Effect of "Nduduagworagwo" Traditional Food on Haematology, Hepatic and Renal Function of Rats

Duru Majesty[1], Amadi Benjamin[2], Ugbogu Amadike[3], and Onuoha Nchekube[4]

[1]Abia State University
P.M.B 2000 (Uturu, Nigeria)

[2]Imo State University
P.M.B 2000 (Owerri, Nigeria)

[3]Abia State University
P.M.B 2000 (Uturu, Nigeria)

[4]Federal College of Education [Technical]
P.M.B 1044 (Asaba, Nigeria)

ABSTRACT—*Effect of "Nduduagworagwo", a traditional food made from boiled, "Ndudu" seed (Vigna unguiculata subsp. sesquipedalis), and other condiments, common among Akokwa people in Imo State on haematology, hepatic and renal function was investigated. Forty male albino rats weighing between 70-80g were allocated to five groups of eight rats each. One group served as the control and was placed on normal rat feed while the test groups were placed on compounded feed of "Nduduagworagwo" and normal rat feed using different proportions. The treatment of experimental rats was in accordance to the National Institute of Health guidelines for the care and use of laboratory animals. Result obtained for haematology showed a significant increase ($p<0.05$) in Hb, PCV, WBC (total) and lymphocytes against those of the control. Hepatic function parameters such as ALT, ALP, AST, total and conjugated bilirubin were insignificantly affected ($p>0.05$) against those of the control. Renal function result revealed that urea was significantly ($p<0.05$) affected in test rats when compared to those of the control. The increased Hb in test rats could be that the studied food supports Hb production while that of urea could be linked to increased protein level in the food. The study has shown the effect of "Nduduagworagwo" on haematology, hepatic and renal function.*

Keywords— Haematology, hepatic function, "Ndudu", "Nduduagworagwo", renal function.

1. INTRODUCTION

Our forefathers while on earth depended on natural foods [1]. Among such natural foods are traditional foods. Traditional foods are those foods which have specific feature or features which distinguish them clearly from other similar products of the same category in terms of the use of traditional ingredients (material of primary products) or traditional composition or traditional type of product or processing method [2-3]. Traditional foods are known for their simplicity, free from chemical additives, and are easily prepared. Amadi *et al.* [4]; Achi [5] noted that traditional foods are associated with traditions and cultures of the people. Studies have attributed a lot of benefits to consumption of traditional foods [4-12]. In recent times, factors such as change in lifestyle, taste and migration have resulted in decline in desire for traditional foods. The knowledge on the importance of consuming traditional foods and as well their preparation methods are poorly transferred [9]. The present generation is a generation of fast foods. Fast foods are foods prepared by food industry. It has been proven that such foods are dangerous to health but they seem to be the order of the day for the present generation. Most consumers of fast foods question the safe nature of traditional foods and give such as one of their reasons for depending on fast foods. Sequel to this, there is need to investigate the safe nature of some existing traditional foods on consumption. "Nduduagworagwo" a traditional food of Akokwa people in Imo State, Nigeria is among the existing traditional foods that needed to be investigated in terms of its safe nature on consumption.

"Nduduagworagwo" is a porridge made from Ndudu" (vegetable cowpea seed; botanically it is *Vigna unguiculata* subsp. *sesquipedalis*), palm oil, "Ugba" (fermented sliced *P.macrophylla* seed), and potash,

used in this study were purchased from Akokwa central market. "Utazi" (*Gongronema latifolium*),"Uziza" seed (*Piper guineense*), crayfish and salt. "Nduduagworagwo" does the functions of unifying Akokwa people at home and abroad. It also showcases the traditions of the Akokwa people.There is this popular saying within Imo State that a visit to Akokwa is incomplete without the taste of this food. This is because the owners of the food are proud of it as their traditional food, which they inherited from their forefathers (Interview with a traditionalist in the community).

In view to study the safe nature of traditional foods, this study investigated the effect of "Nduduagworagwo" on haematology, hepatic and renal function.

