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Nutritional assessment of chronic kidney disease patients of Lucknow city : A comparative study

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Background : Chronic Kidney Disease is a silent epidemic of the 21st century and in India its incidence continues to at an alarming rate. Nutritional assessment of chronic kidney disease patients may help in improving the health status and better life quality of CKD patients.

Objective : Present study was conducted in 2 hospitals of Lucknow city (U.P.) to assess the nutritional status of CKD patients.

Methods : One hundred chronic kidney disease patients were selected randomly, fifty from indoor patient department and fifty from outdoor patient department, more than fifteen years of age, belonging to different socioeconomic status and surveyed. A questionnaire-cum-interview schedule method was used to know the demographic profile, dietary, biochemical and clinical profile of patients and other factors related to disease.

Results : The findings revealed that dietary intake of OPD patients were better than that of IPD. IPD patients showed poor biochemical and clinical profile than OPD. BMI of the subjects decreased with decrease in GFR in both groups.

Conclusion : Malnutrition was common in IPD group. Insufficient food intake associates with malnutrition. Therefore, it is of paramount importance to assess nutritional status of CKD patients to improve their health conditions.

Key Words : Chronic kidney disease, Nutritional assessment, Symptoms of CKD

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INTRODUCTION

Chronic Kidney Disease is a silent epidemic of the 21st century. Its occurrence is universal and in India its incidence continues to at an alarming rate. This silent disease affects people of every walk of life and leads to many co-morbidities that affect patients at all 5 stages of the disease defined by National Kidney Foundation (2002). During these five stages of chronic kidney disease, it can lead to the deteriorated nutritional status and many other health problems including malnutrition and anaemia. Malnutrition is common in people with advanced CKD because of loss of appetite and decreased food intake, decreased absorption of food from the intestines, and acidosis. Anemia develops when the kidneys fail to produce enough erythropoietin (EPO), the hormone that directs the bones to make red blood cells. CKD can also lead to bone problems by throwing calcium and phosphorus out of balance. So the best long term option is to balance the daily nutrient intake of CKD

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patients. Keeping this in mind, the present attempt has been made to assess the nutritional status of kidney patients of IPD and OPD for revealing some important data which will prove beneficial for improving their nutritional profile.

METHODOLOGY

The study was conducted at in and out patient wards of two tertiary care centres of Lucknow (U.P.). A sample of 100 chronic kidney disease patients (50 from IPD and 50 from OPD) undergoing treatment, were randomly selected. A standardized questionnaire was developed that collected information regarding patients' diet, anthropometric, clinical and biochemical information.

Dietary information :

24-Hour dietary recall :

It consisted of an interview where the patient is asked to recall the previous 24-hours food and beverage intakes including the amount and time of consumption (Bingham *et al.*, 1994).

Anthropometric Assessment - Anthropometric measurements such as height, weight and BMI reflect the patterns of growth and development and how individuals deviate from the average at various ages under different diseased conditions.

Body weight and height of subjects were recorded and BMI (Quetlet's index) was recorded by the technique suggested by (Gibson, 1990) and was calculated by using the formula given below:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height}^2 \text{ (m)}}$$

The above formula may have different significance in CKD patients because of reduction of weight with height due to many pathophysiological conditions. The following classification suggested by James *et al.* (1988) has been referred for the same purpose (Table A).

Table A : Assessment of degree of malnutrition in respondents

BMI Class	Presumptive diagnosis
16.0	*CED – Grade III severe
16.0 - 17.0	CED – Grade II moderate
17.0 - 18.5	CED – Grade I mild
18.5 - 20.0	Low Weight Normal
20.0 -25.0	Normal
25.0 - 30.0	Obese Grade I
30.0	Obese Grade II

*CED - Chronic Energy Deficiency

Biochemical profile:

Biochemical parameters like serum creatinine, s. albumin, s. total proteins, hemoglobin etc. have been taken from medical record to know patients' actual condition. For normal ranges of these parameters, Text Book of Medicine by Vasan and Seshadri (1998) has been referred.

