*Available online at* www.ijpab.com

ISSN: 2320 – 7051
*Int. J. Pure App. Biosci.* **2 (4):** 155-160 (2014)
*Research Article*

INTERNATIONAL JOURNAL OF PURE & APPLIED BIOSCIENCE

# The Effect of Diet (Shea Butter Rich) in the Progression of Renal Insufficiency in Unilaterally Nephrectomised Rabbits

**Umaru, Isaac John[1]*, Umaru, Hauwa Aduwamai[2], Mohammed, Abdulrashid[1] and Ahmed, Maryam Usman[1]**

[1]Department of Biochemistry, Faculty of Pure & Applied Sciences, Federal University, Wukari
[2]Department of Biochemistry, Faculty of Pure & Applied Sciences,
Moddibo Adama Federal University of Technology,Yola
*Corresponding Author E-mail: umaruisaac@gmail.com

## ABSTRACT

*Shea butter and carbohydrate rich diet in renal insufficiency of unilateral nephrectomised rabbits was investigated in this study. Four groups of rabbits at which three nephrectomised rabbits were fed on standard laboratory chow, protein replete diet and protein deficient diet respectively. The control group was a sham operated and was maintained on standard laboratory chow, the diet and water inclusive ad-libitum was started a week of post–surgery stabilization period, their renal function status was assessed by serum urea and creatinine estimation obtained from blood sample of the ear on a weekly bases. The result range from week 1 to 12. Serum creatinine concentration (8.46±0.30 to 9.15 ±0.00; 9.04±0.08 to 12.98±0.28; 8.11±0.42 to 11.34±0.87; and 9.57±0.95 to 10.07±0.18) respectively for group A, B, C and D. Serum urea concentration (20.30±0.30 to 18.48±0.01; 21.16±1.03 to 27.9 ±1.08; 24.17±5.08 to 40.85±3.27 and 21.45±0.44 to 22.13±0.75) respective ly for group A, B, C and D shown significant increase when compared to the control. The blood urea nitrogen ratio ranges between (11.21±0.57 to 9. 41 ±0.00; 10.91±0.62 to 10.32±1.23; 13.76±2.53 to 16.8 4±1.17 and 10.52±0.76 to 10.23±0.21) respectively for group A, B, C and D. Finding indicate that protein restricted diet slowed the loss of renal function, while the protein replete diet (shea butter + carbohydrate diet) accelerated loss of renal function when compared with the control.*

***Key words:*** *Shea Butter, Carbohydrate, Urea, Creatinine.*

## INTRODUCTION

Kidney are bean shaped organs that are situated on the posterior part of the abdomen on each side of the vertebral column with weight of about 125—170g in adult and 10% less in female, they contain numerous nephrons which function as a filtration unit, excretion of waste product of protein metabolism maintenance of acid base and $Na^+$, $PO_4^{3-}$, $Mg^{2+}$, and $Ca^{2+}$ balance. It also keeps the volume and composition of extracelluler fluid within normal limits, production of rennin and metabolism of insulin[1] para thyroid hormone and gastrin. The functioning of the nephrons when improved lead to the renal insufficiency i.e. massive reduction in the number of nephrons. When renal mass is further reduced the major function of the normal kidney become progressively impaired with clinical symptoms developed in patients with unilateral nephrectomy, focal glomerular sclerosis has been reported by [2].

Kidney diseases are in various form, the acute renal failure i.e. temporary stops of kidney functioning, this are caused by acute glomeruler and terbular necrosis. The chronic renal failure, by chronic glomerulonephritis and pyelonephritis, Hypertensive kidney disease and Nephrotic syndrome are some of the kidney disease. Although the kidney has a remarkable regeneration power, effort are made to regulate kidney exposed to danger, however, there is no exact pathological or even physiological mechanism known, while increased level of serum urea is toxic to the kidney. The relationship between progressive of renal insufficiency and diet has been suspected for long because urea is a breakdown product of protein catabolism, the restriction of protein diets seems to be diminishes progressive renal damage[1].

