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Research Article

Fish and Egg white Diet In Non-Dialyzing In-Patients with Moderate Chronic Renal Failure

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ABSTRACT: Dietary management of chronic renal failure (CRF) is effective in delaying the progression to end stage renal failure and the need for dialysis. However, a full agreement on the type and optimal protein intake for patients with CRF has not been reached. This study compared the efficacy of low-protein diets obtained from a mixture of fish and egg white diet (experimental diet=diet A) and a mixture of smoked cat fish, cowpea pudding (*moinmoin*) and egg white diet (control diet=diet B) on sixteen in patients (11 males and 5 females) aged 23 to 56 years with moderately severe CRF. The patients were randomly distributed into experimental and control groups of eight patients each. Each group was fed on iso caloric and 0.55g protein/ kgBW /day diets for 28 days. A semi - structured - interviewer- administered questionnaire was used to obtain information on the socio-economic characteristics and the clinical history of the subjects. The initial and final energy intake, anthropometric and biochemical indices of the subjects were compared using student t- test. The mean age of the patients was 47(11.3) years. Hypertensive sclerosis was the major cause of their CRF. The mean difference of the subjects' energy intake, body weight and packed cell volume (194.19 ± 107.10 kcal/day, 2.06 ± 5.2 kg, and $1.50 \pm 0.70\%$) for patients on diet A were significantly higher than the corresponding values of the subjects on diet B (101.42 ± 36.8 kcal/day, 0.44 ± 0.53 kg, $0.91 \pm 0.04\%$) respectively ($p < 0.05$). The blood urea and serum creatinine (-47.35 ± 5.77 mg/dl and -0.81 ± 0.84 mg/dl) decreased significantly in the patients placed on diet A when compared with (-27.24 ± 5.72 mg/dl and -0.41 ± 0.13 mg/dl) in the patients placed on diet B ($p < 0.05$). The combination of smoked catfish and egg white diet was found to be more efficacious while the mixture of smoked catfish, cowpea pudding (*moinmoin*) and egg white diet, performed below expectation in the patients with moderately severe CRF. It is recommended that cowpea protein should be the major protein sources in the diet of patients with CRF.

Keywords: *Chronic renal failure, mixture of fish and egg white diet*

INTRODUCTION

Chronic renal failure is accompanied in most cases by signs and symptoms of uraemia and ultimately results in end stage renal failure (ESRF), and a need for initiation of renal replacement therapy (K/DOQ1, 2002).

Dietary restriction of proteins and electrolyte has represented a cornerstone in the treatment of chronic kidney disease (CKD) or, at least, of its metabolic consequences, due to its efficacy in reducing signs and symptoms of uraemia, lessening the accumulation of waste metabolic products and protecting against hypertension and proteinuria (Mitch, 2005). According to Fouque (2006), a strict low protein diet for patients with mild to moderately severe CRF can delay dialysis treatment. Patients with end stage renal disease (ESRD) can be safely managed with diets for substantial interval after the patients have reached or passed the usual point for beginning dialysis.

In the Johns Hopkins study (1999), on patients with severe chronic renal failure, who were placed on a very low protein diet 0.3g protein/KgBW/day plus essential amino acid (EAA) and/or ketoacid (KA) supplements, the patients were able to postpone dialysis for a median

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of 353 days, with times for beginning dialysis varying from less than one week to four years. Diabetic patients fared as well as non-diabetic patients. Indeed, the guidelines of different scientific societies disagree on what type, and amount of protein that is able to satisfy the three critical requirements which are: good metabolic control of renal failure, minimum risk of malnutrition and reasonable patient compliance (Cianciaruso, 2008)

The Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (K/DOQI 2000), have recommended that patients with CRF with (GFR <25mL/min) should receive a diet providing 0.55-0.75g protein/kg desirable body weight (BW) per day. Toigo *et al.*, (2000) recommended a conventional Low-protein diet (LP-diet) of 0.5-0.6g protein/kg BW/day as the minimum protein requirement for patients with CRF. Fouque *et al.*, (2006) review of 40 previous studies on the dietary management of CRF suggested that the protein content of the diet should be closer to 0.6g protein/kg/day. Cianciaruso (2008) also suggested that in patients with moderately severe CRF a protein intake of 0.55g/kg/day guarantees a better metabolic control and reduced need for drugs without a substantial risk of malnutrition.

