

Data Analysis: All of the data is analyzed using Microsoft excel. Relevant statistical tests such as - Descriptive statistics like range, mean and standard deviation, were used to describe quantitative data, while numbers and percentages were used to present qualitative data. Chi square test was used to test the significance with p value < 0.05.

Ethical Issues: The informed consent has been taken in the local language after explaining the details and purpose of the study. This study was approved by the Institutional Ethics Committee (I.E.C) of Government General Hospital, Srikakulam.

Observation and Results

Objective 1- Socio demographic profile of CKD patients undergoing hemodialysis

Table 1: Socio-demographic profile of CKD patients attending dialysis center in G.G.H., Srikakulam (where n=105)

S. No.	Demographic Variables		Frequency	%
1.	Age (in years)	< 20	1	0.95
		21-30	5	4.76
		31-40	21	20
		41-50	29	27.61
		51-60	31	29.52
		61-70	15	14.28
		> 70	3	2.85
2.	Sex	Males	81	77.14
		Females	24	22.87
3.	Residency	Rural	30	28.57
		Urban	75	71.43
4.	Religion	Hindu	102	97.14
		Christian	3	2.85
5.	Education	Illiterate	53	50.4
		Primary School Certificate	9	8.57
		Middle School Certificate	9	8.57
		High School Certificate	9	8.57
		Intermediate / Diploma	11	10.47
		Graduate	10	9.52
		Profession / Honors	4	3.80
6.	Occupation	Unemployed	84	80
		Elementary Occupation	3	2.85
		Plant & Machine Operators / Assemblers	0	0
		Craft & Trade Related Workers	5	4.76
		Skilled Agricultural & Fishery workers	0	0
		Skilled Workers, Shop & Market Sales workers	5	4.76
		Clerks	2	1.90
		Technicians & Associate Professionals	0	0
		Professionals	5	4.76

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		Legislators, Senior Officials & Managers	1	0.95
7.	Family Monthly Income (in rupees)	≥ 123,322	3	2.85
		61,663 – 123,321	4	3.80
		46,129 – 61,662	2	1.90
		30,831 – 46,128	1	0.95
		18,497 – 30,830	23	21.90
		6175 – 18,496	71	67.61
		≤ 6174	1	0.95
8.	Socio – Economic Scale	Upper	3	2.85
		Upper Middle	4	3.80
		Lower Middle	10	9.52
		Upper Lower	49	46.66
		Lower	39	37.14

Age: About 31 (29.52%) of the subjects were in the age group of 51-60 years followed by 29 (27.61%) of the subjects were in age group of 41-50 years, 21 (20%) were in the age group of 31-40 years, 15 (14.28%) of the subjects were in the age group of 61-70 years, 5 (4.76%) were in the age group of 21-30 years, 3 (2.85%) of subjects were aged > 70 years, while 1 (0.95%) were aged < 20 years.

Sex: Majority were males 81 (77.14%), while 24 (22.87%) of the subjects were females.

Residency: Majority of the subjects resided in the urban areas 75 (71.43%) of Srikakulam district, while 30 (28.57%) of the subjects resided in the rural region.

Religion: With regard to religion, majority were belonging to Hindus 102 (97.14%), while 3 (2.85%) of the subjects were Christians.

Education: Considering the educational level, 53 (50.4%) of the subjects had no formal education, while 11 (10.47%) completed their intermediate/diploma, 10 (9.52%) of the subjects were undergraduates, 27 (25.71%) of the subjects completed their school education, 4 (3.80%) of the subjects did their profession/honors.

Occupation: Regarding the employment of the subjects, > 3/4 of the subjects were unemployed, 5 (4.76%) of the subjects were craft & trade related workers and skilled workers, shop & market sales workers. 3 (2.85%) of them are doing elementary occupation, while 2 (1.90%) did clerical job.

Family monthly income: More than half the subjects 71 (67.61%) have a monthly income of rupees 6175 – 18,496. 23 (21.90%) of the subjects have a monthly income of rupees 18,497 – 30,830. 4 (3.80%) have a monthly income of rupees 61,663 – 123,321. 3 (2.85%) of the subjects have a monthly income of rupees ≥ 123,321. 2 (1,90%) have an income of rupees 46,129 – 61,662. 1 (0.95%) of the subject have a monthly income of rupees 30,831 – 46,128 and rupees ≤ 6174.

Socio-economic scale: Almost half the subjects 49 (46.66%) belong to upper lower class, while 39 (37.14%) of the subjects belong to lower class. 10 (9.52%) of the subjects belong to lower middle class. 4 (3.80%) of the subjects belong to upper middle class. 3 (2.85%) of the subjects belong to upper class.