Looking at the effect of diet, twenty rabbits were considered for the study, fifteen were unilaterally nephrectomised while five were sham operated, and this five were kept as the control. The animals were grouped into four and were maintained on composed mineral and water however renal failure could be assessed through the understanding of plasma urea clearance[3] and creatinine clearance though not widely accepted was used,[4]. Urinalysis and renal biopsy are other techniques used for the assessment[5]. Reported the role of protein in progression of chronic renal failure in Rats shown an increase in renal blood flow and glomerular filtration rate when animals are maintained on high protein diets. In rats high protein intake in the presence of renal injury seem to contribute to the increase perfusion of remnant glomerulus's leading eventually to their destruction[6] and restricted protein diet shows the rats progression of nephropathy in rodent retarded[7]. Low protein fat diet (14%) prevents progression of chronic renal failure in rats[8]. Lipid and their metabolites appear to play a role in progressive renal failure, this retard progressive renal damage in mice[9].

Manipulation of diets lowers the progression in patients at different stages of renal insufficiency and with different renal disease[10]. Reported ad-libitum feeding of a high protein diet might contribute to the progression of renal insufficiency in human being, as it does in rat and thus conclude restriction of dietary protein of patient with chronic renal failure[11] reported the deleterious effect of high phosphate intake on renal function[12]. also reported that it is difficult to separate the effect of restriction of protein from the effect of phosphate in chemical studies because food that are high in one nutrient tend to be high in the other, thus it is easier to restrict dietary source of phosphate, since most phosphate are found in dietary protein thus dietary restriction of phosphate prevented protunuria, renal calcification and death from uremia in rats with one fourth and three fourth nephrectommy[13]. This study is aimed at assessing the effect of a protein-restricted diet (shea butter rich carbohydrate diet) on progression of chronic renal failure.

## MATERIAL AND METHODS

### Collection and Extraction of Shea butter

Shea butter as a carbohydrate deficient protein diet compounder was obtained from shea butter butyrouspermum parkii by boiling. The nuts were obtained from Michika market in Adamawa State. Dried for seven (7) days to reduced moisture and for easy dehusking, the nuts powder was mixed with boiling water (5%w/w) and cooked for 3-4hrs until oil start flowing on top of mixture, fire reduced and oil skimmed from the top and stored for further mixture with carbohydrate diet.

The shea butter, laboratory chow protein diet, and protein deficient diet, were estimated by proximate analysis using the following methods, Dubois method of carbohydrate[14] , shea butter and protein content using Kjedhals methods (General method in chemical analysis of food, 1984). Estimation of urea concentration was obtained as reported by[15], and creatinine as reported by[16].

The material used for surgery, bleeding and analysis were bought from the market in Yola Adamawa State. The raw material for the formulation of diet were also bought from the same market, the shea butter was obtained from extraction.

All the chemicals were of analytical grade from BDH chemical company limited, Poole England and Marck chemical.

### Collection of Experimental Animals

A total of 20 rabbits were used, they were allowed on acclimatization period of 12 days during which they feed on standard laboratory fed, sixteen (16) of the rabbits were sham operated, five animals died under anesthesia, the rabbits were group into four (4) distinct group as shown: Gps A= controls sham operated/ standard lab chow, B= Test nephrectomised / standard lab chow, C= Test Nephrectomized / Protein replete and D=Test Nephrectomized /shea butter carbohydrate rich diet.

### Collection of Blood Sample

The animal was maintained on tap water and vitamin ad-libitum, the weight of the animals was taken on 1$^{st}$, 3$^{rd}$, 5$^{th}$, 8$^{th}$ and 12$^{th}$ week. After every week blood sample was obtained from the rabbit ear, about 25ml using a 5ml syringe into a test tube, blood allowed to clot and centrifuged for seven minutes (7min).

Serum is collected using Pasteur pipette into serum storage vial and stored under $0^{o}$c through the Spam of the experiment.

**Statistical analysis**

Data were presented as Mean ± Standard Deviation (SD) of 2 replicates and were analyzed using DMRT following one-way analysis of variance (ANOVA) using SPSS 16.0 computer software package (SPSS Inc., Chicago, U.S.A). Differences at $p<0.05$ were considered significant.