Clinical assessment :

A pre-tested and pre-designed format has been used to observe the symptoms of nutrient depletion in patients. Clinical conditions including dyspnoea, edema, blurred vision, oliguria, nausea, abdominal pain etc. were recorded.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Dietary assessment :

24 Hours dietary recall report :

The consumption of energy in CKD subjects was found 1742.95±348.90 kCal. per day, in IPD, while, in OPD, it was found 2092.34 ± 393.11 kCal. per day and the observed value of 'Z' was found to be significant (4.7**) at 1 per cent level of significance. The low intake of calories in IPD was due to anorexia, which was caused by uremic toxicity, intake of medicine, emotional depression, illness, dialysis process and hospital environment. The intake of energy was not adequate as per requirement of CKD patients (Antia and Abraham, 1997; Williams, 2005). The daily consumption of protein was noted 41.20 gm. per day with standard deviation 8.25 in IPD and 48.96 g per day with standard deviation 6.89 in OPD (Z=5.10**) with highly significant difference. Protein is generally restricted in CKD and given according to severity of disease. Protein intake was found higher in OPD subjects as compared to IPD subjects. However it was being consumed less by both IPD as well as OPD subjects than its requirement (Table 1). Average mean intake of fat was seen 32.27 ± 8.52 gm. per day and 33.39 ± 7.79 g per day in IPD and OPD subjects, respectively. The observed value of 'Z' test was seen to be non-significant (0.68). Consumption of fat was found adequate in both IPD as well as OPD. CKD patients are allowed to take moderate fat in diet to fulfil

energy need of body as BMI decreases rapidly during CKD. The intake of carbohydrate was 260 ± 81.62 g per day and 335.16 ± 100.38 g per day in IPD and OPD, respectively. The observed value of 'Z' was 4.10**, which showed significant difference in average mean intake of subjects. Both the groups were found taking less carbohydrate than the requirement.

The average mean consumption of iron in IPD (18.90 ± 4.65 mg. per day) and OPD subjects (18.15 ± 3.99 mg per day) was found almost similar with no significant difference (0.86). The average mean calcium intake of IPD was 354.84 ± 153.57 mg per day, while in OPD; it was seen 419.72 ± 231.64 mg per day, which was almost equal to the requirement. Consumption of calcium of IPD subjects were found less than the requirement (Appendix – III). The observed value of 'Z' was found non-significant (1.65). The average mean consumption of sodium was seen 987.02 ± 167.06 mg per day in IPD subjects and 1697.5 ± 374.87 mg per day in OPD subjects with highly significant difference (12.24**). Sodium intake was quite low in IPD subjects as compared to OPD subjects who took satisfactory sodium in their diet. Potassium intake of IPD subjects was observed less (2012.16 ± 370.43 mg per day) as compared to OPD subjects (2371.78 ± 346.87 mg per day) with significant difference (5.01**). The findings disclose that overall nutrient intake of IPD subjects was less than OPD subjects. The reason behind it may be the severity of disease and anorexia in IPD patients. Feeling of discomfort due to disease, dialysis and moreover the atmosphere of hospital and smell of medicines may also be responsible for low intake of food and nutrients as information obtained by IPD subjects.

Anthropometric assessment :

The data in the Table 2 indicates that average mean height of IPD subjects was 157.70±5.79 cm. The average mean height of OPD subjects was 157.60±5.79 cm. There was negligible difference in the average mean height of both IPD and OPD subjects. In IPD subjects, average mean weight was 51.60±6.62 kg and in OPD, average mean weight was 57.88± 6.71kg. Maximum mean weight (64.5±2.50 kg) was found in OPD subjects of age group 15-30 years and in same age group, minimum mean weight (47.08 kg) with least deviation (1.64) was found in IPD subjects. In IPD subjects, mean BMI ranged from 20.36 to 21.50 with average mean BMI, 20.70±2.10, while, in OPD subjects, mean BMI range was found between 22.4 to 25.35 with average mean 23.18±1.33. Minimum mean BMI (20.36±1.80) fell in IPD subjects, belonged to age group 60 and above, and in the same age group, minimum mean BMI *i.e.* 22.4±1.12 was seen