The cost of dialysis is exorbitant in Nigeria and only very few patients can afford it. (Arije, Kadiri and Akinkugbe, 2000). It becomes imperative for the development of efficacious dietary management for patients with CRF, since diets have been shown to retard the progression of chronic renal failure (Fouque, 2006). This study aimed at evaluating the effects of two protein foods consisting of mixture of smoked cat fish and egg white protein, and a mixture of cat fish, cowpea pudding (*moinmoin*) and whole egg diet on

non-dialyzed inpatients with moderate chronic renal failure, at the University College Hospital, Ibadan, Oyo State Nigeria.

MATERIALS AND METHODS

Consent was sought from the consultant nephrologists of the UCH and Ethical consideration was obtained from the U.I/UCH Institutional Ethical Review Board to conduct this study. The study involved sixteen male and female patients with moderately severe chronic renal failure. (Creatinine 3-5mg/dl, glomerular filtration rate < 30ml/1.73m²), admitted to the renal ward of the University College Hospital (UCH), Ibadan, Oyo State Nigeria, who had not commenced maintenance dialysis and had given their consent to participate in the study.

Participants who refused to give their consent to the study and patients with other chronic wasting illness such as malignancy, congestive cardiac failure, uncontrolled hypertension and patients with clear evidence of protein - calorie malnutrition were automatically excluded from the study.

Alternate patients that satisfied the criteria for the study were assigned either to Experimental and Control groups and were placed on diets A and B respectively. for 28 days

The Diet: Diet A (the experimental diet) consisted of an equal protein quantity of smoked cat fish and egg white, while diet B (control diet) consisted of equal protein quantity of smoked cat fish, and hulled steamed cowpea pudding (*moinmoin*) and whole egg diet. The same quantity of protein from the different protein sources were rotated with the different meals (breakfast, lunch and dinner).

Table 1
Menu for Patients with Chronic Renal Failure

Days	Breakfast	Lunch	Dinner
Sunday	Weighed Bread + Pap + sugar + plain stew	Eba + okro + plain stew	Yam Pottage + plain stew
Monday	Pap + sugar + plain stew	Amala + Ewedu + plain stew	Weighed boiled rice + boiled yam + plain stew
Tuesday	Weighed Bread + pap, + sugar + plain stew	Eba + okro + plain stew	Yam pottage + stew
Wednesday	Boiled yam + plain stew	Foofoo + Okro + plain stew	Weighed boiled rice + boiled yam + plain stew
Thursday	Plain stew + weighed Bread+ pap + sugar	Amala + Ewedu + plain stew	Agidi + little vegetable (water leaf) + plain stew
Friday	Boiled yam + Plain stew	Foofoo + okro + plain stew	Weighed rice + fried plantain + plain stew
Saturday	Weighed bread + pap+ plain stew	Eba + Ewedu + plain stew	Agidi + vegetable (water leaf) + plain stew

Diet A- smoked cat fish two times/day and an egg white once/day

Diet B – smoked catfish twice/day and egg white or cowpea pudding alternated as breakfast

Each diet supplied approximately 35g protein/day (0.55g protein/ Kg BW/ day), 6-7mg phosphorus, 35kcal/kg/BW/day, 20-40meq sodium and 45 meq potassium/day. Yam, cassava, *ogi*, *agidi* and vegetable oil supplied the major calorie (Table 1). The diets supplied the same amounts of nutrients and calorie but only differed in their protein sources. After the subjects were allocated to each diet, they were monitored for a period of 28 days. A weekly menu was employed. The patients were served the same type of food according to the menu in Table 1 which differed only in their protein sources. The protein foods were rotated among the different meals (breakfast, lunch and dinner). All the patients had dietary counseling given by an experienced dietitian and were encouraged to keep strictly only to the assigned diets that were served to them in the hospital. No other food was allowed except for 2 dessert spoons of 'Ribena' drink in 200mls of water to be taken in between each meal.