## RESULTS

**Table 1: Percentage Composition of Nutrient in Diet**

| | Carbohydrate | Protein | Fat | Crude fiber | Total |
|---|---|---|---|---|---|
| Replete protein | 35.8 | 45.9 | 8.9 | 3.5 | 93.8 |
| Standard lab chow | 48.8 | 27.9 | 7.5 | 7.5 | 91.7 |
| Carbohydrate+ shea butter | 51.0 | 3.0 | 41.2 | 3.5 | 98.2 |

**Table 2: Serum Creatinine Concentration**

| WK | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gp A | 8.56 ± 0.20 | 8.01 ± 0.89 | 8.39 ± 0.20 | 9.00 ± 0.01 | 9.04 ± 0.35 | 8.64 ± 0.00 | 8.87 ± 0.01 | 8.59 ± 0.10 | 9.17 ± 0.15 | 9.14± 0.15 | 9.15± 0.05 | 9.14 ± 0.10 |
| Gp B | 9.05± 0.07 | 9.83 ± 0.42 | 10.24 ± 0.63 | 10.7 ± 0.20* | 10.78± 1.38 | 10.28± 1.40 | 11.35 ± 0.63* | 11.70± 0.17* | 11.58± 0.43* | 12.20± 0.38* | 12.19± 0.36 | 12.09 ± 0.38* |
| Gp C | 7.98± 0.95 | 8.31 ± 0.37 | 8.59 ± 0.76 | 8.78 ± 0.43 | 9.44 ± 0.53 | 10.38± 1.36* | 10.95 ± 0.69* | 11.27± 0.45* | 11.60± 0.04* | 11.36± 0.85 | 11.32± 0.87 | 11.20 ± 0.83* |
| Gp D | 9.67± 0.94 | 9.65 ± 0.10 | 9.86 ± 0.10 | 9.62 ± 0.57 | 10.02± 0.35 | 10.01± 1.10 | 10.2 ± 0.84* | 9.86 ± 0.33 | 9.94 ± 0.38 | 10.02± 0.18 | 10.01± 0.15 | 10.00 ± 0.45 |

Significant value from control week one ($p<0.05$)
All values are represented as Mean ± S D
WK= Week
GP= Group

**Table 3: Serum Urea Concentration**

| WK | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gp A | 20.40± 0.10 | 22.50± 0.00 | 22.82± 1.59 | 19.08± 0.98 | 23.57± 1.57 | 19.29± 0.40 | 20.15± 0.15 | 18.56± 0.10 | 18.62± 0.10 | 18.48± 0.01 | 18.42± 0.34 | 18.40 ± 0.25 |
| Gp B | 20.88± 1.03 | 21.20± 2.20 | 24.03± 3.96 | 20.52± 0.89* | 21.89± 0.88* | 23.28± 0.58 | 24.59± 0.16 | 25.32± 0.99 | 26.05± 0.76 | 28.01± 1.98 | 28.20± 1.98 | 28.40 ± 0.98 |
| Gp C | 24.52± 10.27 | 26.51± 10.27 | 25.78± 4.62 | 28.00± 4.58 | 30.22± 3.10* | 31.02± 5.39* | 37.54± 6.05* | 38.01± 5.37* | 38.40± 5.0* | 38.42± 4.8* | 39.32± 2.5* | 40.84 ± 3.18* |
| Gp D | 21.65± 0.32 | 20.01± 0.01 | 21.78± 0.64 | 22.30± 0.68 | 21.03± 0.01 | 22.85± 0.07 | 23.07± 0.12 | 22.05± 1.89 | 22.05± 0.85 | 22.13± 0.65 | 22.15± 0.64 | 22.15 ± 0.98 |

Significant value from control week one ($p<0.05$)
All values are represented as Mean ± S D
WK= Week
GP= Group

**Table 4: Blood Urea Nitrogen / Serum Creatinine Ratio**

| WK | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gp A | 11.24± 0.46 | 13.51± 1.75 | 12.16± 1.20 | 10.08± 1.52 | 12.10± 0.58 | 10.21± 0.76 | 10.60± 0.67 | 9.89± 0.00 | 9.90 ± 0.09 | 9.41 ± 0.00 | 9.40 ± 0.58 | 9.38 ± 0.98 |
| Gp B | 10.89± 0.46 | 10.09± 0.79 | 11.09± 3.28 | 9.72 ± 0.24* | 10.01± 0.46* | 10.84± 2.11 | 10.15± 0.32 | 10.19 ± 0.10 | 10.40± 0.14 | 10.32± 1.20 | 10.30 ± 1.89 | 10..29 ± 2.01 |
| Gp C | 13.98± 1.54 | 14.75± 4.01 | 13.79± 2.00 | 14.4 ± 2.27 | 14.64± 0.5 | 14.72± 0.51 | 15.89± 1.40 | 15.98 ± 1.50 | 14.52± 1.96 | 15.17± 2.85 | 16.48 ± 1.17 | 16.84 ± 1.18 |
| Gp **D** | 10.51± 0.80 | 10.02± 0.14 | 10.62± 0.34 | 10.85± 0.74 | 10.12± 0.98 | 10.76± 1.14 | 10.61± 0.83 | 11.00 ± 0.54 | 11.06± 0.76 | 10.30± 0.84 | 10.34 ± 0.92 | 10.23 ± 0.31 |

