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EFFECT OF A CASSAVA BASED DIET (GARI) ON SOME RENAL FUNCTION PARAMETERS IN ALBINO RATS

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ABSTRACT

Aim: The study was carried out to ascertain the effect of Gari (a cassava based diet) on renal functions in albino rats.

Methods: Thirty five Wistar albino rats divided into seven groups were fed Gari mixed with normal rat diet at concentrations of 0, 10, 20, 40, 60, 80, and 100% respectively for 3 weeks and the renal parameters (Creatinine, Urea, Sodium and Potassium) monitored in the animals.

Results: There were dose dependent increases in urea, creatinine, potassium and sodium of albino rats fed Gari diet. Using analysis of variance (ANOVA), there were significant differences in the urea, and creatinine concentrations when compared to their respective controls ($P<0.05$) while sodium and potassium did not show any significant difference ($P>0.05$).

Conclusion: Therefore this study showed that Gari caused changes in renal function based on the concentration of the Gari.

Keywords - Renal, Gari, Creatinine, Urea, Electrolytes

INTRODUCTION

Cassava is a staple food in human diets in over 80 countries (Gomez et al 1988). Gari a starchy food prepared from cassava (Manihot utilisima) tubers is one of the most popular staple foods of the people of the rain forest belt of West Africa and contains mainly starch-20% amylase and 70% amylopectin having lost the soluble carbohydrates (i.e. glucose and sugar) during processing (Ezeji et al., 2009) . Gari has been reported to reduce enzymes induction caused by petroleum through the phenomenon of glucose effect (Braide et al., 2011). The kidneys play an essential role in regulating the amount of several important inorganic ion in the body, including Sodium (Na^+), Potassium (k^+), Chloride (Cl^-) Bicarbonate (HCO^{3-}) hydrogen (H^+), calcium (Ca^{2+}) and phosphate (pi), the kidneys also contribute to the maintenance of organic ion balance. Electrolyte imbalance and fluid loss also causes metabolic acidosis. The kidney can suffer considerable damage before losing

sufficient function to modify the normal clinical indication of renal disease such as the serum creatinine concentration (Longman-Adman, 1997). Approximately 50% or more of renal capacity can be lost before serum creatinine become abnormal and disease is detectable clinically. A battery made up of a combination of different types of test can aid in the detection of damage by a nephrotoxin and also allows for the determination of various threshold damages. The detection of renal damage at a reversible stage is necessary before effective preventive measures can be taken to halt the progress of damage to the irreversible stage. The aim of this study is to determine the effect of cassava based diet (Gari) on renal function in albino rats using sodium, Potassium, Urea and Creatinine as indicators.

MATERIALS AND METHODS

Test Animals

Thirty five Wistar albino rats of 0.195kg average body weight on normal rat diet were obtained from the animal house of the department of Pharmacology and Toxicology, University of Port Harcourt. These rats were fed ad libitum with normal rat pellet and water and acclimatized to laboratory conditions for a period of 14days prior to commencement of study. The gari used in this study was purchased from Mile 3 Market, Port Harcourt. The Commercially prepared Creatinine and urea reagents were obtained from Randox Diagnostics, London.

Experimental Design

Thirty five albino rats divided into seven groups were fed normal rat diet mixed with gari at concentrations of 10, 20, 40, 60, 80 and 100% while the last group was fed only rat diet with distilled water ad libitum for 3 weeks.

Biochemical Studies

The sodium and potassium estimation was done using Flame Photometric method as described by Baker et al., (1998) using Gallenkamp flame photometer. Using compressed air, diluted (1 in 10) serum was sprayed as a fine mist of droplets (Nebulised) into a non luminous gas flame which becomes coloured by the characteristic mission of the sodium or potassium metallic ions in the sample. Light of a wavelength corresponding to the metal being measured was selected by a light filter or prism system and allowed to fall on a photosensitive detector system. The amount of light emitted depends on the concentration of metallic ions present. Accuracy was controlled by analyzing a sodium/potassium standard solution (140/3.0mmol/l) respectively after every two (2) analysis to correct for instrument drift while a Randox normal quality control serum was assayed to determine the precision. Urea estimation was done by Urease - Berthelot colorimetric method. Ten (10) microlitre of sample, standard, control and distilled water was pipette into test tube labeled sample, standard control and blank respectively. Hundred (100) microlitre of urea reagent 1 was added to all the tubes and incubated at 37ºC for 10 minutes. 250 microlitres of urea solutions 2 and 3 was added to all the tubes, mixed and incubated at 37ºC for 15 minutes. The absorbance of the sample, control and standard were read at 546nm against the content of the blank tube. The activity of sample was calculated using the absorbance of sample against absorbance of standard multiplied by concentration of standard (Weatherburn, 1967). Creatinine estimation was done by Jaffe's colorimetric method. Five hundred (500) millilitre of sample, standard, control and distilled water was pipette into test tube labeled sample, standard control and blank respectively containing five hundred (500) millilitre of trichloro acetic acid (TCA).The contents were mixed and spun at 2500rpm for 10minutes. 1000 millilitre of supernatant from each tube was added into respectively labeled test tube containing 1000 millilitre of reagent mixture of Picric acid and sodium hydroxide (500 millilitre each).The contents were mixed and stand at 25ºC for 20 minutes. The absorbance of the sample, control and standard were read at 546nm against the content of the blank tube. The concentration of sample was calculated using the absorbance of sample against absorbance of standard multiplied by concentration of standard (Henry, 1974).

Statistical Analysis

The biochemical data were subjected to some statistical analysis as the Mean (X), standard error of mean (SEM) and ANOVA using Statistical Package for Social Sciences (SPSS) version 18.