Table 1 : Mean nutrient intake of CKD subjects

Sr. No	Nutrient	IPD	OPD	'Z' value
1.	Energy (kCal. per day)	1742.95 ± 348.90	2092.34 ± 393.11	4.70**
2.	Protein (g per day)	41.20 ± 8.25	48.96 ± 6.89	5.10**
3.	Fat (g per day)	32.27 ± 8.52	33.39 ± 7.79	0.68 NS
4.	Carbohydrate (g per day)	260.03 ± 81.62	335.16 ± 100.38	4.10**
5.	Iron (mg per day)	18.90 ± 4.65	18.15 ± 3.99	0.86 NS
6.	Calcium (mg per day)	354.84 ± 153.57	419.72 ± 231.64	1.65 NS
7.	Sodium (mg per day)	987.02 ± 167.06	1697.5 ± 374.87	12.24**
8	Potassium (mg per day)	2012.16 ± 370.43	2371.78 ± 346.87	5.01**

* and ** indicate significance of values at P = 0.05 and 0.01, respectively
NS =Non-significant

Table 2 : Distribution of height, weight and BMI of CKD subjects according to age

Age group (years)	IPD				OPD			
	N	Mean ± SD (Height in cm.)	Mean ± SD (Weight in kg.)	Mean ± SD (BMI)	N	Mean ± SD (Height in cm.)	Mean ± SD (Weight in kg.)	Mean ± SD (BMI)
15 – 30	6	151.82 ± 1.66	47.08 ± 1.64	20.43 ± 0.64	2	159.50 ± 0.50	64.5 ± 2.50	25.35 ± 0.82
30 – 45	12	162.16 ± 6.67	54 ± 7.38	20.52 ± 2.41	10	158.37 ± 8.41	57 ± 8.79	22.57 ± 1.40
45 - 60	24	158.87 ± 6.29	54.31 ± 10.02	21.50 ± 3.55	22	156.40 ± 8.04	55.90 ± 9.89	22.65 ± 1.97
60 and above	8	158.02 ± 8.58	51 ± 7.45	20.36 ± 1.80	16	156.17 ± 6.24	54.13 ± 5.66	22.4 ± 1.12
Total	50	157.70 ± 5.79	51.60 ± 6.62	20.70 ± 2.10	50	157.60 ± 5.79	57.88 ± 6.71	23.18 ± 1.33

in OPD subjects. BMI decreased rapidly in subjects, belonged to age group 60 and above. This showed severe wasting due to CKD in older people. Perusals of Table 3 reveal the distribution of subjects according to BMI. Most of the IPD subjects (16%) fell in BMI range 17.0-18.5 and found underweight and very few subjects (2%) belonged to BMI range of 30 and 30 above who were obese. On the other hand, in OPD, maximum subjects (80%) were found, having BMI, 20-25. Only 4 per cent OPD subjects were seen with BMI 18.5-20.0.

Clinical profile:

