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RESEARCH ARTICLE

A CROSS SECTIONAL STUDY OF NUTRITIONAL ASSESSMENT IN CHRONIC KIDNEY DISEASE PATIENTS.

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Manuscript Info

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Abstract

Background: Chronic kidney disease is one of the global burdens, more so in developing countries where the medical facility is not abundantly available in the rural areas. Along with comorbid conditions, protein energy malnutrition plays a vital role in progression of renal disease. Proper diet management can decrease the rapid progression of chronic kidney disease. Though many studies have been done in other countries regarding the nutritional assessment in chronic kidney disease patients, it is mandatory to assess the prevalence of malnutrition in the rural or urban population of developing country.

Methods: 100 consecutive patients were enrolled for the study. After obtaining written consent, history regarding the demographic data, duration of the disease, associated clinical features and 24 hour dietary recall were obtained. Then basic anthropometric parameters such as height, weight, Body Mass Index, skin fold thickness and mid arm circumference was measured. Later laboratory parameters such as haemoglobin, serum urea, serum creatinine, calcium, phosphorus, uric acid, total protein and serum albumin was measure.

Results: The prevalence of protein energy malnutrition is 36% in our study which is more prevalent in the male gender as the total number of male patients are predominant in our study. And the patients in the initial stages of CKD are not aware of low protein diet. It is advisable to introduce dietary management along with medical management in all stages of chronic kidney disease patients.

Conclusion: The incidence of PEM among the study population is nearly high but proper nutritional knowledge is lacking in these patients. Hence it is mandatory to introduce dietary management along with medical management in all stages of CKD so that rapid progression to end stage renal disease can be delayed.. It is also identified that severe protein energy malnutrition itself increases the mortlity of the patients. Small population, unequal gender and age distribution, shorter time period and unavailability of data for stage 1 CKD were the major limitations of the study. Hence in the future rectifying all the above said limitations such a study has to repeated periodically for better understanding of the study which will further improve the patient care and may help in

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reducing the early progression of the kidney disease.a large randomised control study can throw mucy light in the management of PEM in CKD patients.

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Introduction:-

I would never have been able to finish my dissertation without the guidance of my Professors, help from friends, and support from my family and wife.

I would like to express my deep sense of gratitude to my guide, **Dr. Mohamed Hanifah,** Department of General Medicine, Mahatma Gandhi Medical College and Research Institute, for his guidance, caring, patience, and providing me with an excellent atmosphere for doing research.

I would like to thank my co-guide **Dr. Hemachandran**, who stood as a backbone throughout my research period.

I would also like to thank **Dr. K.Jaya Singh** and **Dr. Lokesh** for helping me pointing out the potential mistakes and pitfalls in my research and correcting it.

I would like to thank my fellow colleagues, the Post Graduates, Assistant Professors, Associate Professors and Professors of Department of General Medicine. My research would not have been possible without their help.

I would also like to extend my sincere gratitude to the Management of MGMC&RI, Dean (Research and PG studies) who helped me out of bounds for the Research purpose

I would also like to thank my parents and my sister. They were always supporting me and encouraging me with their best wishes.

Finally, I would like to thank my husband, **Dr. S. Sabarirajan.** He was always there cheering me up and stood by me through the good and bad times.

Lastly I bow my head before the almighty for bestowing upon His blessings and unconditional favours at all times and under all circumstances.

Abbrevations And Acronyms:-

BMI	**Body Mass Index**
CKD	Chronic kidney disease
CETP	Cholesterol ester Transfer Protein
CRP	C- Reactive Protein
DM	Diabetic Mellitus
GFR	Glomerular Filtration Rate
Gm	Gram
IL 6	Interleukin 6
ISRNM	International Society of Renal Nutrition and Metabolism
Kcal	Kilo calories
Kg	kilogram
LCAT	Lecithin Cholesterol Acyltransferase
LV	Left Ventricle
MAC	Mid Arm Circumference
PEM	Protein Energy Malnutrition
SGA	Subjective global Assessment

Introduction:-

In developing country like India, despite rapid economic growth, there are nearly 25% of the population living in poverty. According to Food and Agriculture Organization, more than 15% of the population is undernourished. According to latest statistics, Pondicherry has maximum number of people below poverty line when compared to other Union Territories. Major source of income in rural and urban areas in Pondicherry include agriculture and fishing.

Chronic Kidney Disease is one of the most progressing epidemic burden worldwide and in India too, particularly in elderly patients with co morbidities such as diabetes, hypertension, dyslipidemia and coronary artery disease. In a country like India where the rural population is more, with less access to health care and more access to over the counter medications, prevalence of chronic kidney disease is more, though the exact statistical data is not available. And the knowledge regarding the disease and the required life style modification is very poor among these populations.

The reference intake for average Indian includes a total calorie of 2000Kcal with 50gms of protein and 260gms of carbohydrate. In rural areas of Pondicherry the main source of protein is derived from dhal, green leafy vegetables and fish.

Diet plays a major role in progression of CKD. High dietary protein intake results in early progression to end stage renal disease. Proper diet counselling and low protein diet helps in slowing down the progression.

Protein energy malnutrition is defined by International Society of Renal Nutrition and Metabolism (ISRNM) as a 'state of decreased body stores of protein.

and energy fuels. There are few studies which prove protein energy malnutrition is a strong predictor for mortality in patients with CKD.