The collected data allows reliable and detailed analysis of the relationship between kidney function and the nutrition status. This demographic study includes CKD patients of all age groups (< 20 to > 70 years) who visited the dialysis centre for dialysis during the months of July to August 2021. Majority were males 81 (77.14%), while 24 (22.87%) of the subjects were females in the study population. Out of 105 subjects, the highest number of CKD patients were reported between the age groups of 51- 60years (29.52%), 41- 50years (27.61%), and the lowest < 20years (0.95%) (Table 2). Most of them belong to the urban areas of Srikakulam District 75 (71.43%), rest of the patients were from those living in rural areas 30 (28.57%). Maximum belong to Hindu religion 102 (97.14%).

Half of CKD patients 53 (50.4%) did not have a formal education; some patients had a meagre school education 27 (25.71%) which is insufficient to get proper employment. < 15 subjects pursued higher studies (10 (9.52%) were graduates, while 4 (3.80%) did their profession/honors). Due to low education level, most of them were unemployed (includes homemakers) 84 (80%). < 5 subjects did either clerical job 2 (1.90%) or elementary occupation 3 (2.85%). 5 (4.76%) of the subjects were either skilled workers/shop workers or craft & trade related workers. 6 (5.71%) of the subjects with good occupation 4 (3.80%) such as professionals, senior officials etc. were noticed, this may be due to proper awareness and economically wellbeing.

Most of the subjects did not earn an income – 71 (67.61%) of subjects have a monthly family income of rupees 6175 – 18,496 which is significantly insufficient to provide for the family as well as for the patient. < 9 (8.57%) subjects have a family income of rupees ≥ 46,129. The upper lower 49 (46.66%) and

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lower 39 (37.14%) class people are most vulnerable to this disease due tolack of awareness, education, lack of traditional knowledge to use indigenous medicines. < 20 subjects belonging to upper 3 (2.85%) and middle class 14 (13.33%) were noticed, they were able to understand the nutrition intervention and management.

Objective 2 – Study of the co-morbid conditions associated with study population.

Table 2: Co-Morbid Conditions Associated With Study Population

1.	H/O CO Morbidities	HTN	62	59.04
		DM	6	5.71
		Others	5	4.76
		HTN & DM	18	17.14
		HTN & Others	7	6.66
		Nil	7	6.66
2.	H/O Social Habits	None	59	56.1
		Smoking	1	0.95
		Tobacco Chewing	6	5.70
		Alcohol	23	21.89
		Liquor	1	0.95
		Alcohol &Tobacco Chewing	14	13.32
		Alcohol &Smoking	1	0.95
3.	Family H/O Non Communicable Diseases	Nil	92	87.61
		HTN	6	5.71
		DM	3	2.85
		HTN & DM	3	2.85
		Others	1	0.95

H/o co morbidities: More than half of the subjects are hypertensive 62 (59.04%), 18 (17.14%) of the subjects have hypertension and diabetes mellitus, 7 (6.66%) of the subjects have hypertension and other co-morbid conditions like asthma, hyperthyroid, seizures, anemia. 6 (5.71%) of the subjects have diabetes mellitus. 5 (4.76%) of the subjects have other co-morbid conditions like anemia, MI. 7 (6.66%) of the subjects have no co-morbidities.

H/o social habits: More than half of the subjects have no social habits 59 (56.1%). 23 (21.89%) of them consume alcohol. 14 (13.32%) of the patients are habituated to alcohol and tobacco chewing. 6 (5.70%) of the subjects chew tobacco/tobacco related products. 1 (0.95%) of the subjects habituated to smoking or liquor or both alcohol and smoking.

Family H/o of non-communicable diseases: Regarding family history, maximum subjects do not have any H/o non-communicable diseases. 6 (5.71%) of the subjects have hereditary hypertension. While 3 (2.85%) of the subjects have diabetes mellitus or both hypertension and diabetes. 1 (0.95%) has hereditary onset other than hypertension and diabetes mellitus.
More than half 59 (56.19%) the patients, are habituated neither to smoking/tobacco chewing nor to alcohol consumption. Some are habituated to alcoholism 23 (21.89%), some subjects to tobacco chewing 6 (5.70%), while some are habituated to both alcohol and tobacco chewing 14 (13.32%). Among the 105 CKD patients, 7 (6.66%) had no co-morbidities. Of the remaining, there was high incidence of hypertension (HTN) 62 (59.04%), then diabetes 6 (5.71%), while both HTN and diabetes were observed in 18 (17.14%). There are also other co morbidities such as seizures, anaemia, hyperthyroid, asthma noticed along with HTN 7 (6.66%) in a significant number of people. Very few patients were identified with co-morbidities other than HTN and diabetes 5 (4.76%) - anaemia, MI. The family history is one of the reasons for onset of non- communicable diseases therefore, onset of hereditary HTN is 6 (5.71%), diabetes 3 (2.85%), while both HTN and diabetes is 3 (2.85%).

