Evaluation of Effect of Consumption of Termites (Macrotermes Nigeriensis) on Biochemical and Haematological Profile of Male Albino Wister Rats

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ABSTRACT

Regardless of their well-known role as pests, termites (Macrotermes) are consumed as part of a traditional diet in Igbo region of Nigeria West Africa (Kinyuru 2009). In response to the administration of salt seasoned fried termites (Macrotermes nigeriensis) were evaluated. Sixty male albino rats of weight (180-200g) were used in the study. They were randomly divided into 3 groups viz.: A, B, and C. Group A animals served as the control group, group B were fed with high dose of the fried termites while group C were fed with low dose. All treatments were for 28 days acute study. Biochemical and haematological diagnosis were performed with blood samples collected from the animals with cardiac puncture.

Results showed that M. subhylanus increased Haemoglobin concentration (14.8 ± 2.05g, 100ml), packed cell volume (44.0 ± 4.21%) platelet count 220 ± 65 x 10⁹/L, and white WBC total count (5,200 ± 160/mm³), in test animals compared with their corresponding controls. The biochemical analysis also showed increased levels in protein (51 ± 1.0%), iron (13.06 ± 0.64mg/100ml and lipid content  (66.50 ± 0.22%) in test animals compared with their corresponding controls. It could be deduced from this study that the salt seasoned fried meals of M. subhylanus (termites) encourages selective haemopoiesis and is well tolerated.

Keywords: Termites, albino Wister rats, haemoglobin, consumption, platelets evaluation.

INTRODUCTION

Insects have been consumed as part of traditional diet (N’kinyuru, 2009) in Igbo land Eastern Region of Nigeria. Many learned individuals in our region have neglected the consumption of termites, regarding it as children’s delicacy, but it has remained a seasonal food in this part of our country. The effects of the consumption of termites (Macrotermes nigeriensis) in our body system are what aggravated my curiosity to take up this research study.

Termites (Macrotermes nigeriensis) is a gregarious termite that is eaten as a delicacy in different parts of Nigeria and several other African countries (Igwe et al., 2011). Termites are a large and diverse group of insects consisting of over 2,600 species worldwide. The main genera in the sub family macrotermitinae are odontermes (79 species), Microtermes (33 species), Macrotermes (21 species), Ancistrotermes (9 species), allodontermes (7 species) and Pseudacanthotermes (5 species). Macrotermes nigeriensis is a winged adult termite of the order, isopteran and family termitdae. Although M. nigeriensis is a eusocial insect with a typical colony containing nymphs (semi-mature young) workers soldiers, and the reproductive individuals (alates) are the winged adults that are commonly caught and consumed (Igwe et al., 2011).

They are the fully developed adult stage of the termites. There exists a bit difference among the winged adults, probably due to geographical locations or developmental stages. There are many species of termites such as M. nigeriensis, M. notalensis, M. subhylanus, or M. belicosus. They are all simply regarded as winged termites; ‘termites’ or Macrotermes species (Banjo et al., 2004; Mbah and Elekima, 2007).

The winged termites are known locally in various parts of Nigeria by different names such as ‘Aku’ in Igbo, ‘chinge’ in Hausa, and ‘Esusu’ in Yoruba (Fasoranti and Aijboye, 1993). Edible termites (M. nigeriensis) swarm during the beginning of rainy seasons in Nigeria around April/May months of the year. Early in the rainy
season, the alates fly off from their nest in large numbers in their nuptial flight. During this flight, pairs of male and female alates isolate themselves from others and fall to the ground. Their wings break off from their nest in large numbers in their "nuptial flight". During this flight, pairs of male and female alates isolate themselves from the others and fall to the ground. Their wings break off and each pair goes its own way to form a nest in a suitable spot, where they become the potential king and queen. During the flight, they are usually attracted to sources of illumination and are harvested by women and children by placing a bowel of water under a bowel.

**Nutrient content of M. Nigeriens:**

Although in modern times, there is a decline in the consumption of termites, yet the insects provide beneficial nutrients to the human body (n'Kinyuru, 2009). Studies executed by researchers in the past on nutrient composition analysis denotes that it contains proteins (45%), trace minerals (iron) 12%, potassium (10%), riboflavin (3%), oleic acid (fatty acids) 53%, Neutral Lipids (64%) and retinal (13%). The reputation of termites as pests is also associated with the presence of termitaria in crop fields and near trees.