Etiology of Protein Energy Malnutrition in Chronic Kidney Disease patients include:

1. Decreased nutrition intake
2. Concurrent co morbidities or super imposed acute illness
3. Dialysis
4. Chronic blood loss
5. Loss of metabolic action of kidney
6. Accumulation of toxic compounds

Low protein diet is the main stay nutritional therapy for CKD. Often people in rural areas lack knowledge about the dietary modification required once chronic kidney disease is diagnosed,

Required protein intake is decreased to 0.6 to0.75gm/kg body weight per day in predialysis stage while the requirement increases to 1.2 gm per kg body weight per day in patients who require dialysis. And calorie intake is 30- 35 kcal/ kg body weight in stage 2-4 whereas it is less than 30 kcal/kg body weight per day in stage 5

Mostly when the patients develops uremic symptoms like loss of appetite, nausea, vomiting food intake is reduced which adds on to increase number of protein energy malnutrition in stage 5 CKD.

Aims And Objectives:-

Aims:-

To study the prevalence of protein energy malnutrition in chronic kidney disease patients

Objectives:-

1 To study the prevalence of protein energy malnutrition in chronic kidney disease patients
2 To study the association between the co morbid illnesses and prevalence of protein energy malnutrition.

Review Of Literature:-

The Guidelines for diagnosis of chronic kidney disease is as follows:

Kidney damage for more than three months as evidenced by structural or functional damage in the form of pathological changes, markers of kidney damage in the blood or urine and /or GFR< 60 ml/min/1.73 square meter(1).

Approximately eighteen to seventy five percent of patients worldwide with chronic CKD show evidence of protein energy malnutrition, which can be diagnosed by measuring Anthropometry, serum protein, Hemoglobin, and diet recall. Uremia, cachexia, depression, blood loss through dialysate, frequent collection of blood samples, blood loss through feces and urine are some of the important causes of PEM in CKD (2)

Markers Of Protein Energy Malnutrition:-

Hemoglobin:-

Iron Deficiency anemia arises in the early stage and severity increases as the disease progresses. Cause for its deficiency includes blood loss from various sources. Its management includes stimulation of erythropoiesis and maintaining sufficient iron levels for hemoglobin production by giving oral or intravenous iron supplementation along with recombinant human erythropoietin. Biochemical indices for identification of iron deficiency are Serum ferritin and transferrin saturation(3).

Diet:-

Elderly patients receiving hemodialysis are at more risk of developing protein energy wasting than their younger counterparts because of reduced protein energy intake and the cause is yet unclear. Studies demonstrate that an overall depression and uremic cachexia are far more common in elderly due to lower functional status, higher co morbidities and preexisting PEM(4).

Imposing a uniform diet restriction plan for all hemodialysis patients has potential adverse effects, for example restriction of phosphorous lead to deficient nutrition ;likewise potassium restriction causes acceleration of atherogenesis.Limiting fluid intake leads to lower protein and caloric consumption; restricting carbohydrate intake in burnt out diabetes has no role in disease outcome. The recommended dietary protein intake in non-dialysis dependent CKD patients is 0.6 gm /kg/day that is 35 to 45 g of total daily protein for a 60 to 75 kg person of either gender (5).

Anthropometry:-

Waist circumference as a surrogate marker of visceral adipose tissue does not correlate significantly in NDD CKD patients, hence cannot be used in assessing PEM in CKD population(6)

Mid arm circumference measurement in assessing nutritional status in CKD patients gives a better predictive value than any other anthropometric indices but it should be normalized to ideal body weight to get accurate results(7).

These measurements not only help in assessing nutritional status but also in figuring out the outcome and mortality, especially in the initial period after diagnosis. Such measurements include Subjective Global Assessment (SGA), Body Mass Index (BMI), tricipital skinfold thickness, mid-arm circumference, assessment of body composition by bioelectrical impedance analysis (BIA), and pre-dialysis serum creatinine, albumin, and total cholesterol(8)

A newer approach is the measurement of adductor pollicis thickness which is better than skin fold thickness because it is not grossly altered by patient hydration status and fat deposition(9)

Laboratory Parameters:-

Lipid Profile:-

High triglycerides, VLDL and LDL with low HDL is the abnormality seen in CKD Patients which is due to several reasons including malnutrition, and causes increased atherogenesis leading to CAD and its complications. The most accepted underlying mechanism is increased vascular calcification due to alteration in calcium and phosphate metabolism, down regulation of lecithin-cholesterol acyltransferase (LCAT) and, to a lesser extent, increased plasma cholesteryl ester transfer protein (CETP). Triglyceride enrichment of HDL in CRF is primarily due to hepatic lipase deficiency and elevated CETP activity.(10)

Thyroid Profile:-

Thyroid dysfunction is seen in 38.6% of CKD patients, the most common being subclinical hypothyroidism (27.2

%), followed by overt hypothyroidism (8.1 %) and subclinical hyperthyroidism (3.3 %)(11).

Serum Protein:-
Hypoalbuminemia has direct relation with CKD; Identification of levels of serum albumin from the early stages of disease can be used as mortality indicators. Low levels of albumin can be seen even in well nourished CKD patients indicating that diet is not the only reason for low albumin levels(12).

Creatinine:-
Estimation of urine protein : creatinine index in random urine samples help in identifying pathological proteinuria which is convenient, fast and dependable test than the commonly used 24 hour urine protein and dipstick methods(13)

Urea:-
Though estimation of serum urea does not show any direct relationship with PEM, high urea levels causing uremic cachexia thus in turn lead to reduced diet intake causing PEM (13).

