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# Effects of Selected Protein Diets on Biochemical profiles and Symptoms of Patients with Chronic Renal Failure

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**ABSTRACT:** The aim of this study was to compare, using randomized controlled design, the metabolic effects of four low-protein diets, A, B, C and D obtained from different protein sources, in out-patients with moderate Chronic Renal Failure (CRF). Thirty two adult outpatients (20 males and 12 females) aged 43.9+17.3 years were randomly distributed into four groups of eight patients each. Each group was placed on isocaloric and 0.55gp/kg/day diets, containing cooked beef (A), egg white and smoked catfish (B),smoked Catfish (C) and egg white, cooked beef, smoked catfish and dehulled steamed cowpea pudding (D) for a period of six months, during which initial and final blood urea, serum creatinine levels and the symptoms experienced by the patients were compared. Blood urea decreased significantly in all the groups with B>C>A>D. The same trend was obtained for blood pressure and blood sodium levels of the patients. All the patients had improvement from their symptoms. However the B diet resulted in significant reduction of blood urea (-45.67±6.22 mg/dl) and improvement from symptoms (87.5 to 100%) in comparison with the corresponding values in patients on diets A, C, and D (range for Blood area = - 41.74±2.02 to -32.47 ± 5.90mg/dl) (P=0.041). Although serum creatinine of the patients placed on the B diet was slightly less than in the other groups the difference was not significant (P =0.93). The study shows that the combination of egg white and catfish diet followed by the catfish diet alone were more efficacious in promoting reduction in blood urea and improvement in symptoms in patients with CRF.
**Key words:** controlled protein diets, chronic renal failure, outpatients

## INTRODUCTION

Several studies have demonstrated the potentials of proper dietary management as representing a cornerstone in the treatment of the metabolic consequences of Chronic Renal Failure (CRF) ( [1-4] Dietary management ameliorates uremic toxicity over a long period of time, reduces signs and symptoms of uremia, lessens the accumulation of waste metabolic products, prevents secondary hyperparathyroidism, protects against hypertension and proteinuria, and markedly slows the decline of the residual renal function and progression of renal disease, of patients with renal insufficiency regardless of the cause[5-6]. Appropriate dietary management also provides a temporary stabilization or occasionally exhibits improvement in renal function for months and in some cases years and can delay the end stage of renal failure and the time of initiating replacement therapy, such as dialysis and renal transplant, thereby reducing the overall cost of treatment[7-8].

Hence, appropriate diet is critically important in the management of patients with CRF. However, despite the great number of studies investigating the dietary management of CRF, a full agreement on the optimal protein intake has not been reached[6]. Guidelines need to be established and more information is required on the extent to which proteins can be restricted and what type of protein can achieve maximal effects on the control of renal disease without provoking or adversely impairing growth in children[3]. The questions now are the degree of protein restriction, what type of protein to prescribe and the most appropriate time to start the diet. Although clinical experience world wide has demonstrated that proper dietary treatment offer several

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advantages and benefits in CRF, the situation in Nigeria is quite different. Reports on clinical experience of dietary management of CRF in Nigeria are limited[9]. There is need to expand the existing knowledge and its application in our locality in an attempt to provide further safety measures to improve the health condition of patients with CRF in Nigeria.

The overall objective of this study was to compare the effects of four diets with different protein sources on the biochemical parameters and symptoms in patients with chronic renal failure.

## MATERIALS AND METHODS

A prospective clinical dietary study of out patients with chronic renal failure (CRF) was conducted at the University College Hospital, Ibadan, Nigeria The study involved 32 ambulatory adult subjects with mild to moderately severe CRF of diverse etiology. The patients were referred to the Dietetic Clinic of the hospital for dietary counseling.

The following inclusion criteria were used; The patients were active out patients with CRF, not yet requiring dialysis, had a basal value of estimated serum creatinine values ranging from >2mg to 4mg/dl or creatinine clearance of 15 to 30mls/min/1.73m$^2$, presented no other systemic disease affecting any other major organ system that might alter the natural history of their renal disease and gave their consent to participate in the study. The subjects were strictly and regularly followed up for six months. Those who did not comply with the prescribed diet or attended the clinic regularly were also excluded from the study. None of the subjects had uncontrolled hypertension. Patients with clear evidence of protein – calorie malnutrition were also excluded from the study. Thirty two (32) patients met the criteria and nine (9) patients were excluded from the study because they did not satisfy the inclusion criteria.