**MATERIALS AND METHOD**

**Animals:**

Sixty male albinos Wister rats were used in this study. They were kept in iron cage at room temperature (25°C) and left in animal house for 2 weeks to get acclimatized to the environment before commencing an acute feeding which lasted for 28 days.

**Experimental Designs:**

Sixty male albino rats (180-200g) were selected and randomly divided into three groups (3 groups). Rats in group b served as those on high dose meal, Group C served as those on low dose meal, while those in Group A served as control. The test rats receive d their normal-rat mixed with 5g of salt seasoned fried and dried termites and drinking water ad libitum.

**Preparation of termite meal:**

The winged edible termites are collected during the beginning of rainy season around May/June periods of the year. As soon as the first termite warms emerge, lights are set up with water buckets and basins underneath to catch them as they drop. The warm lasts for 1 hour (one hour); the termites are removed from the water and frozen immediately.

When ready for processing, they are seasoned with a little pinch of salt, fried, dehydrated and then the wings are removed. They are mixed with the rats feed. 

**Phytochemical Analysis of winged termites:**

The fried edible termites were screened for the presence or absence of metabolites using standard phytochemical screening procedures as described by Harbourne (1973), Trease and Evans (1996). The meals were screened for alkaloids, proteins, carbohydrates, calcium, lipids, fatty acids, flavonoids, glycosides and redundancy sugars.

**Determination of Haematological and biochemical Profile:**

Blood samples collected into EDTA sequestrene bottles were used for the haematological and biochemical studies with hews. The packed cell volume was determined according to the haematological method described by Alexander and Griffiths (1993). The haemoglobin concentration was estimated according to the cyanmethaemoglobin method as described by Alexander and Griffiths, white blood cell counts and platelet count were estimated according to the visual method of Dacie and Lewis (1991). The biochemical analysis was carried out as described by Baker and Silverton (1985).

**Statistical Analysis:**

The results obtained in the study for HB concentration, WBC Count, platelet count, packed cell volume, protein estimation, iron and lipid estimations were represented as mean and standard deviation (mean ± S.D) while students’ t-test was used to compare the result of the control and the tests. A P-value of less than (P < 0.05) or equivalent to (P=0.05) was considered significant.
RESULTS

Table 1: The phytochemical studies of Macrotermes nigeriensis

<table>
<thead>
<tr>
<th>Contents</th>
<th>Carbohydrates</th>
<th>Fats and oil</th>
<th>Calcium</th>
<th>Protein</th>
<th>Riboflavin</th>
<th>Vitamin</th>
<th>Zinc</th>
<th>Alkaloid</th>
<th>Steroid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of concentration</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

- Negative (absent)
+ Present in small concentrations
++ Present in moderately high concentrations
+++ Present in very high concentration.

Table 2: The haematological profile of male albino Wister rats fed with delicacy of Macrotermes nigeriensis for 28 days

<table>
<thead>
<tr>
<th>Groups</th>
<th>Hbg/100ml ± S.D</th>
<th>PCV% ± S.D</th>
<th>WBC per mm³ ± S.D</th>
<th>Platelets count x 10⁹/L ± S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control n = 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1 before M. nigeriens delicacy</td>
<td>12.5 ± 0.62</td>
<td>37.0 ± 1.2</td>
<td>3,500 ± 402</td>
<td>160 ± 82</td>
</tr>
<tr>
<td>Test rats before administrations of M. nigeriens low dose n = 20</td>
<td>12.8 ± 1.42</td>
<td>38.0 ± 2.2</td>
<td>3,700 ± 26</td>
<td>158 ± 24</td>
</tr>
<tr>
<td>High dose n = 20</td>
<td>12.6 ± 2.41</td>
<td>37.0 ± 1.4</td>
<td>3,600 ± 112</td>
<td>162 ± 30</td>
</tr>
<tr>
<td>Test t rats 28 days after administration of M. nigeriens Low dose n=20</td>
<td>14.0 ± 7.3</td>
<td>42.0 ± 7.4</td>
<td>5,000 ± 204</td>
<td>180 ± 58</td>
</tr>
<tr>
<td>High dose n=20</td>
<td>15.2 ± 0.64</td>
<td>45.0 ± 1.2</td>
<td>5,500 ± 180</td>
<td>192 ± 40</td>
</tr>
<tr>
<td>P-value</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
</tr>
</tbody>
</table>

There is a marked percentage difference between the control rats and the test rats fed with M. nigeriens in their haematological profiles.