Approach to diet:-
Normal protein intake vs low protein diet:-
Low protein diet is generally followed worldwide in CKD patients but a possible risk involved is protein energy wasting. In the studies conducted so far shows a significant reduction in serum albumin in patients who are on low protein diet at least for a minimum period of six weeks. They also showed reduction in body fat free mass. A low protein diet may slow down the progression of disease but with detrimental effect on patients nutrition.(14)

A low protein diet supplemented with Keto analogues can delay the progression of CKD with adequate nutrition(15)

A diet plan based on individual needs can increase pre albumin level, reduce proteinuria and increases wellbeing of the patient with slowing down the disease progress(16)

Diet Supplements In Ckd:-
Evidences are lacking to prove the role of dietary supplements or interventions such as calcium enrichment, reducing phosphorous, adding calcium phosphate binders in stopping the progression of disease(17)

Prevention Is Better Than Cure:-
A multimodal approach is needed to prevent or treat Protein energy wasting, The approach includes management of coexisting health conditions, treatment of wasting, diet counselling, psychiatric counselling for depression(18)

Statin therapy in CKD patients not only useful in preventing Coronary artery disease but also help prevent protein energy wasting by reducing proteinuria ; pitavastatin is one such statin (19)

Obesity Paradox-Reverse Epidemiology:-
It is stated that patients of stage 3-5 NDD-CKD there is a possible relation of Higher BMI with delay in progression of disease as well as reduction in mortality among Obesity class I-III compared to the general population(20)

High BMI is associated with high muscle mass which is helpful in preventing the disease progression hence prevention of protein energy wasting help in delaying the progression of the disease(21)

In NDD-CKD patients, being overweight helps the patient but being obese does not because of associated atherogenesis(22)

The survival benefit of obesity paradox is present in individuals more than 65 years but it has a negative effect in younger individuals(23)

In a study conducted by Mohebi R et al among 1,860 individuals with NDD- CKD followed up over a period of ten years showed a high fat mass distribution in hip waist or whole body, results in reduced mortality than the general population(24).

The possible explanation for obesity paradox is as follows:

1 Lean patients are more prone for energy and muscle wasting and accentuated inflammatory process. On the other hand overweight individuals because of the fat distribution which can be utilized for energy needs are less likely to develop PEW (25)
2 Low mortality rate is observed in patients with high BMI hence efforts to increase the dry weight of the patient is warranted irrespective of age and gender(26)
3 Waist circumference is not an independent predictors but BMI in the overweight range has reduced risk of progression of kidney disease(27)

Disease Pattern In India:-

Though it is a well-established fact, the actual impact of PEW in our country is still not elaborately studied and the little data available today is all based on single center study and only narrate the incidence but does not study its cause.(28)

Among the data available the cause for protein energy malnutrition is as follows: lack of periodic follow ups, not following the proper diet plans, increased comorbidities, increased incidence of atherosclerosis, low socio economic status (29)

The current K/D OQI guidelines suggest a recommended protein intake of 0.6-

0.75 gm./kg/d Which is the same as followed elsewhere around the world and following a universal diet plan in our Indian population has its negative effect hence there is a need to revise the current diet regiments and come up with a novel approach to look specifically for our Indian population(30)

Subjective Global Assessment-Tool To Restore:-

SGA score helps in assessing the nutritional status of the patient during every outpatient visit which if used regularly can help in changing the life style of the patient, there by preventing the occurrence of protein energy wasting as well as can help in arresting its progression.(31)

Modified quantitative subjective global assessment is a more reliable marker than the conventional method as it takes mainly the anthropometric as well as lab parameters in assessing the nutritional status which can be used both in dialysis dependent as well as NDD – CKD patients(32)

Volume Status - The Corner Stone:-

Volume parameters are the vital factors influencing malnutrition scores. Elimination of volume overload helps in preventing inflammation and malnutrition(33)

Assessing the volume status by bio impedance analysis gives accurate information and combining with SGA and serum albumin and cholesterol monitoring prevents fluid overload, LV dysfunction and reduce the mortality rate(34)

Late Referral – Nutritional Point Of View:-

Patients referred late to the nephrology clinic showed a greater amount of weight loss, and reduced values in anthropometric measurements and body composition based on SGA. Patients who were referred late showed a greater degree of malnutrition and early progression of disease(35)

Next Level Tools To Assess Pew:-

Apart from questionnaires, anthropometry, baseline blood and urine investigations fewer, not widely used methods to assess nutrition are Bio impedance analysis, Microarrays, Muscle fibre size, Hormones like Leptin, Ghrelin, Growth hormone, C- reactive protein, interleukin 6, tumor necrosis factor alpha and DEXA(2)

Serum fibroblast growth factor -23,a hormone derived from skeletal frame work, increases phosphorous level, also causes dyslipidemia in CKD, high FGF23 level causes osteodystrophy which inturn lead to reduction in body mass leading to protein energy wasting(36)

Effect Of Pew On Co Existing Illness:-
Excessive abdominal fat places the patient at higher risk for developing coronary artery disease, but presence of excess fat mass helps to prevent PEW hence increase in dry weight alone is of benefit in CKD patients .(37)

PEW, C-Reactive protein, Pulse pressure were independent risk factors for concentric hypertrophy and LV dysfunction(38)

CKD patients with diabetes often has poor glycemic control with oral anti diabetic drugs and high sensitivity to insulin because of reduced excretion. High blood sugar levels cause loss of muscle mass and appearance of protein energy wasting. Oxidative stress caused by high blood sugar on kidney causes rapid progression form early stage to end stage kidney disease (39)

Diabetes mellitus increases the prevalence of anemia in Chronic kidney disease patients(40)

Dyslipidemia in CKD appears to be caused by a synergism of different mechanisms, such as malnutrition, inflammation, oxidative stress, and genetic components(41)

Measures To Prevent Or To Treat Pew By Drug Therapy:-
Sevelamer, Lanthanum, iron,calcium, colestin, bixalomer, nicotinic acid, and magnesium are some of the promising drugs available today to treat PEW in NDD-CKD patients if started early based on subjective global assessment and comorbidities(42)