At baseline, the subjects were randomly allocated into four groups I, II, III, and IV with each group having both males and females. Simple randomization was generated by means of the use of numbered opaque sealed envelopes opened in sequence by the researcher. Groups I, II, III and IV were assigned to isocaloric and low-protein diets A, B, C and D respectively.

### The Diets

Each of the subject in the four groups had individual dietary counseling and was placed on diets A, B, C and D, each supplying 0.55g protein, 6-7mg phosphorus and 35 – 45 Kcal (140-168KJ)/Kg Bw/day, for a period of six months. Dietary sodium and potassium were regulated (20-40m Eq and 45m Eq/day respectively) according to the presence or absence of hypertension, oedema and serum levels of sodium. The protein in the diets was provided from cooked beef (diet A), equal quantities of Protein from eggwhite and smoked catfish (diet B), smoked catfish (diet C) and equal quantities of protein from crooked beef, egg white, smoked catfish and hulled steamed cowpea pudding (diet D). The diet differed exclusively only in their protein sources. The amount of protein (0.55g/kg/day) in each diet was chosen on the basis of the minimum protein requirement (0.55kg/day) for general population as recommended by the World Health Organization (1996). All the dietary prescriptions were estimated according to the patients dry body weight (DBW) derived from the body mass (BMI) index equation (weight (kg)/height (m) $^2$, and obtained by multiplying the squared value of the height (in meters) by a reference BMI value of 23[10,11]. The diets were basically the same in nutrients and calorie but differed exclusively only in their protein sources. Multivitamins and 200mg iron tablets and antihypertensive drugs were also prescribed by the nephrologists as appropriate. The subjects were seen every 6 weeks by the dietitian who, at the first visit, carried out a detailed dietary interview and, at each subsequent visit obtained a written dietary diary, a 24-hour dietary recall and anthropometric assessment of height and weight. The initial and final weight and BMI were assessed and the biochemical parameters such as serum creatinine, blood urea, electrolytes, serum albumin, total protein and packed cell volume were obtained from the patient's hospital records. Each subject was given a diet sheet to serve as a reminder at home to enhance maximum compliance with the prescribed diet. All the subjects were followed up for an average of six months by the nephrologists and dietitians. The extent to which the subjects comply with the prescribed diet was verified carefully at each visit to the dietitian by means of the following procedures:

1. An interview on the previous 24-hour diet with each subject and /or those members of their family who were taking care of their food preparation.
2. Written dietary diaries at 6 week's interval were obtained from each subject.
3. The close check of body weight and blood urea level variation.

Compliance with diet was scored as very good, good, fair or poor. All the patients had high blood pressure and received antihypertensive drugs throughout the study.

The base line data collected by the investigator at the first visit prior to the start of each of the test diet, and at subsequent visits of each subject to the clinic for comparison include:

1. Assessment of the weight, biochemical data of serum urea, creatinine, phosphate, calcium, total protein and albumin, haemoglobin or packed cell volume (PCV) performed as routine examinations.
2. Information symptoms such as headache, nausea, vomiting, diarrhea, fatigue, bone pain (osteodystrophy), joint pain, oedema and blood pressure were assessed by nephrologists and recorded.

**Statistical analysis**

The data were analysed according to the diet groups.

The SPSS package version 12.0 was used to calculate the adjusted means and other statistics such as the analysis of co-variance table. Data were expressed as range, mean ± SD and percentages where necessary. Statistical comparisons of the change in the initial and final values between the groups were performed using the analysis of variance for more than two groups. The effects of the different diets on the biochemical parameters were examined using the analysis of co-variance (ANCOVA) technique. The initial values of these parameters were taken as co-variants while the biochemical parameters themselves serve as the dependent variables.

For biochemical parameters, a pair-wise comparison, using the student t-test was used to identify which of the diets had more statistically significant effect than the others. Multiple regression analysis (logistic regression) was performed to identify those variables that were associated with compliance to the assigned diet.