The food intake of the patients was determined by direct weighing method for the last two weeks of the experiment. Food left over, plate waste, discarded foods and snacks were weighed during the study period. Multivitamin, folic acid, iron tablet and hypertensive drugs were prescribed by the nephrologists for all the patients as required.

A bathroom scale with accuracy of 0.5kg was used to measure the body weight of each patient. Heights were measured using a stadiometer, calibrated in centimeter and a non-stretchable steel measuring tape was used to determine the patients mid- upper arm circumference. Efficacy of the diet was assessed by comparing the energy intake, anthropometric indices, serum urea, creatinine, sodium, potassium, bicarbonate, chloride and PCV of the patients.

The data collected were analysed and expressed as range, means, with their standard deviations and percentages. The mean difference of the initial and the final values of the food intake, anthropometric and biochemical indices of the patients according to the different diets was compared using the student t- test.

RESULTS

Table 2 presents the general information on the sixteen (16) patients, 11(68.75%) males and 5(31.25%) females that participated in the study. The age of the patients ranged from 23 to 56 years. The clinical history of the patients are presented in table 2. Nine (56.25%) of the patients had hypertensive sclerosis, 5(31.25%) had chronic glomerulonephritis (CGN) and 2(12.50%) had polycystic kidney disease. The symptoms experienced by the patients included, tiredness, weakness of the

body, dizziness, anorexia, weight loss, nausea and vomiting. Only 3(18.75%) of the subjects were on dietary restriction before they were admitted.

Table 2:
The General Information of the Subjects

	Experimental n (%)	Control n (%)	Total n (%)
Sex			
Male	6(75.0)		
Female			
Clinical Diagnosis			
Chronic glomerulonephritis (CGN)	2(25.0)	3(37.5)	5(31.25)
Hypertensive Sclerosis	5(62.5)	4(50.0)	9(56.25)
Polycystic Kidney Disease	1(12.5)	1(12.5)	2(12.50)
Symptoms			
Anorexia	4(50.0)	3(37.5)	7(43.75)
Nausea Only	2(25.0)	1(12.5)	3(18.75)
Nausea And Vomiting	2(25.0)	2(25.0)	4(25.0)
Diarrhea	1(12.5)	2(25.0)	3(18.75)
Weakness of the Body	5(62.5)	6(75.0)	11(68.75)
Noticed Weight Loss	3(37.5)	3(37.5)	6(37.5)
Dizziness	6(75.0)	5(62.5)	11(68.75)
Tiredness on mild exertion	6(75.0)	6(75.0)	12(75.0)
Palpitation	1(12.5)	2(25.0)	3(18.75)
Loss of sex drive	2(25.0)	1(12.5)	3(18.75)
Presence of oedema	5(62.5)	6(75.0)	11(68.75)
On diet restriction before admission			
Yes	2(25.0)	1(12.5)	3(18.75)
No	6(75.0)	7(87.5)	13(81.25)
Enjoyed the food served			
Yes	6(75.0)	3(37.5)	9(56.25)
No	2(25.0)	5(62.5)	7(43.75)
If No, Why?			
The food is not palatable	1(12.5)	3(37.5)	4(25.0)
Food is served cold	1(12.5)	2(50.0)	3(18.25)
Patient's feeling about the diet			
I can comply for life	6(75.0)	3(37.5)	9(56.25)
I feel sad that I have to be on such diet	3(37.5)	5(62.5)	8(50.0)