Objective 3 – Assessment of the nutrition status of the study population

Table 3: PG-SGA Study Tool Characteristics

S.No.	PG-SGA Categories			Frequency	%
1.	Variability in Weight Loss	Unchanged		21	20
		Increased		47	44.76
		Decreased		37	35.23
2.	% Weight Loss & Points	>= 10%	4	5	4.76
		5% - 9.9%	3	8	7.61

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		3% - 4.9%	2	7	6.66
		2% - 2.9%	1	8	7.61
		0% - 1.9%	0	77	73.33
3.	Nutrient Intake	Unchanged		2	1.90
		More Than Usual		0	0
		Less Than Usual a. less than normal amt.		40	38.09
		b. only solid food		0	0
		c. only liquids		1	0.95
		d. only nutritional supplements		0	0
		e. very little of anything		63	60
		f. only tube feeds		0	0
4.	Metabolic Demand (stress to increase protein and calorie needs, in terms of onset and duration of fever, use of steroids)	None (0)		84	80%
		Low (1)		21	20%
		Moderate (2)		0	0%
		High (3)		0	0%

Variability in weight loss: Subjects on hemodialysis exhibit gradual loss of weight such that 47 (44.76%) show increased weight loss, while 37 (35.23%) show decreased weight loss i.e. increase in body weight. The body weight is unchanged for 21 (2S0%) subjects.

% weight loss and points: Majority show < 2% weight loss with a score of 0, while 5 (4.76%) show ≥ 10% weight loss with a score of 4 points. 8 (7.61%) of the subjects show weight loss of 2% - 2.9% and 5% - 9.9% with scores of 1 and 3 respectively. 7 (6.66%) of subjects show weight loss of 3% - 4.9% with score of 2 points.

Nutrient intake: With respect to the dietary nutrient intake, majority of the patients have a sub optimal nutrient intake - < 1/2 the patients consume very little of anything, 40 (38.09%) of the subjects consume less than normal amount. 2 (1.90%) subjects report no change in the nutrient intake.

Metabolic demand: In order to maintain optimum nutrition, subjects require nutrient supplementation, appetite stimulants such as anabolic steroids etc. The stress/demand may present as fever. However, majority of subjects show no metabolic demand despite the catabolic state. This may be because of lack of awareness, dieticians. 21 (20%) of subjects show a low metabolic demand.

CKD patients, in particular, incident dialysis patients, may experience rapid weight loss in the first several months of starting dialysis. The data correlates with the trends in weight changes over time and their associations with morbidity, mortality in CKD patients. In this study (Table 3), there is an increased variation in the loss of body weight 47 (44.76%), while the body weight is significantly unchanged for 21 (20%) patients. There is increase in body weight (decreased weight loss) in 37 (35.23%) patients. Most of their weight loss is < 2% (per month) 77 (73.33%) (Table 3).

The studies of weight loss (< 2% to > 10%) (Table 3) per month indicates, 77 (73.33%) have < 2% weight loss, to 5 (4.76%) having >= 10% weight loss. The weight loss between 2-5% range are in between. This loss of body weight may be due to suboptimal intake of nutrients 40 (38.09%), most of them hardly take anything as nutrient 63 (60%) and few others (0.95%) are totally on liquid diet. 2 (1.90%) of the subjects have reported of no change in dietary pattern. Despite the weight loss, subjects are not taking any supplements to help build up the protein mass. Consequently, 84 (80%) of the subjects have shown no metabolic demand, while 21 (20%) of subjects show low metabolic demand in the form of fever onset, lasting for < 72hrs with no use of steroids. This could be due to lack of awareness, illiteracy.