McNemar's chi-square test for categorical paired data was used to assess the significance of improvement in different symptoms following diet therapy. The four possible scenarios were noted as follows: either the subject had the symptoms before and after the diet; had no symptom before the diet and after the diet; did not have the symptoms before but had it after the diet; did have the symptom before but not after the diet. The data for each symptom was expressed in four folds contingency table to calculate the chi-square test.

## RESULTS

The mean age of the subjects was 43.9 17.3 years. Chronic glomerulo-nephritis, nephrosclerosis and chronic pyelonephritis were the main causes of renal failure in the subjects**.**

**Table 1:**
The Blood Pressure, Blood Urea and Serum Creatinine of the Subjects

| | A (n = 8) | B (n = 8) | C (n = 8) | D (n = 8) |
|---|---|---|---|---|
| **SUBJECTS** | | | | |
| **Systolic Blood Pressure (mmHg)** | | | | |
| Initial | 168.11±4.69 | 167.78±4.93 | 167.50±5.07 | 167.01±6.67 |
| Final | 137.50±5.07 | 135.00± 3.61 | 136.38±4.96 | 139.66±5.35 |
| Mean difference | -30.61± 2.18 | -32.78± 2.64 | -31.22±1.25 | -27.35±5.77 |
| **Diastolic Blood Pressure (mmHg)** | | | | |
| Initial | 106.52±3.67 | 106.67±3.07 | 105.00±4.35 | 103.33±3.00 |
| Final | 85.50±4.63 | 78.33± 5.00 | 83.75±5.18 | 84.27±5.34 |
| Mean difference | -21.02± 3.27 | -28.34± 2.89 | -21.25±2.26 | -19.06±3.08 |
| **Blood Urea (g/dl)** | | | | |
| Initial | 83.22±19.25 | 84.67±20.81 | 83.76±20.37 | 79.18±19.82 |
| Final | 43.00±11.46 | 39.00± 9.63 | 42.02±10.25 | 46.71±12.47 |
| Mean difference | -35.22± 3.77 | -45.67± 6.22 | -41.74±2.021 | -32.47±5.90 |
| **Serum Creatinine (m/dl)** | | | | |
| Initial | 3.56±0.62 | 3.36±0.51 | 3.70±0.57 | 3.41±0.66 |
| Final | 2.89±0.79 | 2.51± 0.99 | 2.91±0.85 | 3.06±0.84 |
| Mean difference | -0.67± 0.17 | -0.85± 0.20 | -0.79±0.18 | -0.35±0.18 |

**Values are means ± SD**

A = Cooked beef, B = Egg white + Smoked cat fish , C = Smoked cat fish

D = Cooked Beef + Egg White+ Smoked cat fish + Steamed Cowpea pudding *(moin moin)*

**Table 2:**
The Nutritional Indices of the subjects

| SUBJECTS | Types of Diets | | | |
|---|---|---|---|---|
| | A (n = 8) | B (n = 8) | C (n = 8) | D (n = 8) |
| **(c) Body Weight (kg)** | | | | |
| Initial | 54.81±4.61 | 54.78±4.52 | 54.83±4.60 | 54.87±4.52 |
| Final | 55.64±3.54 | 56.69±4.37 | 56.01±3.85 | 55.19±3.60 |
| Mean difference | 0.83±0.23 | 1.91±0.57 | 1.18±0.35 | 0.32±0.17 |
| **(e) Body Mass Index** | | | | |
| Initial | 20.30±0.31 | 20.29±0.27 | 20.31±0.31 | 20.32±0.51 |
| Final | 20.61±0.12 | 21.00±0.11 | 20.74±0.16 | 20.44±0.32 |
| Mean difference | 0.31±0.02 | 0.71±0.07 | 0.43±0.03 | 02±0.09 |
| **Serum Albumin** | | | | |
| Initial | 4.23±0.33 | 4.26±0.38 | 4.36±0.32 | 4.02±0.58 |
| Final | 4.34±0.22 | 4.57± 0.35 | 4.49±0.57 | 4.07±0.27 |
| Mean difference | 0.11± 0.05 | 0.31± 0.10 | 0.13±0.20 | 0.05±0.22 |
| **Total Protein (g/dl)** | | | | |
| Initial | 7.12±1.39 | 7.36±1.14 | 7.58±1.08 | 7.34±1.05 |
| Final | 7.38±1.28 | 7.70± 0.99 | 7.88±1.02 | 7.38±0.91 |
| Mean difference | 0.26± 0.05 | 0.26± 0.11 | 0.30±0.25 | -0.04±0.12 |
| **PCV** | | | | |
| Initial | 29.78±0.44 | 29.57±1.09 | 29.56±0.88 | 29.72±1.45 |
| Final | 30.87±1.00 | 30.80± 1.10 | 30.60±0.00 | 30.61±1.79 |
| Mean difference | 1.09± 3.27 | 1.33± 0.37 | 1.04±0.29 | 0.89±2.78 |