The present strategies available for the management of protein energy wasting fall very short from meeting the personal demands for the patient(43)

Add on therapy of vitamin B12 supplementation is an effective and useful therapy in treating hyper-homocysteinemia in NDD-CKD patients(44)

Vitamin D Supplementation in CKD patients help in preventing secondary hyper parathyroidism and reduces proteinuria(45)

Whole foods like fish, fruit, vegetables contains a multitude of vitamins including vitamin A,E,D ; thus the synergistic effect on antioxidant system is enhanced, reducing the oxidative stress on kidney(46)

Targeting patients of lower body size, or low muscle mass with supplemental protein can redefine the management of protein energy malnutrition in this subset of patients(47)

Long term iron supplementation intravenously produces a significantly increasing trend towards infection related mortality in NDD-CKD patients(48)

Inorganic phosphate enriched food products like milk, grains , cereals increases serum phosphorous concentration; thus a nationwide food campaign can be initiated by the government at reasonable price (49)

Zinc supplementation in diet helps in reducing renal dependent anemia over a long term by increasing hemoglobin affinity (50)

Care should be taken while advising supplements for CKD patients for example addition of iron based phosphate binders may cause aluminum overload because citrate facilitates its absorption(51)

Autonomic dysfunction in ESRD patients may be overcome by nutritional supplementation like antioxidants(52)

Food additives like fish oil if added to the patients with diabetic nephropathy help in preventing chronic kidney disease(53)

Excessive dietary acid load in CKD patients is associated with increased risk for acidosis, early progression of disease and mortality hence addition of soda bicarbonate helps neutralizing the acid and helps reducing

mortality(54)

Subjects And Methods:-

Characteristics Of The Study:-

The Study of "**A CROSS SECTIONAL STUDY OF NUTRITIONAL ASSESSMENT IN CHRONIC KIDNEY DISEASE PATIENTS**" was carried among 100 patients who attended General Medicine, Nephrology Out Patient Departments and Emergency Department of Mahatma Gandhi Medical College and Research Institute in Pondicherry.

Study Place:-

General Medicine, Nephrology Out Patient Department and Emergency Department of Mahatma Gandhi Medical College and Research Institute in Pondicherry

Study Design:-

Single centre observational hospital based study

Number Of Subjects Included:-100

Period Of Study:-

January 2015 to July 2016

Ethical Committy Approval:-

Obtained

Characteristics Of The Patient Inclusion Criteria:-

CHRONIC KIDNEY DISEASE patients above the age of 18 and below the age of 70 of both genders

Exclusion Criteria:-

1 Recent infection
2 Recent hospitalisation (less than one month for infective causes)
3 On Haemodialysis

Sampling Procedure:-

All consecutive patients fulfilling the selection criteria are included in the study.

Sample Size;-

The sample size of the study is 100. Selected patients are asked for history regarding their disease and co-morbidities, anthropometry is taken and few blood samples are collected.

Brief Explanation Of The Procedure:-

All consecutive patients, already diagnosed or recently diagnosed cases of chronic kidney disease not on hemodialysis, who attended the outpatient department of either General Medicine or Nephrology or who came to the Emergency Department were first enrolled for the study.

Procedure was explained to the patients and their relatives in their known language and a written consent was obtained.

Then a brief history regarding their demographic data, duration of the disease, associated co morbid conditions and features suggestive of recent infections and uremic symptoms were obtained. Then a 24 hour dietary recall was obtained from which the nutritional assessment was done.

Anthropometric data such as height, weight, Body Mass Index, Mid –arm circumference and skin fold thickness was measured.

Later laboratory values such as haemoglobin, serum urea and creatinine, serum calcium, phosphorous and uric acid, and serum albumin and total protein were measured.

With the guidelines from the National Kidney Foundation for Protein Energy Malnutrition, Protein energy malnutrition was calculated for every patient.

Potential Pitfalls And Notes:-
None

Data Collection:-
A brief history regarding their demographic data, duration of the disease, associated co morbid conditions and features suggestive of recent infection and uremic symptoms were obtained. Then a 24 hour dietary recall was obtained from which the nutritional assessment was done.

Anthropometric data such as height, weight, Body Mass Index, Mid –arm circumference and skin fold thickness was measured.

Later laboratory values such as haemoglobin, serum urea and creatinine, serum calcium, phosphorous and uric acid, and serum albumin and total protein were measured. These data were entered in a performa as attached in the appendix.

Statistical Methods:-
Percentage
Mean
Standard deviation
Chi square.

Results:-

Descriptive Analysis:-
Descriptive analysis was done to describe the data in this study. The following table shows the results obtained in our study. Chi square test was used.

Stages Of Chronic Kidney Disease:-
The study included patients under stage 2 to stage 5 chronic kidney disease not undergoing dialysis. The following table shows that there are 26% ie 26 patients in stage 2, 25% ie 25 patients in stage 3, 24 % ie 24 patients in stage 4 and 25% ie 25 patients in stage 5.

Table 1:- Stages of chronic kidney disease

Stage	Frequency
2	26
3	25
4	24
5	25

Figure 1:-Stages of chronic kidney disease

Demographic Data:-

Gender Distribution:-

The demographic characteristics of this study are provided in the table. Out of the total 100 patients, 32 were females and 68 were males. Their distribution according to each stage is depicted in the following table and figure.