TABLE 3:
Nutritional Status of the Patients

	Experimental (Diet A)	Control (Diet B) p-value
Energy Intake(Kcal/day)		
Initial	1967.32±147.3	1943.25 ±115.2
Final	2162.22- ±102.70	2044.67±94.8
Mean difference	194.19±107.10	101.42±36.81 p<0.05
Weight(kg)		
Initial	54.82±3.27	54.85±4.21
Final	56.88±3.52	55.29±2.73
Mean difference	2.06±5.2	0.44±0.53 p>0.05
Height(m)		
Initial	1.65±0.08	1.64±0.15
Final	-	-
Mean difference	-	-
BMI(kg/m²)		
Initial	20.14±0.21	20.39±0.43
Final	20.89±0.12	20.56±0.15
Mean difference	0.75±0.04	0.17±0.07 p>0.05
Mid upper-arm circumference (cm)		
Initial	25.04±0.81	25.08±0.32
Final	25.61±0.74	25.27±0.73
Mean difference	0.57±0.36	0.19±0.87 p>0.05
Packed cell volume (PCV%)		
Initial	29.46±0.07	29.77±1.12
Final	30.96±1.09	30.68±1.54
Mean difference	1.50±0.70	0.91±0.04 p>0.05
Serum albumin(mg/dl)		
Initial	3.45±0.27	3.76±0.36
Final	3.76±0.21	3.82±0.13
Mean difference	0.27±0.31	0.06±0.13 p>0.05

Values are mean ±(SD)

Key: Diet A = Egg white + smoked cat fish, Diet B =smoked cat fish + steamed cowpea Pudding + egg white.

Most 6(75.0%) of the patients that were prescribed diet A enjoyed their meals while majority 5(62.5%) of the patients on diet B did not enjoy their meals, because the foods served were not palatable. Nine (56.25%) of the patients felt they could comply for life with the diet while 8(50.0%) felt sad that they had to be on such a diet for life.

The effects of both diets on the energy intake and the anthropometric indices of the patients is represented in Table 3. Significant changes in the initial and the

final energy intake was observed in the patients that were prescribed diets A and B. However, the change in the energy intake of the patients on diet A was significantly greater than the patients that were placed on diet B (p<0.05)

Also, there were slight improvement in the anthropometric indices of all the patients but the improvement was greater in the group of patients diet A. However, the increase in the anthropometric indices were not significantly different between the groups of patients (p>0.05). In the patients that were prescribed diet A, the mean PCV increased by 1.50±0.70% and the serum albumin by 0.27± 0.31mg/dl. These values are greater than the mean PCV increase of 0.91± 0.04% and 0.06±0.13mg/dl which were observed in the patients prescribed the B diet.

Table 4 shows the effects of diets A and B on the biochemical parameters of the patient. Serum creatinine decreased by -0.81± 0.24 mg/dl and blood urea decreased by- 47.35 ± 5.79 mg/dl which were significantly different from the serum creatinine of - 0.41± 0.13mg/dl and blood urea of -27.24± 5.72 mg/dl in the patients on the B diet respectively(P<0.05). Also, there were significant improvement in the plasma sodium, and potassium of the patients which were placed on diets A. Although there were also improvement between the initial and final biochemical parameters of the patients placed on diet B, the changes were more pronounced in the patients that were placed on diet A. These information indicate the benefits of consuming fish and egg white diet in comparison with the consumption of the mixture of smoked cat fish cowpea pudding, and egg white diet.

DISCUSSION

In the past 50 years dietary restriction of protein and some electrolytes such as phosphorus, sodium and potassium has been a cornerstone for the management of chronic renal failure (CRF) because of its efficacy in preventing and correcting the metabolic consequences of CRF (Mitch, 2005). Cianciaruso *et al.*, (2008) confirmed that a diet containing 0.55gp/kgBW/day along with high intake of energy (35kcal/kgBw/day) was associated with lower dietary sodium, phosphate, and metabolic control in patients with moderate CRF (creatinine <5mg %) when compared with their counterparts who were placed on a higher level of dietary protein intake. Fadupin *et al.*,(2008) showed that egg white protein alone was efficacious in improving the nutritional status and metabolic control in albino rats with renal insufficiency.