A = Cooked beef, B = Egg White + Smoked cat fish, C = Smoked cat fish
D = Cooked Beef + Egg White + Smoked Cat Fish + Dehulled steamed cowpea pudding (*moin moin)*

**Clinical Parameters of the Subjects**

The summary of the change in systolic and diastolic blood pressure, blood urea and serum creatinine levels of the subjects are shown in table 1. At the end of the six months diet therapy A significant decrease in the initial systolic and diastolic blood pressures was observed in all the subjects regardless of the types of diets ($P<0.05$). The effects of the different diets on the systolic blood pressure of the subjects was not significantly different ($P>0.05$). However diastolic blood pressure of the group of subjects prescribed the B diet was significantly lower than the other groups prescribed the other diets ($P<0.05$) .Also up to 50% decrease in blood urea and a slight decrease in serum creatinine levels were observed in all the subjects. The decrease in the initial blood urea of the subjects who were placed on the different types of diets was significant ($P<0.05$). Also, the blood urea of the group prescribed the B followed by the C diet was significantly lower than the blood urea of the other group of subjects who were placed on the other diets ($P<0.05$). The serum creatinine levels of the subjects who were placed on the B and the C diets was slightly less than observed in the groups of subjects who were placed on the other diets.The effects of the different diets in reducing the serum creatinine level of the subjects was not significant. ($P>0.05$)

**The Nutritional Indices of the Subjects**

At baseline no significant difference was observed in the weight, BMI, serum Albumin, total protein and PCV of the subjects in the different groups ($P>0.05$), (Table 2). At the end of the study the weight, BMI, serum albumin, total protein and Packed Cell Volume (PCV) of the subjects improved with each diet. However, the improvement effects of the diets on these parameters was significant ($P<0.05$). only the diet B improved the weight, BMI, serum albumin and the PVC of the subjects more than the other diets, while the D diet had the least effect in improving these nutritional indices in the subjects.

**Serum Electrolytes of the Subjects**

The variation in the initial and final value of the serum electrolytes of the subjects is presented in table 3. All the low-protein diets prescribed regardless of their sources reduced serum electrolytes of all the subjects. But the reduction of the serum electrolyte by the different diets on the subjects was only significant on their sodium level ($P>0.05$).

**Improvement in Symptoms Following the Diets of the Subjects**

The percentage of improvement in the symptoms following the low-protein dietary trial of the subjects is summarized in table 4.

At the initial stage of the study, all the subjects complained of headache, general fatigue or tiredness, bone or joint pain, anorexia, occasional nausea, vomiting, diarrhea and presence of oedema. Their clinical report also showed that all the subjects were pale and had certain degrees of proteinuria. At the end of the study a higher percentage (87.5 to 100%) of the subjects that were placed on the B diet experienced significant improvement from these symptoms when compared with the subjects on the other diets.($P<0.05$) The effect of the B (egg white + fish) diet on the improvement from all these symptoms, was also significant ($\chi^2 > 3.84$). The percentage (75.0 to 100%) of the subjects with symptoms improvement, among those who were placed on the diet C (fish diet) was also high. A Lower percentage (62.5–100%) of subjects who consumed beef diet had improvement in their symptoms compared with those who were placed on the combination of egg white and fish or the fish diet. The effect of the beef diet alone was also not significant in improving most of the symptoms of the subjects in that group. A much lower percentage (50 to 75%) of the subjects who were placed on the combination of egg white, fish, beef plus cowpea diet had an improvement in their symptoms. ($\chi^2 > 3.84$). With respect to improvement of symptoms commonly experienced by patients with CRF, there was improvement in symptoms following each of the diet but the effect was significantly high in the patients prescribed the combination of egg white plus fish, and the group placed on the fish diets, when compared with the other diets.