2. MATERIALS AND METHODS

Sample collection

"Ndudu" (vegetable cowpea seed; botanically it is *Vigna unguiculata* subsp. *sesquipedalis*), palm oil, "Ugba" (fermented sliced *P.macrophylla* seed), and potash, used in this study were purchased from Akokwa central market. "Utazi" (*Gongronema latifolium*), "Uziza" seed (*Piper guineense*) were collected from Imo State University school farm while the crayfish and salt used in the "Nduduagworagwo" preparation were purchased from Owerri main market.

Preparation of "Nduduagworagwo"

Tiny stones and debris were first removed from the purchased one kilogram of "Ndudu". The stone and debris-free "Ndudu" was further separated into good and damaged ones. The damaged ones got discarded while the good ones were washed thoroughly with plenty of water. The washed "Ndudu" was soaked in water for eight hours to shorten the cooking time. The soaked "Ndudu" was then placed in a pot and 4litres of water was added to it in the pot and was boiled. This took about 3hr before it was confirmed consumption fit. The remaining water in the cooked "Ndudu" pot was then filtered off into an empty container. 10g of ground pepper, 2g of ground potash, 200ml of palm oil, 18g of ground crayfish, 8g of "Uziza"seed , and three wraps of "Ugba" were added and mixed together with the cooked "Ndudu". While mixing the whole components, the filtered water earlier used in cooking the "Ndudu" was gradually added at intervals. 75g of salt was added to taste. Finally, the mixed "Ndudu" was garnished with some sliced "Otazi" leaves to form "Nduduagworagwo" ready to be served.

Sample preparation for analyses

The prepared "Nduduagworagwo" was oven dried at 70^{o}C for 48 hours. The dried sample was ground into flour using hand mill device. The ground sample was stored in air tight container till needed for analyses.

Experiment animals

Forty- male wistar albino rats weighing between 70g-80g obtained from the animal colony of Department of Biochemistry, Abia State University, Uturu, Abia State Nigeria were used in this study. The animals were housed in clean and dry plastic cages with good ventilation, and were given pelletized commercial rat feed (Pfizer Livestock Co., Ltd, Aba, Nigeria) and tap water *ad libitum*. The rats were given the same feed before acclimatization. The acclimatization period lasted for 7days. After acclimatization period, the animals were allocated to five groups of eight rats each. Their weights were equalised as nearly as possible. Aside the control group, the remaining groups were given compounded rat feed for twenty-eight days. Treatments for the rats were as follows.

Control group= Normal feed+ tap water; Group I_5= 5% of "Nduduagworagwo" + Normal feed + Tap water; Group I_{10} = 10% of "Nduduagworagwo" + Normal feed + Tap water; Group I_{15}= 15% of "Nduduagworagwo" + Normal feed + Tap water; Group I_{20}= 20% of "Nduduagworagwo" + Normal feed + Tap water

The treatment of experimental animals was in accordance to the National Institute of Health (NIH) guidelines for the care and use of laboratory animals [13].

Blood sample collection

At the end of twenty-eight days treatment period, the rats were reweighed. Anaesthetic ether was used to anaesthetize the rats in a closed container before they were sacrificed by making incisions at their cervical

regions with sterile blade. Blood was collected by cardiac puncture into anticoagulant free tubes with corks for hepatic and renal studies while that of haematology was collected in anticoagulant tubes. The tubes were used for analysis.

Haematological analysis

Blood percentage (Hb) and red blood cell (RBC) levels were determined using Sahli`s and Alexander and Griffith [14] methods respectively. Westergreen`s method was used for erythrocyte sedimentation rate (ESR), Counting chamber and slide methods were used for white blood cell total count (WBC) and differential counts respectively. Haematocrit method [15] was used for packed cell volume (PCV) whereas, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC), were determined as described by Alexander and Griffith [16]

Serum assay

The levels of alkaline phosphatase (ALP) were determined by Write *et al.* [17]. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were determined as described by Reitman and Frankel [18]. The assay of bilirubin both conjugated and total was carried out using the Jendrasik and Groff [19]. Creatinine was determined as described by Heinegard and Triderstorm [20] while urea was done using Urease-Berthlot method.

Statistical analysis

The statistical analysis was conducted using the student t-test as described by Steel and Torris [21] .Each test group was compared to control group at 5% significant level.