Significant value from control week one ($p<0.05$)
All values are represented as Mean ± S D
WK= Week
GP= Group

## DISCUSSION

The nutrient diet was compounded with shea butter + carbohydrate as carbohydrate rich diet, protein diet was solely from defatted Soya beans and grower's marsh. Proximate analysis was carried out on three diets, which is used for feeding the animals as shown in table 1. The protein replete diet composition contain 35.8% carbohydrate, 45.9% protein, 8.9% fats, 3.5% crude fiber with a general total of 93.8%, while standard laboratory chow composition contain; 48.8% carbohydrate, 27.9% protein, 7.5% fats and 7.5% crude fiber respectively with the total of 91.7% and carbohydrate + shea butter compounder contain; 51.00% carbohydrate, 3.0%, protein, 41.02% fats and 3.4% crude fiber with total of 98.02%.The compounded diet was administrate to the various group, the sham operated which is control fed with standard laboratory chow, the nephrectomised rabbits were fed with standard laboratory chow, while the nephrectomised group C were fed with protein replete diet and the group D nephrectomised rabbits was fed with shea butter + carbohydrate rich diet. It could appear from the result of the administration of this diet to the control, group A, and nephrectomised rabbits group B, C, and D as shown on table 2, the protein restriction diet slows the loss of renal function while a high protein diet accelerates the loss of renal function ,this results are in agreement with result obtained from other studies[17].

The main serum creatinine value obtained for the group A animal (sham operated controls) did not show any significant rise from week 1 to week 2 experiment period, but from week 2 the value ranges from 8.01±0.89 to 9.15 ±0.05, this show that they have full complement of nephrons since they were not nephrectomized but sham operated, (i.e kidney was extirpated). This result from sham-operated controls confirms that surgery may not be involved in exacerbating renal failure in unilaterally nephrectomised animals.

The main serum urea concentration (22.5±0.00 to 18.42 ±0.34) also support the absence of surgery in exacerbating renal failure, it also show no significant difference when compared with one of the the same group (20.40± 0.10). The nephrectomized group B animals showed a slight gradual increase in main serum creatinine value (9.05± 0.07 to 12.09±0.38) and mean serum urea values (20.98± 1.03 to 28.40 ±0.98) were compared to that sham operated control week one value for creatinine (8.56± 0.20) and urea (20.40±0.10), this gradual increase was probably because they fed on moderately high protein diet (27.9%) which shows a slow progressive loss of renal function.

It is interesting to note that the group C animal which were nephrectomized and fed on a high protein diet (45.9%) showed a significant gradual increase in serum creatinine values (7.98± 0.45 to 11.20 ±0.83) when compared with sham operated controls week one value, these indicates accelerated progression of

renal insufficiency which agrees with the studies of[17,12,15] but 7-12 weeks were statically significantly different from the sham operated controls week one, these significant increase of serum urea ( 24.52 ± 0.80 to 40.84±3.18 ) when compared to the control animal, the result indicate an initiate progressive renal disease especially with high protein diets this agrees with[1]. When the serum creatinine mean value for group D was (9.67± 0. 94 to 10.00± 0.98) animals showed no significant rise relative to the control thus it was concluded that preservation of renal function as a result of fed restricted protein diet (3.0%) with high fat (shea butter). These help to retard the progression of chronic renal failure as also studied by[8]. This result is also in consistence with that got from mean serum urea levels (21.65 ± 0.32 to 22.15± 0.98), which also do not show any significant rise when compared with the control.