Table 2:-Frequency pattern for gender distribution

			CKD STAGE				
			2	3	4	5	Total
SEX	FEMALE	7(.9%)	9(28.1%))	6(18.8%)	10(31.3%)		32
	MALE	19(27.9%)	16(23.5%)	18(26.5%)	15(22.1%)		68
Chi square: 1.768; df: 3 ; 'p' value: 0.6							

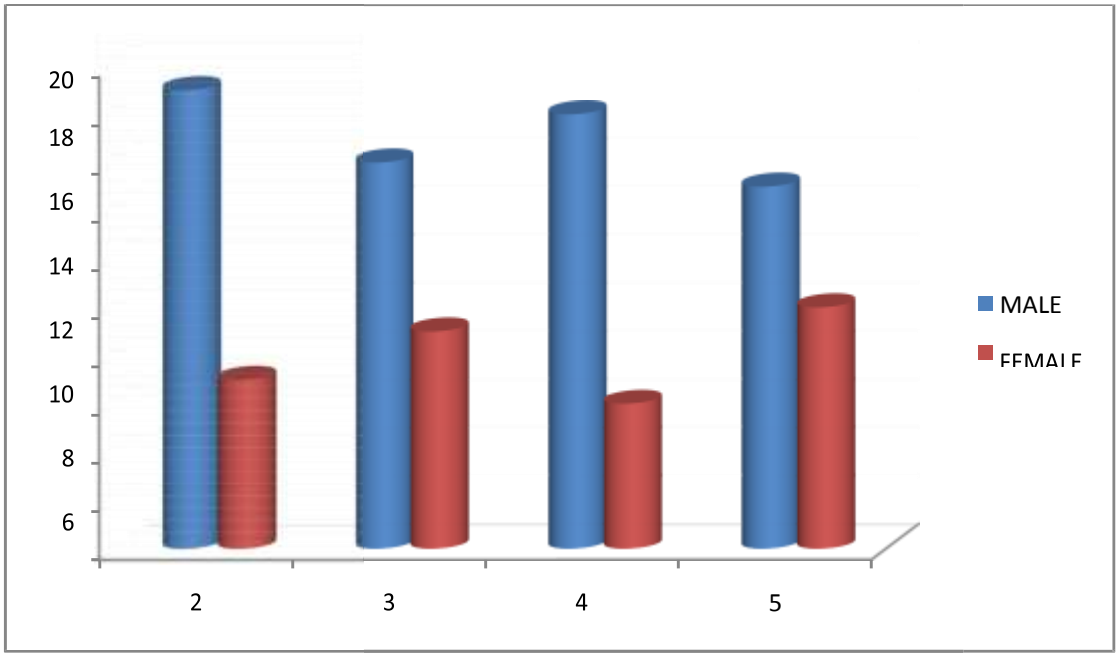

Figure 2:-Gender distribution in each stage

Associated Comorbid Conditions:-

The co-morbid conditions that were taken into account were diabetes mellitus, hypertension, dyslipedemia and coronary artery disease. Of the total study population, 49 patients were diabetics, 54 patients had hypertension, 11 had dyslipidemia and 13 had coronary artery disease. Their distribution according to each stage of CKD is shown in the following tables.

Table 3:- Number of patients with Diabetes

		CKD STAGE				
		2	3	4	5	Total
DM	ABSENT	12(23.5%)	13(25.5%)	13(25.5%)	13(25.5%)	51
	ESEN T	14(28.6%)	12(2.5%)	11(22.%)	12(24.5%)	49
Chi square: 0.361 ; df: 3 ; 'p' value: 0.9						

Table 4:-Number of patients with hypertension

		CKD STAGE				
		2	3	4	5	Total
HTN	Absent	15(33.3%)	10(22.2%)	8(17.8%)	12(26.7%)	45
	Present	11(20.%)	15(27.8%)	15(27.8%)	13(24.1%))	54
Chi square: 2.992 ; df: 3 ; 'p' value: 0.3						

Table 5:- Number of patients with Dyslipidemia

		CKD STAGE				
		2	3	4	5	Total
DLP	Absent	23(25.8%)	23(25.8%)	22(2.7%)	21(23.%)	89
	Present	3(27.3%)	2(18.2%)	2(18.2%)	4(36.%)	11
Chi square: 1.050 ; df: 3 ; 'p' value: 0.7						

Table 6:-Number of patients with coronary artery disease

		CKD STAGE				
		2	3	4	5	Total
CAD	Absent	23(26.4%)	23(26.4%)	22(25.3%))	19(21.8%)	87
	Present	3(23.1%)	2(15.4%)	2(15.4%)	6(46.2%)	13
Chi square: 3.738 ; df: 3 ; 'p' value: 0.2						