3. RESULTS AND DISCUSSION

Table 1: Haematology of rats given "Nduduagworagwo" for 28days.

Groups / Parameters	Control	I_5	I_{10}	I_{15}	I_{20}
Hb (g/dl)	12.10±2.03*	13.85±1.38	15.19±1.14*	15.27±2.03*	15.63±0.19*
PCV (%)	26.20± 1.12	28.07± 0.20	31.22± 2.01*	31.54±1.95*	31.41±1.87*
RBC (10^{12}/L)	3.87±0.19	4.01±0.32	4.87±0.70	5.09±1.04	5.12±1.00
WBC (10^9/L)	9.11±1.18	10.93±1.07	12.48±1.90*	12.53±1.02*	12.32±2.13*
Neutrophil (%)	10.37±1.90	11.43±1.30	11.45±1.21	11.56±2.09	11.98±1.17
Lymphocyte (%)	67.32±0.17	69.50±1.01*	69.84±2.06*	69.48±0.94*	69.61±1.11*
Eosinophil (%)	2.13±0.03	3.01±0.01	3.01±0.06	3.40±0.09	3.15±0.05
Monocyte (%)	1.60±0.21	2.17±0.10	2.89±0.20	3.96±0.21	4.01±0.83
Basophil (%)	0.10±0.01	0.46±0.09	0.49±0.11	0.51± 0.13	0.50±0.10
MCH (pg)	30.18±0.84	31.85±0.17	31.98±1.09	31.09±1.64	31.97±1.04
MCHC (%)	4.19±1.08	4.22±1.85	4.27±1.39	4.91±1.04	5.10±1.07
ESR (mm/hr)	8.35±0.16	5.08±0.60*	4.33±1.00*	4.20±0.79*	4.20±0.43*

Results are mean and standard deviation of eight determinations. Values asterisked are statistically significant against the control ($p<0.05$).

Hb, PCV, RBC, WBC, and Lymphocytes increased significantly ($p<0.05$) in rats given "Nduduagworagwo" when compared to those of the control (Table 1). The increased in Hb levels as observed in test rats in the present study could be that "Nduduagworagwo" affected the glycoprotein hormone known as haematopoietin, which control erythropoiesis or red blood cell production positively. Decreased RBC is linked with anaemic condition [22]. The increased RBC in rats placed on the studied food could be an added advantage against anaemic condition. Also, the committee for orphan medical products, Europeans Medical Agency [23] noted that the decrease in RBC involves the polymerization (molecules joining together into a chain) of haemoglobin S. Such polymerization may not be possible with consumption of "Nduduagworawo" since RBC significantly increased ($p<0.05$) in test rats against the control rats in this study. The observed increase in PCV of test rats compared to those of the control in the present study is normal in a haematology study that produced increase in Hb levels [24-25]. The combine effects of physiological and chemical factors in the metabolic

system of the rats which the studied food may have induced could be the cause of the significant increase ($p<0.05$) observed in test groups against the control in this study. WBC and its components are defensive against foreign substances. Lymphocytes are associated to immunoglobulins while neutrophils aid in the protective work. Levels of lymphocytes in this study were significantly increased ($p<0.05$) in test rats when compared to those of the control. The levels of neutrophils, eosinophils, monocytes and basophils were insignificantly affected ($p>0.05$) in test rats when compared to those of the control. The observed insignificant affect in this study could be indication of non-toxic nature of the studied food in the system. Keele *et al.*, [26] noted that normocytic or hypochromic anaemia results when there is reduced MCH or MCHC. There was insignificant increased ($p>0.05$) in MCH and MCHC in rats placed on "Nduduagworagwo" when compared to those of the control in the present study. This observation is in line with the increase in Hb and RBC production earlier observed in this study. ESR of test rats in this study reduced significantly ($p<0.05$) against the control. The observed reduction could be as a result of increase in some of the parameters as observed in this study.

Table 2. Hepatic function results of rats given "Nduduagworagwo" for 28days.