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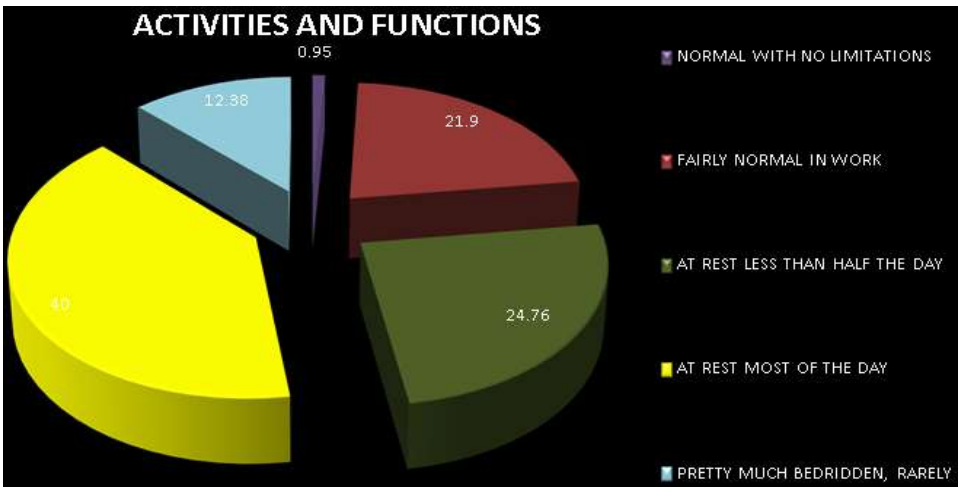

Figure 1: Performance of activities and functions in day-to-day life of CKD patients: (most of the patients are at rest most of the day (40%) or bedridden (12.38%). Some require rest for less than half day (24.76%), while others are fairly normal (21.90%) or normal (0.95%) in their activity and function).

Subsequently with low nutrient intake and weight loss, gradually the activity and function becomes low - they are at rest most of the day (40%), or pretty much bedridden, rarely out of bed (12.38%) while some require rest atleast less than half day (24.76%). Others are normal with no limitations (0.95%) or fairly normal at work (21.90%).

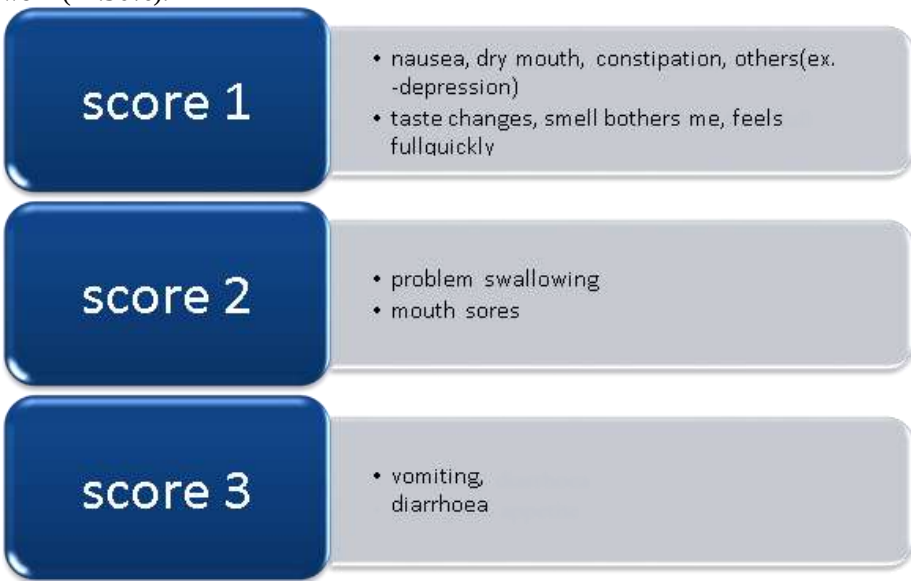

Figure 2: Nutrition Impact Symptoms: (Nutrition may affect the subjects on hemodialysis such that they may present with symptoms that are graded as following – score 1- gastrointestinal symptoms, taste changes, smell changes, feels full quickly; score 2 – problem swallowing, mouth sores; score 3 – vomiting, diarrhoea, pain, poor appetite)