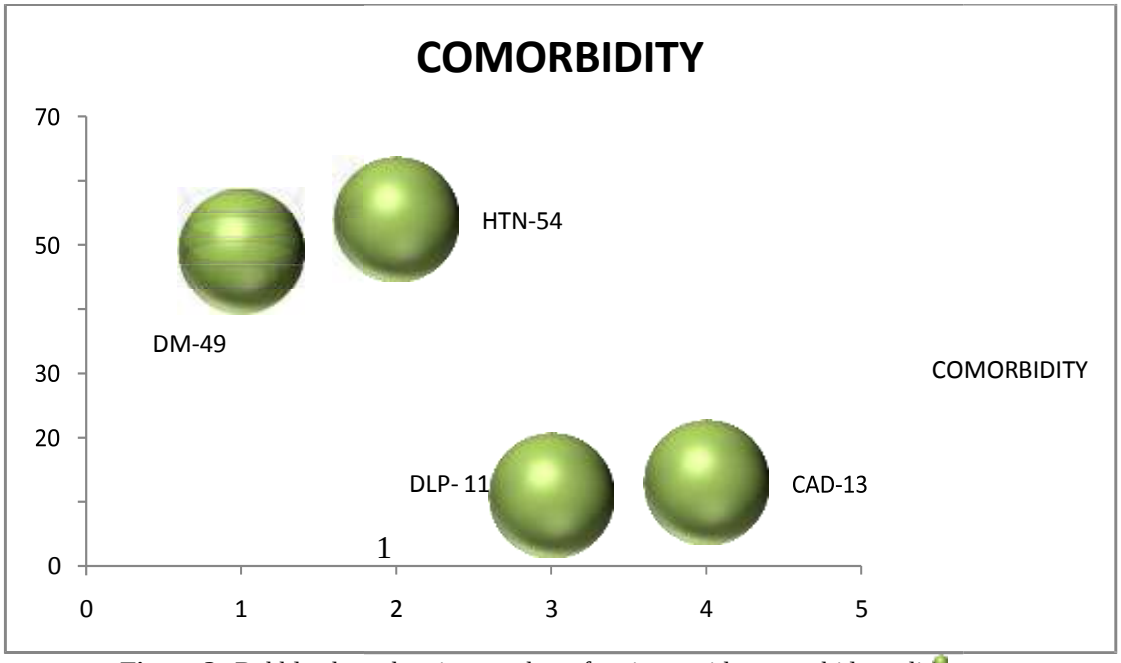

Figure 3:-Bubble chart showing number of patients with co-morbid conditionns

Association With Clinical Features:-

Presence of clinical features is an important criterion as onset of uremic features or infection will affect the food intake of the patient.

Table 6:-Frequency data on number of patients who developed nausea

		CKD STAGE				
		2	3	4	5	Total
NAUSEA	NO	24(32.9%)	23(31.5%)	16(21.9%)	10(13.7%)	73
	YES	2(7.4%)	2(7.4%)	8(29.6%)	15(55.6%)	27
Chi square: 23.798 ; df: 3 ; 'p' value: 0.00						

Table 7:-Frequency data on number of patients who developed vomiting

		CKD STAGE				
		2	**3**	**4**	**5**	**Total**
VOMITING	NO	26(31.0%)	24(28.6%)	20(23.8%)	14(16.7%)	84
	YES	0(0%)	1(6.3%)	4(25%)	11(68.8%)	16
Chi square: 22.222 ; df: 3 ; 'p' value: .000						

Table 8:-Frequency data on number of patients who developed loss of appetite

			CKD STAGE				
			2	3	4	5	Total
APPETITE	No	23(30.7%)		23(30.7%)	20(26.7%)	9(12%)	75
	Yes	3(2%)		2(8%)	4(16%)	16(64%)	25`
Chi square: 27.535 ; df: 3 ; 'p' value: 0.00							

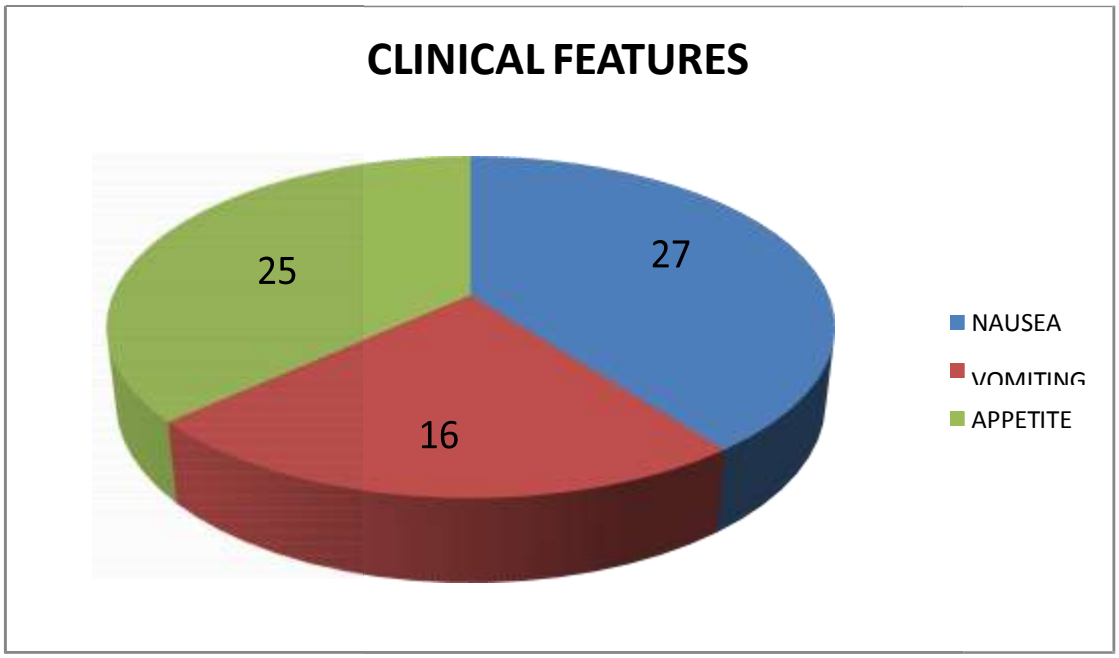

Figure 4:-Donut chart showing number of patients who developed uremic features

Association With Anthropometric Parameters:-

Anthropometric parameter such as height, weight, BMI, mid arm circumference and skin fold thickness was measured for all patients.