Groups / Parameters	Control	I_5	I_{10}	I_{15}	I_{20}
ALP (U/L)	23.09±2.10	23.12±2.97	23.56±1.10	24.11±2.01	24.93±2.18
AST(U/L)	58.20± 1.12	58.34.± 0.20	58.21± 1.10	59.11±0.82	58.07±1.03
ALT(U/L)	35.10±0.64	35.07±0.90	35.82±0.24	35.73±0.47	35.80±0.13
Total bilirubin(mg/dl)	0.42±0.03	0.43±0.07	0.45±0.10	0.44±0.02	0.44±0.05
Direct bilirubin(mg/dl)	0.21±0.10	0.21±0.08	0.23±0.01	0.26±0.03	0.21±0.07

Results are mean and standard deviation of eight determinations.

The activity of serum enzymes may be elevated in extra hepatic disease condition [27-28]. AST and ALT are among the enzymes that could mark hepatic disease conditions when they get elevated in serum. ALT appears to reflect hepatic disease damage and it is more specific for hepatic disease condition than AST due to the subcellular location of the enzyme AST. Injury in the liver or inflammatory disease condition may be reflected by elevation of AST and ALT along with elevation of ALP activity [29-30]. AST, ALT, and ALP levels in test rats in the present study when compared to those of the control were insignificantly affected ($p>0.05$). This could be indication that "Nduduagworagwo" food may not be link to hepatocellular damage. The study of bilirubin (both total and direct bilirubin) of the system is important. It is used to ascertain the occurrence of disease conditions such as jaundice, etc in children. The total and direct bilirubin levels of test rats when compared to those of the control were insignificantly affected ($p>0.05$). The insignificant effect could be that diseases such as jaundice and other diseases that occur in the body as result of bilirubin break down in the system may not be possible with "Nduduagworagwo" food when consumed in the body.

Table 3. Renal function studies of rats given "Nduduagworagwo" for 28days.

Groups / Parametrs	Control	I_5	I_{10}	I_{15}	I_{20}
Creatinine (mg/dl)	0.71±0.03	0.74±0.30	0.83±0.04	0.82±0.03	0.80±0.09
Urea (mg/dl)	51.09± 2.19	52.85± 1.23	54.30± 1.17	54.42±2.01	55.04±2.30
K^+ (mEq/L)	4.40±1.30	4.75±0.21	4.16±0.38	4.04±0.21	4.39±0.84
Na^+ (mEq/L)	144.17±3.01	143.68±2.65	144.58±2.19	145.03±2.10	145.27±2.23
Cl^-(mEq/L))	101.08±0.16	102.14±0.33	102.23±0.25	101.11±0.37	102.49±0.07
HCO_3^- (mmol/L)	30.01±2.09	30.18±1.76	31.11±1.85	31.30±1.42	31.52±2.07

Results are mean and standard deviation of eight determinations.

Homeostasis work of absorption of important materials and excreting waste products are the sole functions of the kidney [31-32]. Creatine is protein metabolized in the muscles. Its metabolism gives rise to creatinine as waste product. Creatine on its own is produced in the liver and through the circulatory system; it is taken up by the muscles. Retention of creatinine in the blood is a sign of kidney problem [33-34]. Creatinine levels of test rats were insignificantly affected ($p>0.05$) against the control in this study. Urea is the main product of protein metabolism. The liver is the site for urea cycle where ammonia produced is converted to urine. Decrease in urea occurs in a severe liver condition. When the condition facilitates destruction of cells urea cycle could be affected. The observed increase in urea in test groups I_{10}. I_{15} and I_{20} were significant when compared to that of the control. The observed increase could be due to the protein content of the studied food hence on increased consumption, more of it was metabolized and excreted. The movements of the electrolyte ions in and out of the kidney tubules are facilitated by a hormone known as aldosterone [34-35]. This hormone stimulates the tubules on the need to conserve or release more ions to the exterior as the case may be (Robert *et al.,* 2003). The K^+, Na^+ Cl^- and HCO_3^- that make up the electrolyte ions of the system were insignificantly affected ($p>0.05$) in test rats against the control. This could imply that "Nduduagworagwo" has nothing to do with the hormone that stimulates the kidney tubules in terms of absorption of these ions in the system [36-37].

4. CONCLUSION

The present study has shown that "Nduduagworagwo" has no harmful effect on haematology, hepatic and renal function of rats. Hence humans that consume it may be exposed to the same effect.

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