**Table 3:**
Changes in the Serum Electrolytes of the Subjects

| ***Types of Diets*** | | | | |
|---|---|---|---|---|
| | **A (n = 8)** | **B (n = 8)** | **C (n = 8)** | **D (n = 8)** |
| **SUBJECTS** | | | | |
| **Phosphate (mg/dl)** | | | | |
| Initial | 3.70±0.56 | 3.64±0.29 | 3.47±0.19 | 3.43±0.29 |
| Final | 3.43±0.18 | 3.24± 0.21 | 3.19±0.15 | 3.30±0.29 |
| Mean difference | -0.27± 0.06 | -0.40± 0.07 | -0.28±0.13 | -0.13±0.03 |
| **Calcium (g/dl)** | | | | |
| Initial | 9.40±0.90 | 9.08±0.85 | 9.32±0.82 | 9.21±0.67 |
| Final | 8.88±0.72 | 8.50± 1.14 | 8.74±0.71 | 8.73±0.40 |
| Mean difference | -0.52± 0.17 | -0.58± 0.2.3 | -0.58±0.26 | -0.50±0.03 |
| **Sodium (mg/dl)** | | | | |
| Initial | 134.56±3.50 | 138.33±2.24 | 137.22±3.03 | 136.70±9.60 |
| Final | 130.99±3.74 | 134.44± 2.83 | 133.65±3.00 | 133.49±10.31 |
| Mean difference | -3.57± 1.39 | -3.89± 0.97 | -3.57±0.58 | -3.21±0.67 |
| **Potassium (m/eq)** | | | | |
| Initial | 4.43±0.40 | 4.53±0.60 | 4.48±0.67 | 4.41±0.53 |
| Final | 3.95±0.31 | 3.86± 0.49 | 3.93±0.34 | 3.96±0.35 |
| Mean difference | -0.48± 0.15 | -0.67± 0.19 | -0.55±0.37 | -0.45±0.12 |
| **Chloride (meq)** | | | | |
| Initial | 105.89±6.25 | 102.67±5.39 | 102.33±2.87 | 102.60±8.24 |
| Final | 102.57±1.07 | 101.38± 3.62 | 101.02±6.12 | 101.41±2.80 |
| Mean difference | -2.43± 1.46 | -1.29± 1.81 | -1.31±2.80 | -1.19±0.58 |
| **Bicarbonate (mg/eq)** | | | | |
| Initial | 4.43±0.40 | 4.53±0.60 | 4.48±0.67 | 4.41±0.53 |
| Final | 3.95±0.31 | 3.86± 0.49 | 3.93±0.34 | 3.96±0.35 |
| Mean difference | -0.48± 0.15 | -0.67± 0.19 | -0.55±0.37 | -0.45±0.12 |

Values are mean ± SDA = Cooked beef, B = Egg White + Smoked cat fish,
C =Smoked cat fish D = Cooked Beef + Egg White + Smoked Cat Fish + Dehulled steamed cowpea pudding *( moin moin)*