Table 9:-Frequency of patients having decreased mid arm circumference

		CKD STAGE				
		2	3	4	5	TOTAL
MAC	Decreased	6(17.6%)	5(14.7%)	6(17.6%)	17(50%)	3
	Increased	20(30.3%)	20(30.3%)	18(27.3%)	8(12.1%)	66
Chi square: 17.311 ; df: 3 ; 'p' value: 0.001						

Table 10:-Frequency of patients having decreased skin fold thickness

		CKD STAGE				
		2	**3**	**4**	**5**	**Total**
SF	Decreased	8(2.2%)	1(3%)	7(21.2%)	17(51.5%)	33
	Increased	18(26.9%)	24(35.8%)	17(25.4%)	8(11.9%)	67
Chi square: 23.578 ; df: 3 ; 'p' value: 0.000						

Table 10:-Frequency of patients having decreased BMI

		CKD STAGE				
		2	3	4	5	Total
BMI	DECREASED	7(11.9%)	13(22%)	18(30.5%)	21(35.6%)	59
	INCREASED	19(6.3%)	12(29.3%)	6(14.6%)	4(9.8%)	41
Chi square: 20.0565 ; df: 3 ; 'p' value:0.000						

Association With Biochemical Parameters:-

Table 11:-Frequency of patients having decreased serum albumin

		CKD STAGE				
		2	3	4	5	Total
ALBUMIN	Decreased	16(31.4%)	5(9.8%)	12(23.5%)	18(35.3%)	51
	Normal	10(20.4%)	20(40.8 %)	12(24.5%)	7(14.3%)	49
Df: 3; chi square: 15.191; p- 0.002						

Table 12:-Frequency of patients having decreased total cholesterol

		CKD STAGE				
		2	**3**	**4**	**5**	**Total**
Total Cholesterol	Decreased	12(30%)	10(25%)	9(22.5%)	9(22.5%)	40
	Normal	14(23.3 %)	15(25%)	15(25%)	16(26.7%)	60
Df: 3; chi square: 0.639 ; p= 0.887						

Protein Energy Malnutrition:-

Table 13:-Frequency of patients having PEM in each stage

			CKD STAGE				
		2	3	4	5		Total
PEM	Yes	9(25%)	3(8.3%)	7(19.4%)	17(47.2%)	36	
	No	17(26.6%)	22(34.4%)	17(26.6%)	8(12.5%)	64	
Df: 3; chi square: 17.86 ;p=0.000							

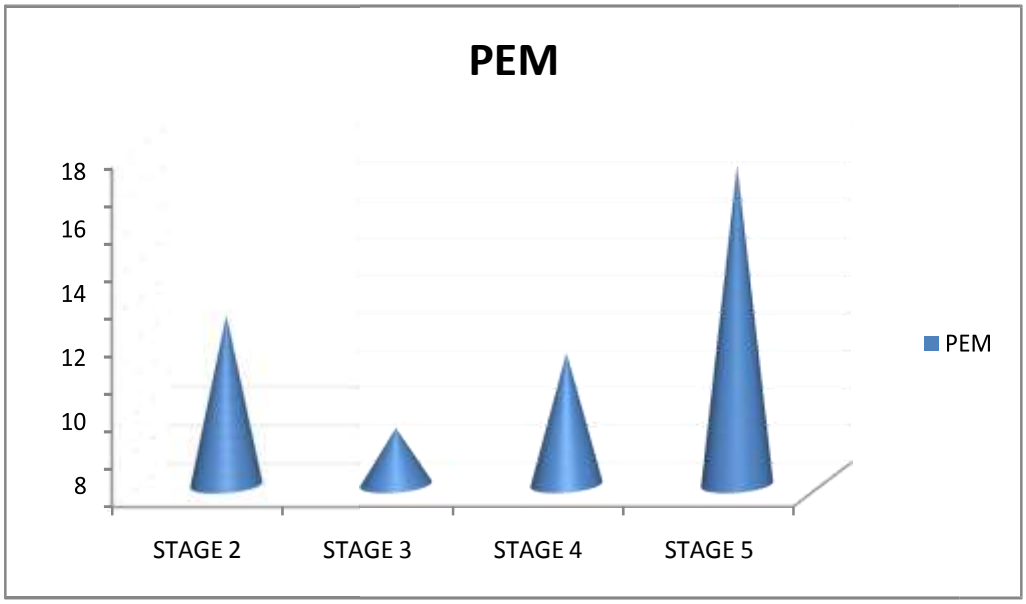

Figure 5:-Frequency of patients having PEM in each stage

Table 14:- Association of PEM and gender

		Sex		
		Female	**Male**	**Total**
PEM	Yes	15(1.7%)	21(58.3%)	36
	No	17(26.6%)	47(73.4%)	64
Df: 1 chi square: 2.1; p-0.12				

Table 15:- Frequency of patients consuming excess protein

		CKD STAGE				
		2	**3**	**4**	**5**	**Total**
Protein intake	Decrease	3(6.4%)	6(12.8%)	13(27.7%)	25(53.2%)	47
	Increase	23(43.4%)	19(35.8%)	11(20.8%)	0(0%)	53
Df: 3; chi square: 47.121; p= 0.000						