Table 4:
Blood Pressure, Blood Urea, Creatinine and Electrolyte
Levels of the Patients

	Experimental (Diet A)	Control (Diet B) p-value
BLOOD PRESSURE		
Systolic (mmHg)		
Initial	165.97 \pm 3.74	164.78 \pm 7.37
Final	135.55 \pm 3.21	135.54 \pm 6.04
Mean difference	-30.42 \pm 2.44	-29.24 \pm 6.29 p<0.05
Diastolic (mmHg)		
Initial	105.73 \pm 2.03	104.93 \pm 2.94
Final	88.46 \pm 3.12	90.86 \pm 4.41
Mean difference	-17.27 \pm 2.64	-14.08 \pm 2.87 p<0.05
Urea (mg/dl)		
Initial	86.37 \pm 21.17	81.79 \pm 17.91
Final	39.02 \pm 7.53	54.55 \pm 13.67
Mean difference	-47.35 \pm 5.77	27.24 \pm 5.72 p<0.05
Creatinine (mg/dl)		
Initial	3.65 \pm 0.71	3.57 \pm 0.76
Final	2.84 \pm 0.57	3.16 \pm 0.39
Mean difference	-0.81 \pm 0.24	-0.41 \pm 0.13 p>0.05
Sodium		
Initial	137.10 \pm 7.23	136.72 \pm 3.10
Final	134.08 \pm 9.21	133.97 \pm 2.37
Mean difference	-3.02 \pm 0.54	-2.75 \pm 0.71 p>0.05
Potassium		
Initial	4.25 \pm 0.54	4.27 \pm 0.37
Final	3.64 \pm 0.47	3.75 \pm 0.42
Mean difference	-0.61 \pm 0.20	-0.52 \pm 0.10 p>0.05
Bicarbonate		
Initial	4.55 \pm 0.53	4.43 \pm 0.38
Final	3.81 \pm 0.27	3.96 \pm 0.26
Mean difference	0.74 \pm 0.29	-0.47 \pm 0.17 p>0.05

Values are mean \pm (SD)

Key: Diet A = Eggwhite + smoked catfish, Diet B =smoked
cat fish + steamed cowpea pudding egg.white

Fish protein also showed a better effect on the nutritional status and metabolic control in humans, while egg white alone induced vomiting and was not tolerated as the only protein source in humans (Fadupin, 2009).

As a follow up of the above information, this controlled clinical study was conducted to compare the efficacy of a low-protein diet obtained from combination of egg white plus fish protein diet with another low- protein diet from the mixture of smoked cat fish, cowpea pudding and egg white commonly served to patients with moderate CRF in Nigeria (Akinsola *et al.*, 1991).

In this study which was conducted among Yoruba from South – West Nigeria, the mean age of the patients was 47(11.3) years with a range of 23-56 years. This age range is unlike the situation reported in developed countries where the incidence of CRF is highest between 70 and 90 years (Mc Geown *et al.*, 1990; Fored *et al.*2003). It was noted from this study that a higher percentage of the patients were males. This information is also in agreement with the earlier observation of Alebiosu *et al.*, 2006, among the patients with CRF attending a tertiary hospital in Nigeria which indicated that male were more affected with CRF than females. Males are generally bread winners of the family in developing countries such as Nigeria and their illness could thus affect the economic stability of the patients as well as their family. This information underscores the necessity to take all the necessary efforts in Nigeria to prevent the wastage of economically productive lives as a result of CRF.

Dietary adjustment in subjects with CRF is complex because multiple modifications of protein, phosphorus, sodium and potassium intake are required and these changes in food intake must be maintained for years (Cianciaruso *et al.*, 2008). Dietary adjustment had obvious negative influence on the feelings of patients and this could make the acceptance of the new diet difficult. It was observed through direct daily weighing of the patients foods and the daily food diaries kept by the patients, that although they complained of the low-salt in their food, they complied well with their diet. In all the patients, the blood urea was consistently lower than the initial values, indicating that the patients compliance with their diet was good (El-Nahas and Cole,1986). The two low protein low-salt diets reduced the serum sodium levels of the two groups of patients to the normal range (130-145 mEq/L) and the oedema of all the patients also reduced. However reduction in all these indices was more apparent in the patients who were prescribed the smoked catfish and egg white diet compared with the responses from the other diet.