**Table 4:**
Improvement in Symptoms Percentage of Out Patient Subjects

| Symptoms | Effects | *Diet* | | | |
|---|---|---|---|---|---|
| | | **A** N (%) | **B** N (%) | **C** N (%) | **D** N (%) |
| Headache | Improvement | 5(62.5) | 7(87.5) | 5(62.5) | 4(50.0) |
| | ($\chi^2$ – value) | 3.1 | 4.5* | 4.0* | 1.5 |
| Pallor | Improvement | 8(100.0) | 8(100.0) | 8(100.0) | 6(75.0) |
| | $\chi^2$ – value | 4.0* | 4.0* | 4.0* | 4.0* |
| General Fatigue/Tiredness | Improvement | 5(62.5) | 7(87.5) | 6(75.0) | 3(62.5) |
| | $\chi^2$ – value | 3.5 | 4.0* | 3.9* | 1.6 |
| Bone/Joint Pain | Improvement | 6(75.0) | 7(87.5) | 6(75.0) | 4(50.0) |
| | $\chi^2$ – value | 3.8 | 4.2* | 4.0* | 1.5 |
| Anorexia | Improvement | 6(75.0) | 8 (100.0) | 8(100.0) | 4(50.0) |
| | $\chi^2$ – value | 4.0* | 4.2* | 4.2* | 1.0 |
| Nausea | Improvement | 5(62.5) | 8(100.0) | 7(87.5) | 4(50.0) |
| | $\chi^2$ – value | 3.2 | 4.0* | 4.0* | 2.0 |
| Vomiting | Improvement | 5(62.5) | 8 (100.0) | 8(100.0) | 6(75.0) |
| | $\chi^2$ – value | 3.0 | 5.0* | 4.5* | 4.0* |
| Diarrhea | Improvement | 6(75.0) | 8(100.0) | 8(100.0) | 6(75.0) |
| | $\chi^2$ – value | 4.0* | 4.4* | 4.0* | 4.0* |
| Oedema | Improvement | 5(62.5) | 8(100.0) | 6(75.0) | 5(62.5) |
| | $\chi^2$ – value | 3.4 | 4.5* | 4.0* | 3.4 |
| Proteinuria | Improvement | 5(62.5) | 8(100.0) | 6(75.0) | 4(50.0) |
| | $\chi^2$ – value | 3.0 | 4.2* | 3.4 | 1.7 |

*** Significant improvement = $\chi^2 > 3.84$**
A = Cooked beef, B = Egg white + Smoked cat fish, C = Smoked cat fish
D = Cooked Beef + Egg white+ Smoked Cat Fish + Dehulled steamed Cowpea pudding *( moin moin*)

## DISCUSSION

Protein-restricted diets have been recommended for decades in the management of CRF in order to reduce the accumulation of waste products[6]. This is because the associated problems (accumulation of ureaemic toxins, arising mainly from protein metabolism, accumulation of phosphates and acids that cause abnormal bone and muscle metabolism, anemia ets.) can be ameliorated by careful planning of a low protein diet[4,5]. However, in the last decade some researchers have questioned the benefits and have cast doubt on the wisdom of administering low- protein diets for CRF patients[12]. Secondly the hypothesis that protein restriction slows the progression of CRF (another rationale for its use) has not been equivocally confirmed[6]. However, some recent publications confirm that low- protein diet remains the mainstay of the management of CRF patients when it is carefully planned [4,13,]. The result of this 6 months clinical dietary study indicate that metabolic consequences and the symptoms of uremia in CRF patients can be ameliorated by skillfully planning and administering a low- protein diet.

Elevated blood pressure, blood urea, serum creatinine and proteinuria are considered major factors in the progression of CRF[14-16]. This clinical study has shown that all the low-protein diets tested caused reduction in the systolic and the diastolic blood pressure of the CRF patients in addition to the antihypertensive drugs administered to the patients. However, the combination of the eggwhite and fish diet was the most effective. ($P < 0.05$). Hypertension in CKD is almost certainly related to impaired ability of the kidney to regulate salt balance and this problem was ameliorated with low-protein-low sodium diet administered to the patients it has been shown that low protein diet prevents the development of cardiovascular disease and progressive glomerular sclerosis in patients with CRF. In this clinical dietary trial, the primary outcome was the modification of blood urea, although other metabolic markers were

investigated. All the prescribed low-protein diets contributed up to 40 to 50% decrease in blood urea and a slight decrease in serum creatinine. The production of urea and other nitrogenous waste products depends on protein intake[17]. This suggests that low-protein diets from all animal food protein sources and their mixtures can be prescribed and would effectively retard the renal functional deterioration without the risk of malnutrition in subjects with CRF. However, combination of egg white plus fish diet and fish diet alone were found to be more efficacious than the other diets.