Table 4 shows the symptoms of kidney disease at the time of onset of disease. Among the 50 patients of IPD studied, oedema and dyspnoea were the most common symptoms, followed by oliguria and vomiting. Nausea was found in 32 per cent of IPD subjects. Fever, headache, unconsciousness and abdominal pain were prevalent in almost 20 per cent of the subjects. In OPD, majority of subjects were suffering from abdominal pain (30 %), followed by vomiting (16 %). Dyspnoea, fever, blurred vision, headache and unconsciousness were not found in OPD subjects. The causes for edema and oliguria may be due to impaired ability to excrete urine because of defective tubular function, resulting in an overt expansion of the plasma and extra cellular fluid volumes and it leads edema. Dyspnoea may indicate congestive heart failure, anemia or metabolic acidosis. Blurred vision of eyes is due to increased level of glucose in the blood, in case of diabetes, affects the eyes and leads to change in vision. The reason of abdominal pain in OPD subjects may be infection of intestine, glomeruli and renal tubules. It is common in CKD patients with diabetes and infection due to gastric disorders. Fever generally appears in case of infection and glomerular disease. Edema occurs because kidney does not remove extra fluid, which builds up in the body, resulting swelling in legs, ankles, extremities and other body parts. Headache, unconsciousness and seizures are due to brain swelling. Brain has no place to expand because it is enclosed in the rigid skull cavity. The reason behind vomiting is severe build up wastes in blood which gives metallic taste to mouth. Dyspnoea refers the air hunger or shortness of breathe, which is due to extra fluid in the body. Headache and unconsciousness may be due to shortness of breathe, anorexia, feeling of nausea and discomfort.

Table 3 : Distribution of subjects on the basis of BMI

Sr. No.	BMI	IPD		OPD	
		N	%	N	%
1.	17.0 - 18.5	8	16	-	-
2.	18.5 – 20.0	13	26	2	4
3.	20.0 - 25.0	24	48	40	80
4.	25.0 - 30.0	4	8	5	10
5.	30.0 and above	1	2	3	6
	Total	50	100	50	100

Table 4 : Status of symptoms of chronic kidney disease at the time of onset

Sr. No.	Symptoms	IPD		OPD	
		N	%	N	%
1.	Dyspnoea	20	40	-	-
2.	Edema	20	40	4	8
3.	Fever	11	22	-	-
4.	Vomiting	19	38	8	16
5.	Frequent urination	6	12	4	8
6.	Blurred vision	4	8	-	-
7.	Hematuria	8	16	3	6
8.	Nausea	10	20	7	14
9.	Headache	10	20	-	-
10.	Unconsciousness	12	24	-	-
11.	Abdominal pain	10	20	15	30
12.	Oliguria	18	36	6	12

Biochemical picture :

As Table 5 indicates, different biochemical parameters were used to explain patients' biochemical profile at the time of investigation. The mean value of serum sodium was found 133.82 mEq per Litre with standard deviation 6.75 in IPD and 140.82 mEq per Litre with standard deviation 8.11 in OPD subjects. The mean value of serum sodium in IPD subjects was less than the cut off limit of serum sodium (136-145 mEq per Litre) as referred by Vasan and Seshadri (1998), while in OPD, it is within the range. The difference in mean serum sodium level was significant (4.6**) at 1 per cent level of significance. For potassium, both the values of IPD and OPD were within the standard range of serum potassium. The 'Z' value was found to be quite significant (4.72**). The level of serum proteins was found less than the cut off limit in IPD, while it was within the range in OPD subjects. The difference, in the mean serum proteins level was significant (7.7**) at 1 per cent level of significance. Low levels of serum proteins in IPD subjects may be due to restriction of protein on one hand and loss of protein in urine (proteinuria) on other hand. In IPD, mean serum albumin was seen low than the cut off limit of (3.8-5.0 g per dl), while, it was seen within the range in OPD subjects. This may be due to loss of albumin in urine as impaired kidney may fail to separate albumin from the wastes. Also the decrease in protein intake may result in a fall in the serum albumin concentration. The difference, in the mean serum albumin level of both groups was found to be highly significant (8.6**). The mean s. calcium level was found to be more in OPD subjects, as compared to IPD subjects yet both the values were within the range (9.0-11 mg per dl). The mean value of serum creatinine of OPD subjects was less as compared to IPD subjects and the difference between mean of IPD and OPD subjects was found to be significant (8**). High level of serum creatinine showed the severity of CKD in subjects. The level of serum inorganic phosphorus was seen quite high in IPD subjects, while it was within the range in OPD subjects. High level of serum inorganic phosphorus causes hyper phosphatemia which is one of the complications of CKD, as diseased kidney are unable to remove phosphorus from the blood. The observed value of 'Z' test between IPD and OPD was found to be significant (3.8**).