Some of the most important observation of this study is the nutritional and the metabolic status of the patients prescribed the two low-protein diets which differed only in their protein sources. According to EL Nahas and Cole (1989), the most hazardous of dietary protein restriction is malnutrition. It is therefore very important to avoid muscle wasting in patient on a low protein diet. However clinical experiences worldwide, has already demonstrated the potentials of proper dietary management in CRF, as offering several advantages and benefits without inducing malnutrition (Giovannetti, 1985; Barsotti *et al.*, 1996; Agodoa *et al.*, 1999). It is interesting to note that in this study regardless of the source of the low-protein diets, the energy intake of the patients improved significantly ($p < 0.05$) and the weight, BMI, mid-upper arm circumference, PCV and serum albumin improved in the patients prescribed any of the two low protein diets. However, a better, but not significant improvement was observed in the anthropometric indices, BMI, and the PCV of the patients that were placed on the mixture of the egg white and smoked catfish diet in comparison with the patients placed on the diet consisting of the mixture of catfish, cowpea pudding and egg white diet. Elevated blood pressure, blood urea, serum creatinine and proteinuria are considered major factors for progression of CRF (Rutherford *et al.*, 1977). In line with the observation of Brenner (1983), on the effect of low-protein diets, all the patients on the two low-protein diets, experienced decrease in their high systolic and their diastolic blood pressure, blood urea, and sodium levels than their respective baseline values ($p < 0.05$). These indices decreased faster in the patients prescribed the mixture of egg white and smoked catfish diet than their counterparts that were placed on the other diet. This suggests that low protein diet will effectively retard renal functional deterioration without inducing malnutrition in patients with CRF.

Egg white is known for its high quality protein as it contains all the essential amino acids for muscle building and repair when it is compared with a whole egg, the yolk in the whole egg contains more fat and cholesterol which can accelerate sclerotic changes. Fish contains protein of high biological value and also known to contain Omega 3 fatty acids which prevent formation of sclerotic changes in the body tissues (Tidwell *et al.*, 2007). Fish also add some aroma to food. Cowpea contains protein of a lower biological value which is deficient in sulphur, amino acids, (methionine and cystine). Plant proteins such as cowpea usually yield more urea than animal proteins (Sathe, 2002). This information could probably explain the reasons why the mixture of egg white and fish

protein produced better effects in CRF than a mixture of fish, cowpea pudding and egg white diet when served in the same quantity of protein.

The sample size of the patients in this study is relatively small due to the difficulty involved in having a larger number of patients that satisfied the criteria for the study. That notwithstanding, the findings in this short term supervised clinical trial, suggests that the quality as well as the quantity of protein offered to the patient with CRF must be considered in order to obtain good metabolic control of renal failure and to prevent malnutrition in the patients. Other confounding factors might have interfered with the ameliorating effect of the toxicity and improvement in the nutrition of the patients in this study. However, dietary restrictions appear to have been responsible for the differences in the two groups of patients. All the patients were on antihypertensive therapy and none had uncontrolled or accelerated hypertension which could aggravate glomerula injury.

It is obvious from the results obtained from this study, that low protein diet is an important strategy for ameliorating uremic toxicity without inducing malnutrition (Giovannetti, 1985; Bankir and Kriz 1984). It is worth noting that dietary restriction and haemodialysis treatments are both ameliorating therapeutic procedures, which do not result in anticipated "cure" that is expected (Arije *et al.*, 2000). However an appropriate dietary protein restriction serves as an affordable, better-tolerated treatment option that could be started early to reverse or ameliorate uremic toxicity and delay end state renal failure.

This study has also shown that the type of protein sources and their mixture from animals and plant source produced variable effects on food intake, nutritional parameters and renal functions of patients with CRF. Also it has confirmed that low-protein diet from a mixture of egg white and smoked cat fish protein conferred better nutritional and metabolic effects when compared with the same quantity of protein from a mixture of smoked cat fish, cowpea pudding and egg white diet, in addition to high energy diet in patients with CRF.

It is recommended that cowpea should be excluded from a low-protein diet prescribed for patients with CRF. The dietitians in Nigeria should develop local seasoning agents that will make the diet of patients with CRF quite palatable without adversely increasing their serum sodium level and oedema. It is also important for dietitians to convince the patients with CRF of the benefits derived from low-protein and low-salt diet so that they can accept and cope with the diet

appropriately. A similar study involving a larger number of patients is also recommended.

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