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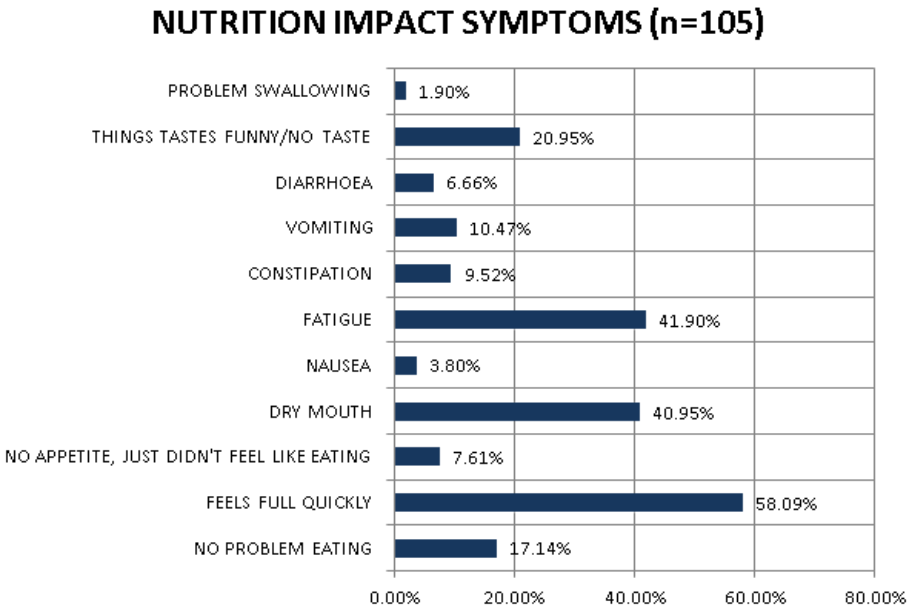

Figure 3: Nutrition Impact Symptoms Presented by CKD Patients: (Of all the symptoms reported, majority (58.09%) have complained of feeling full quickly, 41.90% of subjects have reported symptoms of fatigue. 40.95% have reported of dry mouth. 20.95% subjects have complained of funny taste/no taste of food while eating. 10.47% have reported of vomiting, 9.52% have reported of constipation. 7.61% of subjects have reported of loss of appetite. 6.66% have reported of diarrhoea, while 3.80% have reported of nausea. 17.14% subjects stated no problem while eating.)

Very few reported no change 2 (1.90%) (Table 3) in the dietary intake, while maximum (98.09%) reported suboptimal dietary intake of varying degree (Table 3); most of them consume little of anything resulting in weight loss. 58.09% of the subjects reported symptoms (Figure 5) of feeling full quickly after taking little amount of food, limiting their dietary intake. With restrictions in liquid diet, 40.95%% have reported symptoms of dry mouth, while 41.90% have complained of fatigue. 21.88% of subjects have reported (Figure 5) gastrointestinal symptoms (anorexia (7.61%), nausea (3.80%), vomiting (10.47%)). 20.95% of subjects have complained of changes in food taste/no taste, 6.66% have reported diarrhoea symptoms. Significantly, 17.14% of the subjects have stated no problem while eating.

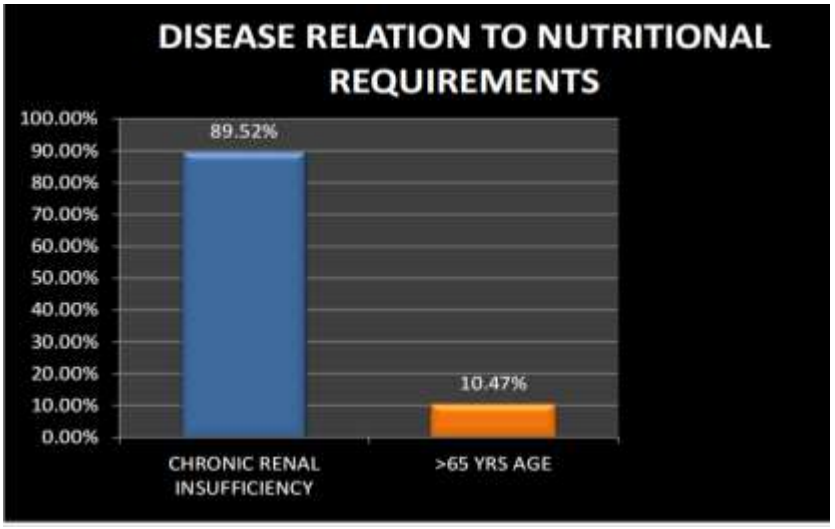

Figure 4: Disease Relation to Nutritional Requirements: (With respect to diseases that affect the nutrition status of subjects, most of them have chronic renal insufficiency while 10.47% of subjects are aged > 65 years, which may affect the nutrition status of the subject)

There are diseases that involve the nutrition status or may affect the nutrition of the individual. In this study, maximum subjects have chronic renal insufficiency (89.52%) (Figure 6) while 10.47% of the subjects of age > 65 years, we can notice symptoms (Figure 5) such as loss of appetite, problem swallowing, diarrhoea, constipation and fatigue.