RESULTS

The sodium concentration was 136.33±1.20 in control while it was 136.00±0.58 at 10% Gari diet. Also at 20% Gari diet the sodium concentration was 131.00±0.58while the others

were139.00±6.66135.33±4.91, 136.00±2.30 and 128.00±1.15 at 40%, 60%, 80% and 100% respectively as shown in table 1 below. The Potassium concentration was 6.90±0.30 in control while it was 6.77±0.12 at 10% Gari diet. Also at 20% Gari diet the Potassium concentration was 7.23±0.18 while the others were 8.23±1.10, 6.27±0.12, 6.43±0.38 and 8.40±0.59 at 40%, 60%, 80% and 100% respectively as shown in table 1below. The urea concentration was 5.35±0.75 in controls while it was 7.07±0.58 at 10% Gari diet. Also at 20% Gari diet the urea concentration was 9.3±0.38 while the others were 10.47±0.82, 7. 11.45±0.73, 13.19±0.22 and 14.52±0.28 at 40%, 60%, 80% and 100% respectively as shown in table 1 below. The creatinine concentration was 7.44±0.22 in control while it was 9, 86±0.24 at 10% Gari diet. Also at 20% Gari diet the creatinine concentration was 10.16±0.18 while the others were 8.29±0.36, 8.87±0.09 10.31±0.69, 37.77±4.75 and 11.70±0.78at 40%, 60%, 80% and 100% respectively shown in table 1 below.

Table 1. Effect of Gari on some renal parameters in albino rats

Concentration (%)	Sodium (mmol/l)	Potassium (mmol/l)	Urea (mmol/l)	Creatinine (mg/dl)
0.00	136.33±1.20	6.90±0.30	5.35±0.75	7.44±0.22
10	136.00±0.58	6.77±0.12	7.07±0.58	9,86±0.24
20	131.00±0.58	7.23±0.18	9.3±0.38	10.16±0.18
40	139.00±6.66	8.23±1.10	10.47±0.82	8.29±0.36
60	135.33±4.91	6.27±0.12	11.45±0.73	8.87±0.09
80	136.00±2.30	6.43±0.38	13.19±0.22	10.31±0.69
100	126.00±2.30	8.40±0.59	14.52±0.28	11.70±0.78
F	1.621	2.657	31.282	10.456
P	0.214	0.062	0.000	0.000
		POST HOC		
0.00 vs 10	P>0.05	P>0.05	P>0.05	P<0.05
0.00 vs 20	P>0.05	P>0.05	P>0.05	P<0.05
0.00 vs 40	P>0.05	P>0.05	P>0.05	P>0.05
0.00 vs 60	P>0.05	P>0.05	P<0.05	P>0.05
0.00 vs80	P>0.05	P>0.05	P<0.05	P>0.05
0.00 vs 100	P>0.05	P>0.05	P<0.05	P>0.05
10 vs 20	P>0.05	P>0.05	P>0.05	P>0.05
10 vs 40	P>0.05	P>0.05	P>0.05	P>0.05
10vs 60	P>0.05	P>0.05	P>0.05	P>0.05
10 vs80	P>0.05	P>0.05	P<0.05	P>0.05
10 vs 100	P>0.05	P>0.05	P<0.05	P>0.05
20 vs 40	P>0.05	P>0.05	P>0.05	P>0.05
20 vs 60	P>0.05	P>0.05	P>0.05	P>0.05
20 vs 80	P>0.05	P>0.05	P>0.05	P>0.05
20 vs 100	P>0.05	P>0.05	P<0.05	P>0.05
40 vs 60	P>0.05	P>0.05	P>0.05	P>0.05
40 vs 80	P>0.05	P>0.05	P>0.05	P>0.05
40 vs 100	P>0.05	P>0.05	P>0.05	P>0.05
60 vs 80	P>0.05	P>0.05	P>0.05	P>0.05
60 vs 100	P>0.05	P>0.05	P>0.05	P>0.05
80 vs 100	P>0.05	P>0.05	P>0.05	P>0.05

DISCUSSION

The kidneys play an essential role in regulating the amount of several important inorganic ion in the body, including sodium, potassium, chloride, bicarbonate, hydrogen, calcium and phosphate. The kidneys also contribute to the maintenance of organic ion balance. Electrolyte imbalance and fluid loss also cause metabolic acidosis. The result of the study showed dose dependent increase in urea and creatinine concentration. There was significant difference (P<0.05) in urea and creatinine concentrations of albino rats fed Gari. This is similar to the study of Adegoke et al., (2013) using granulated sugar. It has been shown that glucose feeding causes in both man and microorganism profound changes in metabolism include inhibition of induction of several enzymes, stimulation of others and blockage of most effects of glucocorticoids (Melvin and Goldberg, 1975). Increased serum creatinine and lower creatinine were related to diagnosis of chronic renal failure (Sesso et al., 1996). Creatinine is the anhydride of creatine. It is formed largely in the muscle by the

irreversible and non enzymatic removal of water from creatine phosphate. Formation of creatinine is apparently a preliminary step required for the excretion of most of the creatine. Blood urea level is one of the routinely assessed markers of kidney function, but its reliability in assessment of kidney function is often compromised in the face of factors that significantly elevate it (Mark et al., 2005). The central role played by the kidney in elimination of metabolic waste and the in maintenance of pH balance cannot be contended (Arroyo, 2008). The study also showed that there were no significant different in the potassium and sodium concentrations of Gari fed albino rats. Gari is a food made from cassava which is known to contain cyanide, a known inhibitor of the respiratory chain, the major source of ATP (Ramsey et al., 2004). Gari is a food made from cassava which is known to contain cyanide, a known inhibitor of the respiratory chain, the major source of ATP (Ramsey et al., 2004).

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