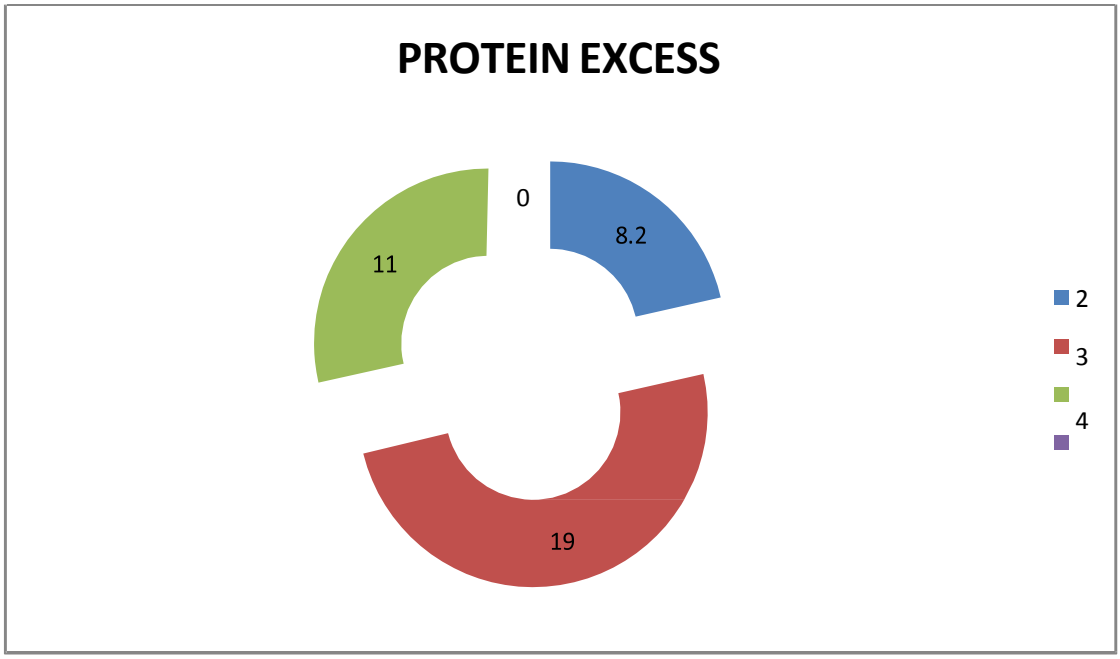

Figure 7:-Frequency of patients consuming excess protein

Discussion:-

As the burden of people living with chronic kidney disease is increasing worldwide, it is essential not only to treat the disease per se but also the coexisting conditions such as Diabetes, hypertension, coronary artery disease, anemia, dyslipidemia and protein energy malnutrition etc. Among all these, PEM is one of the most common and preventable yet under corrected condition as it goes on undiagnosed for many years before the telltale signs of the disease become readily visible. Keeping this in mind the study was done.

A cross sectional study of nutritional assessment in chronic kidney disease patients is a study done over a period of two years among hundred patients with chronic kidney disease. The major indices for diagnosing PEM in this study include history of nausea, vomiting, loss of appetite, loss of weight; Anthropometric measurements such as height, weight, BMI, mid arm circumference, skin fold thickness; and lab parameters such as hemoglobin, serum urea, creatinine, calcium, phosphorus, uric acid, total protein, albumin, fasting lipid profile.

The significance of this study is as follows:-
As per our study out of hundred patients thirty six patients had protein energy malnutrition already existing or as a

consequence of renal dysfunction which is a significant finding, and it is correlating with the study done by Csaba P Kovesdy et al(55)

Patient selection was almost equally distributed in each stage of CKD except stage one which had no patients because the patients were randomly selected. The prevalence of PEM is much higher in stage four and five than the early stages this may be attributed to the natural process of the disease.

The reason for more number of protein energy malnutrition in later stages of chronic kidney is due to uremic symptoms such as Nausea, Vomiting, loss of appetite which is a common complication of advanced medical renal disease This finding correlates with the study done by Yashpal P. Jadeja et al (56)

Protein energy malnutrition is more common in women than in men in our study which does not correlate with other studies done among the Western population and it may be because the dietary habits differ according to gender due to social circumstances, Economic status, Educational level and failure to seek early medical advice (57)

Anthropometric measurements play a significant role in identifying PEM especially in a country like ours where all the biochemical investigations are not readily available for the poor population. The indices particularly mid arm circumference, BMI helps to identify the at risk population even before it becomes evident by investigations as seen in the study done by Vasantha Janarthanan et al(58)

Contrary to the belief that co morbid conditions like Diabetes, hypertension, dyslipidemia lead to early progression of the inflammatory process,there by increased risk of developing PEM is not true. As per this study patients with diabetes mellitus seem to have increase risk of protein energy malnutrition. The reason for this difference is not clearly understood and it needs further evaluation hence not dealt with in this study. This finding does not correlate with any other study such as the study done by Pragna rao et al(59)

Apart from other biochemical parameters, serum albumin is the single best biochemical value in predicting PEM and any value less than 4 mg / dl is considered significant, This finding is consistent with the study done by Robert H.Mak et al (60)

Majority of the patients, with later stages of CKD, consume less than the requirement of protein intake per day. On the whole strict adherence to a proper protein diet is absent among all the patients of our study and this finding is seen widely among the Indian population as shown in the study done by Sontakke et al (61)

Major limitations of this study include

1 Smaller sample size,
2 No patients were included in stage one CKD,
3 Absence of application of advanced lab parameters like C- Reactive protein, cytokines and other inflammatory markers.
4 Follow up study
5 Future plan is to find out the causes of PEM in CKD other than Diabetes mellitus, hypertension, Dyslipidemia. Formulation of an accepted diet plan for every individual based on their life style, economic status. To include diet supplementation with proteins of high biological value, Trace elements, amino acid supplementation and re do the study to assess the Level of PEM in patients in who are strictly adherent to the diet and find out the cause of PEM in such patients

Conclusion:-

From our study we are able to conclude that

Protein Energy Malnutrition is highly prevalent among the late stages of CKD

Lack of knowledge about the need for proper diet plan is the reason for such high prevalence

Not only low protein but also not taking a protein diet with high biological value also can lead to protein energy malnutrition, even in obese patients

Association of comorbid conditions other than Diabetes and hypertension has to be studied and assessed in a separate study among the CKD patients. Formulation of individual diet plan, periodic anthropometric

measurements and serum biochemical monitoring of total protein and albumin can delay the occurrence of protein energy malnutrition in patients. Not only complicated workup helps in diagnosing protein energy malnutrition, basic history taking with 24 hours dietary recall, anthropometric measurements and basic biochemical investigations help in identifying protein energy malnutrition in early stages.

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