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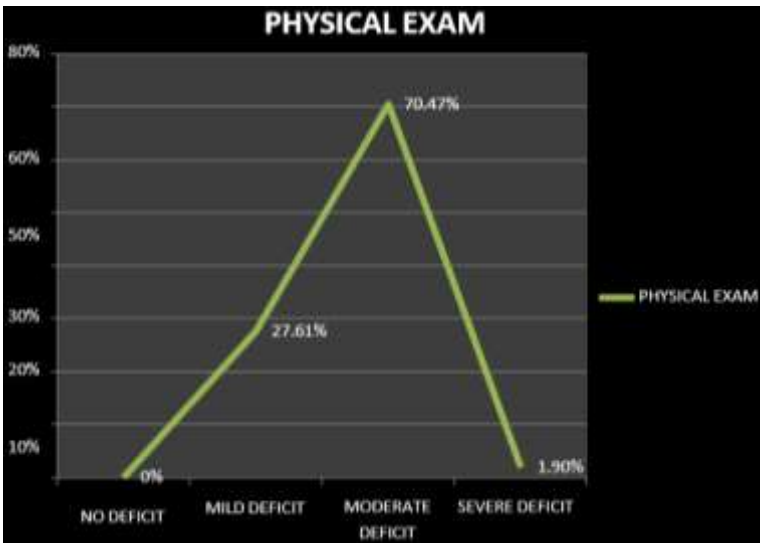

Figure 5: Physical examination of CKD patients (assessment of muscle status, fat stores, excess fluid status): (following the physical assessment of subjects considering the muscle status, fat stores within the body, excess fluid status, 70.47% of the subjects show a moderate deficit, while 27.61% of the subjects show mild deficit, 1.90% of subjects show severe deficit. The deficit in muscle status precedes over the fat stores and excess fluid status.)

The subjective examination (Figure 7) includes assessment of muscle status, fat stores and fluid status. the muscle deficit is determined by examination of the calf, thigh, temples, shoulders, scapula, and interosseous muscles. The fat stores are determined by examination of the orbital fat pads, triceps skin fold, fat overlying the lower ribs. The fluid status is determined by examination of the ankle edema, ascites and sacral edema. 70.47% of the subjects show a moderate deficit of body composition/presence of excess fluid, while a mild deficit is observed in 27.61% of the subjects, and severe deficit is noticed in 1.90% subjects. The muscle deficit takes precedence over fat stores and excessive fluid status.

The Patient-Generated Subjective Global Assessment (PG-SGA) is well recognized in clinical research as the reference method for assessing nutrition status in patients and is a modified version of the nutritional assessment. In this study the most of the patients had nutritional status at baseline with linear progression towards deterioration (Figure 8); 23.80% had an SGA score = 4-8 which can be managed with dietician intervention. More than three fourth of the study participants (78.09%) had an SGA score >=9 requiring critical need for improved symptom management and nutrient intervention. Basing on the PG-SGA assessment categories (Figure 9) i.e. weight loss, nutrient intake, nutrition impact symptoms, function and activity and physical exam parameters, the overall global assessment designates the malnutrition in CKD as severe malnutrition (15.23%), moderate malnutrition (46.66%), and suspect malnutrition (35.23%).