The BUN/ (creatinine) ratio for the control (11.24 ± 0.46 to 9.38 ± 0.98) did not show any statistically significant difference relative to week one. The ratio for B, C, D groups (10.89 ±0.42 to 10.29± 2.01); (13.98 ± 1.54 to 16.84 ± 1.08) and (10.51±0.80 to10.23± 0.31) were all within a range and non-showed any statistically significant difference when compared with the control week 1 (11.24 ± 0.46).

The BUN/ creatinine ratio is a very good index for measuring renal function. Normally the ratio of BUN /creatinine is between 10:1 and 20:1. Ratio higher than 20:1 indicate condition of extra renal origin like liver failure the ratio for protein replete animals was however higher (approx 14:1) relative to sham operated control (approx 10:0)

## CONCLUSION

In conclusion, the liberal intake of carbohydrate and shea butter should be encouraged as the protein restricted diet which slows the progression of chronic renal failure in place of a high protein diet it accelerates the progression of renal insufficiency.

## REFERENCE

1. Kiprov, D.D Colvin, R.B and Mcluskt, R.T., Focal and segmental glomerulosclerosis and proteinuria associated with unilateral renal agenesis. *Lab invests***. 46(3)**: 275—281 (1982)
2. Levey, A.S. and Caggiula, A.W., Effect of dietary protein restriction in the progression of advanced renal disease in the modification of diet in renal disease study. *Am J kidney Dis* 27:652-663 (1996)
3. Chasis, H. and Smith, H.W., The extraction of urea, in normal man and in subjects with glomerulus's nephritis. *J. Clin invest*, **17**: 347 (1938)
4. Payne, R.B. Creation clearance, a reductant clinical investigation. *Ann clin Biochem*, 23: 243 (1986)
5. Mackary, E.M. and Mackary, L.L., Addist factor, which determine renal weight vs the protein intake in rats. *Am J Physic*. **86**: 459-465 (1928)
6. Goltschalk, C.W. Function of the chromzally diseased kidney the adaptive rephness. *Circ. Res*, 28: 1-3 (1971)
7. Gottschalk, C. W. and Mogensen, C. T., Kidney function and its relation to nephron adaptation. *Circ Res*, **30**: 10-15 (1972)
8. Kenner, C.H. Evan, A.P. Blomgren, P. Aronoff, G.R. and Luft, F.C., Effect of protein intake on renal function and structure in partially nephrectomized rats. *Kidney Int.* **27**: 739–750 (1985)
9. Hurd, E.R. Johnston, J.M. and Okita, J.R., Prevention of glomerulus's-nephritis and prolonged survival in hybride mice fed on essentially fatty acid different diet. *J. Clin Invest*, 67:476-485 (1981)
10. Addis, T. and Drury, D.R. The Rate of Urea Excretion. VII. The effect of various other factors than blood urea concentration on the rate of urea excretion. *J Biol Chem.* **55**: 629–638 (1942)
11. Haunt, L.L. Alfrey, A.C. Angenherim, S. and Buddinton, B., Renal toxicity of phosphate in rats kidney. *Int*. 1**9**: 410-415 (1981)
12. Hunsicker, L.G. Studies of therapy of progressive renal failure in human semen. *Nephrol*, **9**: 380-397 (1989)
13. Ibels, L.S. Alfrey, A.C. Hant, L. and Huffer, W.E., Presentation of function in experimental renal disease by dietary restriction of phosphate. *N-Engl J Med*. **298**: 122-126 (1978)

14. Dubois, A.K. Giller, J.K. Mamilton, A.P. Reber, A. and Smith, F., Calorimetric methods for suger and related substance. *Ana Chem*. **28**: 350-356 (1956)
15. Mashio. 0. Oldrizzi, L. and Rugiu, C., Dietary protein manipulation. In Mitch WE, Stein ill (eds): The progressive nature of renal disease, 2nd ed. Contemporary issues in nephrology, **26**: New York, Churchill Livingstone, 1992, pp.167-182.
16. Klshr, S. and Tripathy, K. Evaluation of renal function in malnutrition. *Arch. Intern. Med.,* **118**: 322-325 (1966)
17. Mitch, WE. Dietary protein restriction in chronic renal failure: Nutritional efficacy, compliance and progression of renal insufficiency. *J. Am. Soc. Nephrol*., **2**: 823-831 (1991)