Also, all the patients treated with low-protein diet regardless of the source had small but insignificant increase in serum albumin, packed cell volume, and serum protein concentrations. Hypoalbuminemia was not observed in any of the groups of patients .It is well known that a rough correlation exists between the amount of phosphorus and protein contained in natural food sources thus a low-protein diet is synonymous with a low-phosphorus diet[18]. The pathogenesis of tissue injury and hyperphosphatemia common in CRF is known to result in an inflammatory and fibrotic response in a variety of tissues in CRF[19-20]. Hence, the rationale behind low-phosphorus diet advocated in CRF. In this clinical dietary trial both serum phosphateand calcium level were lower in all the subjects who were prescribed the different low-protein diets. This also suggests that a low-protein diet will supply a low phosphorus diet which will help in preventing hyperphosphatemia and inflammatory and fibrotic responses in the tissues. Furthermore all the low-protein, low sodium and potassium diets, regardless of the source of food protein used, reduced most of the serum electrolytes of the subjects. There was no significant difference in the rate of reduction of the electrolytes of the groups by the different diets ($P>0.05$).

It is well known that CRF is associated with complex symptoms which are more severe in advanced renal insufficiency (uremia). However the prominence of these symptoms may vary in patients even among those with the same disease[21-22] Symptoms are correlated with the level of serum nitrogen[23]. This indicates that protein restriction which has been found to reduce serum nitrogen (urea and creatine) would reduce symptoms at any given level of renal function in CRF patients. The subjects that participated in the outpatient clinical dietary trial were mostly in their early or moderate chronic renal failure as reflected in their serum creatinine level (mean ($3.2\pm$ 0.13mg/dl)[24]. All the low-protein diets, in this study, provided relief from the symptoms manifested by the patients. However, symptoms improvements following the different diets were more significant in the subjects that were prescribed the combination of egg white plus fish and also the fish- protein diet, compared with the other diets. Lower percentage of subjects who were prescribed beef alone or mixture of egg white, beef, fish and cowpea diets had the least relief of their symptoms. This reduction in symptoms and signs of uremia has revealed an important benefit of an appropriate nutritional regimen in CRF in addition to reduction in future complications by lowering the accumulation of waste products and perhaps slowing the rate of decline of GFR. This indicate that a low-protein diet will ameliorate uremic symptoms.

Thus all evidences from this clinical dietary trials indicate that restriction of protein intake is an acceptable and effective regimen for ameliorating uremic toxicity, especially when it is started early in the course of chronic renal failure. Among the different food protein sources tested, combination of eggwhite plus fish diet and fish diet alone appeared to show better effects on the biochemical parameters, symptoms and the general well-being of the patients in comparison with beef or mixture of egg white, beef, fish and cowpea diet.

The quantity and quality, of protein source prescribed are likely to produce different renal responses in patients with CRF. A previous study had shown that the type of protein sources and their mixtures from animal and plant sources produced variable effects on renal function and structures in rats with substantial renal insufficiency[2].

In conclusion, the findings from this clinical dietary trial has demonstrated the beneficial effects of low-protein diet. Furthermore, it has been able to categorize the effectiveness of selected common food protein sources and their mixtures as consumed in Nigerian diets. Low-protein diet from combination of egg white and cat fish diet, followed by smoked catfish alone were more efficacious in ameliorating uremic toxicity and improving the common symptoms experience by patients with CRF than beef or combination of beef, fish and red cowpea diet.

**Recommendations**

It is recommended that: Patients with CRF should receive a well –designed low- protein diet before being started on dialysis; Low-protein from fish in combination with egg white should be more

frequent in the diet of patients with chronic renal failure. Low-protein diet from cowpeas alone or its combination with other animal protein sources should be avoided as such a diet did not perform up to expectation. Safe local seasonings should be developed to enhance the taste and food intake of patients with chronic renal failure. Skilled dietitians should be encouraged to formulate attractive diets that are restricted in protein content and also counsel patients

with chronic renal failure properly on the diets. Dietitians should work closely with the nephrologist in following the patients up to achieve more success in their diet therapy.

## REFERENCES

**Agodoa L, Briggs G, Mitch W, Mc Cleland W, kopple J. (1999):** Nutrition in ESRD patents rationale and plan for initiative. Journal of Renal Nutrition; (3): 116-8.

**Akinsola W, Smith F, Alimi T, Odewale F, Ladipo GOA. (1991):** Low protein/high calorie dietary regimen in the dietary management of chronic renal failure: A preliminary study of Nigerian patients. Afr. Med. Sci; 20: 53-95.