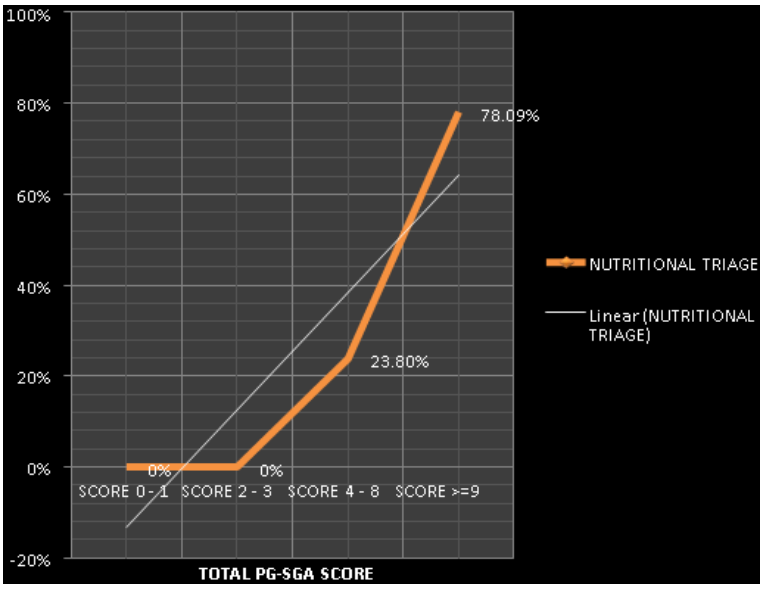

Figure 6: Nutritional triage of ckd patients based on total PG-SGA score: (basing on the PG-SGA categories, there is a linear progression in nutritional triage. > 3/4 of the subjects show a score of ≥ 9 indicating critical nutrition intervention and optimal nutrition management. While 23.80% of subjects show a score of 4-8 indicating education of patient and family by renal dietician/nurse/clinician basing on the values obtained.)

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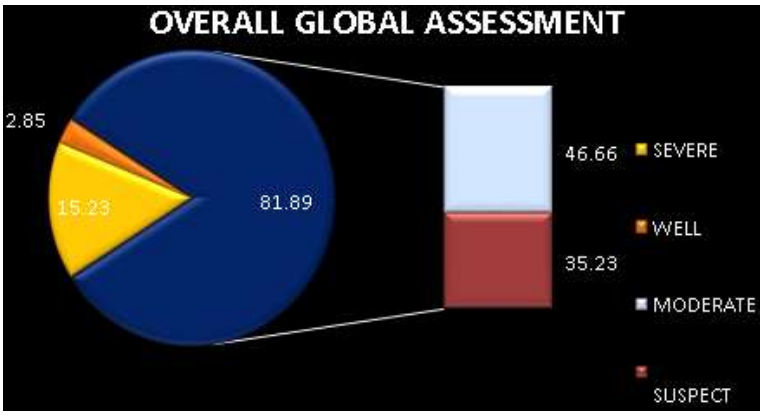

Figure 7: Overall global assessments of CKD patients: (basing on the PG-SGA assessment categories, the malnutrition on an overall basis is categorized; 46.66% of study participants are moderately nourished, 35.23% of participants are suspected for malnutrition. 15.23% of participants are severely malnourished, while 2.85% of the participants are well nourished.)

Table 4: Distribution of factors associated with malnutrition

Demographic Variables		Malnutrition Degree (where n= 105)					
		WellNourished	Suspect	Moderate	Severe	χ2	Pvalue
Age (in years)	≤50	3 (2.85%)	18 (17.14%)	28 (26.66%)	10 (9.52%)	3.13	>0.05
	>50	0	20 (19.04%)	20 (19.04%)	6 (5.71%)		
Residency	Urban	1 (0.95%)	31 (29.52%)	31 (29.52%)	11 (10.47%)	3.72	>0.05
	Rural	2 (1.90%)	9 (8.57%)	15 (14.28%)	5 (4.76%)		
Education	Illiterate	2 (1.90%)	11 (10.47%)	30 (28.57%)	10 (9.52%)	9.63	<0.05
	Literate	1 (0.95%)	26 (24.76%)	19 (18.09%)	6 (5.71%)		
Occupation	Unemployed	3 (2.85%)	28 (26.66%)	43 (40.95%)	15 (14.28%)	7.61	<0.05
	Employed	0	10 (9.52%)	5 (4.76%)	1 (0.95%)		
Socio-Economic Status	Upper	0	2 (1.90%)	1 (0.95%)	0	9.13	>0.05
	Upper Middle	0	2 (1.90%)	2 (1.90%)	0		
	Lowermiddle	0	6 (5.71%)	3 (2.85%)	1 (0.95%)		
	Upper Lower	1 (0.95%	18 (17.14%)	21 (20%)	9 (8.57%)		
	Lower	2 (1.90%)	9 (8.57%)	22 (20.95%)	6 (5.71%)		
H/O Co-Morbidities	1 Co Morbidity	1 (0.95%)	25 (23.80%)	28 (26.66%)	13 (12.38%)	7.85	>0.05
	2 Co Morbidity	1 (0.95%)	10 (9.52%)	10 (9.52%)	4 (3.80%)		
	No Co Morbidity	1 (0.95%)	2 (1.90%)	10 (9.52%)	0		
H/O Social Habits	No	0	23 (21.90%)	26 (24.76%)	10 (9.52%)	1.03	>0.05
	Yes	3 (2.85%)	18 (17.14%)	19 (18.09%)	6 (5.71%)		
Family H/O Co-Morbidities	No	3 (2.85%)	30 (28.57%)	42 (40%)	16 (15.23%)	1.78	>0.05
	Yes	0	6 (5.71%)	8 (7.61%)	0		

On further analysis, the degree of malnutrition was high among illiterates and unemployed than literates and unemployed and this association is statistically significant with p value < 0.05.