Table 3: The biochemical profile of male albino rats on fried meal of Macrotermes nigeriensis for 28 days

<table>
<thead>
<tr>
<th>Groups</th>
<th>Protein g/l</th>
<th>Iron mmol/L</th>
<th>Lipids mmol/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control rats n=20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1 before M. nigeriens delicacy</td>
<td>63 ± 2.5</td>
<td>15 ± 0.8</td>
<td>4.2 ± 1.0</td>
</tr>
<tr>
<td>Test rats before administration of M. nigeriens Low dose n = 20</td>
<td>65 ± 1.7</td>
<td>14 ± 2.4</td>
<td>4.0 ± 0.6</td>
</tr>
<tr>
<td>High dose n = 20</td>
<td>62 ± 0.9</td>
<td>19 ± 1.8</td>
<td>3.8 ± 1.4</td>
</tr>
<tr>
<td>Test rats 28 days after administration of M. nigeriens Low dose n=20</td>
<td>80 ± 0.3</td>
<td>18 ± 7.2</td>
<td>4.4 ± 1.5</td>
</tr>
<tr>
<td>High does n = 20</td>
<td>76 ± 5.0</td>
<td>26 ± 3.0</td>
<td>5.0 ± 0.2</td>
</tr>
<tr>
<td>P-Value</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
</tr>
</tbody>
</table>

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DISCUSSIONS

The effects of consumption of Macrotermes nigeriensis on the biochemical and haematological profile of male albino Wister rats have been evaluated.

Observing the results obtained in this study (Tables 2 and 3), there is a marked significant effect of (P < 0.05) the Fred salt seasoned insect on the haematological and biochemical profile of the animals. The result recorded average of 30% improvement in the results obtained in the central test rats compared with their corresponding controls.

Africans especially Nigerians, seasonal consumption of Macrotermes nigeriensis is traditionally and culturally acceptable means of supplementing the meagre protein content of their high carbohydrate diets (Ekpo et al., 2009). The result obtained in the case of protein indicates that the termite is a good source of protein for animals and possibly man (Igwe et al., 2011). Protein plays a major role in body tissue repair and growth. An important function of the serum proteins is the maintenance of Osmotic balance between the circulating blood and the tissue spaces (Harold, 1977). These blood proteins are responsible for about 25mm of the total osmotic pressure of plasma. Serum protein like other proteins, are amphoferic and can thus combine with acids or bases. At the normal pH of the blood, the proteins act as an acid and combine with cations (mainly sodium). Proteins assist in transport of substances otherwise insoluble in plasma. Protein such as fibrinogen, prothrombin and albumin are produced solely in the liver (Harper, 1977) and are very helpful in blood coagulation. The phytochemical analysis of M. nigeriensis revealed the moderate presence of calcium ion which is helpful in bone formation and in clothing of blood in injured vessels.

The haemoglobin concentration (g/100mill) of the pricked cell volume (μ/L), white blood cell count (per mm³) and platelet count (count x10⁹/L) were increased, though within the normal range as a result of the administration of M. nigeriensis in the test rats. It could be deduced from these outcome that the iron content, proteinous content in the insect could have assisted in beefing up these haematological parameters. Iron and proteins are major contents of haemoglobin in the body.

Hence, the termite is suggested as a source of improving low blood levels in malnourished children and adults. Dietary fats increase the palatability of food by absorbing and retaining flavor.

Hence, the high lipid content observed in this termite could have contributed to its highly acceptable flavor when fried or roasted and may contribute to the reduced need of oil in the preparation of its delicacy (Igwe et al., 2011).

The results of the phytochemical analysis also showed that the termite has a moderate content of carbohydrate. Given the observed high lipids, protein and carbohydrate contents of this termite, it could be inferred that the delicacy, if adequately promoted, can help in controlling protein energy malnutrition, an imbalance between the supply of protein and energy, and the body’s demand for them to ensure optimal growth and function, which is currently ravaging children in developing countries (Okwu et al., 2010).

REFERENCES


Baranowski T., Dzewaltowski D., Kuzma A. et al., 2011). The effects of consumption of Macrotermes nigeriensis on the biochemical and haematological profile of male albino Wister rats have been evaluated.

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