**Arije A, Thomas J, Kadiri S (2002)** Rapidly progressive glamerulonephrities in adult Nigerians A report of 4 cases. Afr. J. Med. Sci.2002 31:75-77.

**Barsotii G, Morelli E, Cupisti A, Meola M, Dani L, Giovanetti S, (1996):** A low nitrogen, Low-phosphous vegan diet for patietnts with chronic nenal failure. Nephron; 74 (2): 390-4.

**Barsttis G, Giannoni A, Morelli T, Lazzeri M, Viamis I, Baldi R, Giovannetti (1984):** The decline of renal function slowed by very low phosphorus intake in chronic renal failure patients following a low nitrogen diet. Clin Nephorn; 21:54-59.

**Bergstrom J, Alvestran A, Butch H, Gutierrez A (1988):** What is the role of controlling protein intake in outpatients in the progression of renal disease? Blood Purif,; 6:336-343.

**Bergstrom J (1994);** Discovery and recovery of low protein diet Clin Nephrol; 21:29-34,

**Ciaciaruso B, Pota A, Pisani A, Torraca S Lombardi P, et al. (2007):** Metabolic effects of two low-protein diets in chronic kindney disease stage 4-5-A random controlled trial. Nephron. Dial transplant:1-9

**De Zeeuw D, Remuzzi G, Parving HH et al (2004)**: Proteinuna, a therapeutic target for cardiovascular protection in type 2 diabetic patients with nephropathy. Circulation,; 110:921-927.

**El- Nahas AM, Coles G.A (1986):** Dietary Treatment of Chronic renal failure. Ten unanswered questions. Lancet; 1:597-600

**Fadupin G.T, Keshinro OO, Arije A, Taiwo VO (2008):**. Effects of controlled intake of selected protein foods on nephractonited rats. African J. of Biomedical Research; 11:46-54.

**Fouque M, Lavilla M, Broissel J. (1992):** Controlled protein diets in chnonic renal insufficiency. British Med. Journal; 204:216-20.

**Giovanetti S. (1985):** Dietary treatment of chronic Renal Failure: Why is it not used more frequently? Nephron; 40: 1-12.

**Guyton AC (1991):** Blood pressure control – special role of the kidneys and body fluid. Science:252: 1813-1816,

**Klair S, Levey AS, Beck GJ et al (1994):** The effects of dietary protein restriction and blood pressure control on the progression of chronic renal disease. N. Eng J. Med; 330: 877-884.

**Kopple J.D, Shinabaerger JH, Coburn JW, Sorensen MK, Rubini MF (1969):.** Evaluating modified protein Diets for Uremia. J. Am Diet. Assoc; 481-485.

Mackenzie W, Willam E, Mitch WE, Bradley J, Maroni BJ and Kopple JD. Should protein intake be restricted in predialysis patients?

**Mackenzie W.E, Brenner BM. (1998):** Current Strategies for retarding Progression of renal disease. Am. J. Kidney Dis.; 31:161-70.

**Maroni BJ Steiman TL, Mitch WE (1985):** A method for estimating nitrogen intake of patients with chronic renal failure. Kidney Int.; 27:58-65.

**Maroni BJ, Mitch WE (1997):** Role of nutrition in prevention of the progression of renal disease. Annu. Rev Nutr. 17:435- 455.

**Maschio G. (1983):** Effect of dietary protein and phosphonus restriction on the progression of early renal failure. Kidney Int. 22:371-6.

**Mitch W.E: (2005):** Benficial responses to Modified diets in treating patients with chronic Kidney disease. Kindney Int,; 67 (Suppl. 94) 5133-S1335.

**National Institute of Health (1998):,** as published in Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998

**Percheron C, Colette C, Astre C, Monnier L (1995):.** Effect of moderate Chnages in protein Intake on urnary albumin excretion in type 1 diabetic patients. Nutrition: 11:345-349.

**World Health Organization (1996):** Expert Committee on physical status. The use and Interpretation of Anthropometry, physical status: Report of a WHO Expert Committee. WHO Technical Report Series 854. Geneva: WHO; 1996.