Discussion

One of the most important factors affecting the quality of life of chronic kidney disease (CKD) patients is nutrition. Improper nutrition is associated with increased frequency and the duration of hospitalizations. Malnutrition is an important predictive factor for morbidity and mortality in patients on hemodialysis therapy [18]. In this study we evaluated malnutrition in CKD patients on hemodialysis. Malnutrition is prevalent in 61.89% (moderate in 46.66% and severe in 15.23%); this is consistent with findings from other studies [8].

In the present study, the incidence is higher in the age group 51-60 years (29.52%) followed by slight decrease of 27.61%, 20%, 14.28% among the age groups of 41-50, 31-40, 61-70 years. The two major communities (National Health and Nutrition Examination Survey and the NFK's Kidney Early Evaluation Program) have documented the prevalence of CKD rises with increasing age. Most of them belonged to the middle class background, living in the urban areas of Srikakulam district. With a monthly income of rupees < 4000, most of them did not have formal education resulting in the unemployment with sedentary lifestyle leading to lack of daily physical activity. Approximately 4% patients were educated to understand the dietary and fluid restrictions as a part of nutrition intervention with symptom management. Most of them preferred municipal water which is the water source available for drinking and domestic purposes. 21.90% patients preferred RO source, 4.76% preferred candle filters for drinking purpose. Municipal water is solely ground water that is treated and processed and sent to

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various homes and industries through the underground pipes.

According to the data, the incidence is higher in patients who do not have any social habits such as smoking/chewing tobacco, alcohol consumption. The result is incident with Egyptian study [8]; the incidence is higher in patients who were neither alcoholics nor smokers. Among all the participants, 59.04% patients had HTN, indicating that HTN is the major risk factor, diabetes is present in 5.71% patients, both HTN and diabetes is present in 18% patients. Hereditary HTN is present in about 5.71% patients.

Based on the obtained data, the results have been consistent with other published studies; > 50 years old HD patients tend to be malnourished and the prevalence increased significantly among the elderly. Similarly, Alharbi and Enrione [4]conducted a study investigating the prevalence of malnutrition in HD patients at Jeddah Kidney Center, Jeddah, Saudi Arabia; and reported that older HD patients (>=55 years) tend to be malnourished. The prevalence of malnutrition among the elderly can be attributed to the loss of appetite, taste changes, gastrointestinal symptoms (such as nausea, vomiting, and constipation), feeling full, and difficulty in buying food due to low income, chronic/acute diseases which in turn may affect the nutrition requirements.

In addition, HD is a catabolic process that promotes to significant loss of essential nutrients like amino acids, proteins, vitamins, glucose. If nutrition replenishment is not sufficiently done with time, there can be deterioration of the nutrition status. Maximum patients report to have sub-optimal dietary intake of varying degree. Due to low literacy rate, patients were unable to understand the significance of dietary restrictions and recommended diet plans contributing to malnutrition among HD patients. With weight loss < 2% and low nutrient intake, the activity and function gradually became low, in a way that patients prefer to take rest most of the day.

Multifactorial causation of malnutrition has made it difficult to maintain optimum nutrition in HD patients; they need proper assessment and individual approach. This includes oral or intradialytic nutrient supplementation, appetite stimulants (ex.–anabolic steroids), maintaining adequate HD, anti-inflammatory therapies (statins, eicosanoids, α-linolenic), and anti-oxidant drugs (like vitamin E, and pentoxifylline). All of this requires awareness among health care providers, dieticians, and patients[8, 20, 25].

Basing on the PG-SGA categories, maximum patients were malnourished (suspect - 35.23%, moderate – 46.66%, severe – 15.23%), indicative that there is urgent need for critical nutrition intervention, optimum symptom management, assess the quality of hemodialysis. This makes it necessary to assess the nutritional status of CKD patients periodically and take measures to prevent protein energy malnutrition.

Conclusion

In conclusion, this study has highlighted that malnutrition continues to be an under diagnosed condition in CKD. The quality of life can be increased with early diagnosis and treatment of suspect malnutrition in patients. According to the demographic study of patients attending dialysis centre, the following are some of the reasons for malnutrition - Older age, low literacy rate, low income, tobacco use, alcohol consumption, co-morbidities and family history of CKD were independently associated with CKD. Nutritional status deteriorated in more than three fourth of the patients under the study.

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