Relationship between GFR, body weight and BMI :

Perusals of Table 6 show the correlation between GFR, body weight and BMI. It is clear that maximum mean BMI was seen in subjects whose GFR values were between 60-89 in IPD and in case of OPD, maximum mean BMI was found in subjects who had GFR value 90 and higher. The table also showed that BMI of the subjects decreased with decrease in GFR. Correlation

Table 5 : Biochemical profile of chronic kidney disease subjects

Sr. No.	Parameters	IPD	OPD	Z value	Standard value
1.	S. Sodium (mEq. per lit.)	133.82 ± 6.75	140.82 ± 8.11	4.69**	136-145mEq. per lit
2.	S. Potassium (mEq. per lit.)	4.94 ± 1.36	3.9 ± 0.85	4.72**	3.5-5.0 mEq. per lit
3.	S. Total proteins (g per 100 ml.)	5.9 ± 0.57	6.95 ± 0.78	7.7**	6.0-8.4 g per 100ml
4.	S. Albumin (g per dl.)	2.81 ± 0.59	3.88 ± 0.65	8.6**	3.8-5.0 g per dl
5.	S. Calcium (mg per 100 ml.)	8.45 ± 1.27	9.76 ± 0.84	6.2**	8.5-10.5 mg per 100ml
6.	S. creatinine (mg per 100 ml.)	5.2 ± 3.0	1.75 ± 0.56	8**	0.6-1.5mg per 100ml
7.	S. Inorganic phosphorus (mg per 100 ml.)	4.92 ± 1.22	3.85 ± 1.59	3.8**	3.0-4.5mg per 100ml

* and ** indicate significance of values at P=0.05 and 0.01, respectively
NS = Non significant

Table 6 : Correlation between GFR, body weight and BMI

GFR (ml./minute)	Stage	IPD			OPD		
		N	Mean ± S.D. (Wt. in kg.)	Mean ± S.D. (BMI)	N	Mean ± S.D. (Wt. in kg.)	Mean ± S.D. (BMI)
90 or higher	1	-	-	-	4	59.75 ± 4.43	23.6 ± 1.67
60 - 89	2	4	64 ± 4.24	23.25 ± 3.34	24	62.5 ± 7.5	22.9 ± 1.49
30 - 59	3	5	59.2 ± 14.10	22.60 ± 3.82	16	56.1 ±7.4	22.0 ± 1.0
15 – 29	4	21	52.95 ± 8.23	20.83 ± 2.77	6	49.6 ± 5.82	21.41 ± 1.06
Below 15	5	20	49.75 ± 4.8	19.44 ± 1.43	-	-	-
r value		50	0.52*	0.52*	50	0.55*	0.62*

co-efficient value was found positively significant for both IPD as well as OPD groups (0.52* vs. 0.62*). Table 6 also shows the correlation between GFR and body weight. It is clear that maximum mean body weight was seen in subjects whose GFR values were between 60-89 in IPD as well as in OPD (64 kg. vs. 62.5 kg.). Correlation co-efficient value was found positively significant for both IPD as well as OPD groups (0.52* vs. 0.55*). This showed that subjects' body weight decreased with decrease in GFR.

Summary and conclusion:

Nutritional information plays an important role for maintaining nutritional status in kidney disease and insufficient food intake associates with malnutrition. So the study was conducted to estimate anthropometric, clinical, biochemical data and dietary intake of chronic kidney disease patients of IPD and OPD. The findings concluded that dietary intake of OPD patients was better than IPD. IPD patients showed poor biochemical and clinical profile than OPD. Malnutrition was common in IPD group. Positive correlation was found between GFR, body weight and BMI of patients of IPD as well as OPD. It is of paramount importance to assess nutritional status of CKD patients to improve their health conditions and life quality.

Conflicts of interest:

The authors declare that there are no conflicts of interest regarding the publication of the paper.

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