EVALUATION OF PROTEIN QUALITY OF RAW AND ROASTED CASHEW NUTS \textit{(Anacardium occidentale)} USING WEANLING ALBINO RATS

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\textbf{ABSTRACT}

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Evaluation of the protein quality of raw and roasted cashew nuts \textit{(Anacardium occidentale)} yellow apple variety, using weanling albino rats showed that feeding the animals with the raw cashew nut based diet resulted in reduced weight gain \((2.75 \pm 0.31 \text{g})\) Nitrogen Balance (NB) \((2.22 \pm 0.11\%\)), Protein Efficiency Ratio (PER) \((2.37 \pm 0.38\%\)), Gross Protein Digestibility (GPD) \((57.00 \pm 0.21\%\)), Net Protein Utilization (NPU) \((42.77 \pm 0.23\%\)), Total Protein Digestibility (TPD) \((63.30 \pm 0.20\%\)) and Biological Value (BV) \((58.00 \pm 0.11\%\)). Roasting resulted in higher weight gain; \(3.68 \pm 0.19\text{g}\), NB; \(3.16 \pm 0.13\%\), GPD; \(66.0 \pm 0.14\%\), NPU; \(60.98 \pm 0.20\%\), TPD; \(71.00 \pm 0.13\%\), BV; \(76.00 \pm 0.10\%\) and PER; \(2.87 \pm 0.26\%\). Hence roasting is adjudged the better alternative of cashew nuts; preparation for use in animal feed formulation.

\textit{Keywords:} Protein quality, cashew nuts, roasting, Biological value

\textbf{INTRODUCTION}

Studies have shown that nuts do not only contain protein in appreciable quantity and quality but that their proteins have superior amino acid composition which gives them nutritional and economic edge over other plant product (Ulyat, 1984). Like nuts of other tropical crops cashew nuts \textit{(Anacardium occidentale)} yellow apple variety is reported to contain among other chemicals a reasonable amount of protein (Penny & Suess, 2000). The word “Cashew” is the common name for the \textit{Anacardium occidentale}, a member of the \textit{Anacardiaceae} family or the cashew family. Two other important plants in this family are mango tree and pistachio tree. The Portuguese who brought the tree to India from Brazil named the mysterious nut the “Caju” which is not too far from what we call it today, (Colliers Encydopedia, 1989). Thus it is assumed that the Portuguese who planted cashew trees in East Africa and India were already aware of the importance of cashew as an edible nut. The plant therefore crossed the Atlantic Ocean with the Trans Atlantic trade and found its way to West Africa including Nigeria (Opeke & Vickery, 1987).

Cashew has proven to be a good crop in areas where other tree crops produce little or nothing. It is of medium size with spreading canopy often with branches that droop (Naggy, 1980). The cashew has the apple and the nut. The cashew apple is the fruit that surrounds the cashew kernel or nut. Technically the actual nut is the thick-shelled seed which is encased in an impenetrable rock hard shell. The apples are usually discarded in pursuit of the nuts which when processed and stored properly the cashew nuts can be kept for one year or longer (Himejima, 1993).

In rural communities of Nigeria consumers of cashew nuts roast the dry and mature nuts in hot wood ash for up to thirty (30) minutes before they are cracked and eaten. Edet, (2007) reported significant effect in the proximate composition, minerals, toxicants and vitamin contents of cashew nut subjected to roasting at \(250^\circ\text{C}\) for thirty (30) minutes. In view of this, the study was set up to determine some indicators of protein quality in cashew nut and to recommend the better alternative preparatory method of cashew nut for use in animal feed formulation.

\textbf{MATERALS AND METHODS}

Source, Collection and Treatment of Sample before analysis: The cashew nuts (yellow apple variety) used for the study were obtained from a plantation in the premises of Cornelia Corneli College, Uyo in Akwa Ibom State, Nigeria. The plantation had average of 85-100 trees. Healthy and mature nuts were taken to the laboratory where they were massaged and cracked using a hand operated serrated knife and the kernel extracted from the shell using a nut pick. The red papery skin that surround each kernel was peeled off with a small knife, the ‘naked’ nut washed with cold water to remove any dirt and allowed to dry in air but without exposing the nuts to sunlight. The kernels were pooled and group into lots; portion X and Y. Portion X kernels were ground in a blender. Portion Y were spread out as a monolayer of kernels on non-perforated tray and introduced into a preheated hot air circulating oven (BS – 250 Gallenkamp. UK) for 30 minutes at temperature \(250^\circ\text{C}\). Roasting period was taken from the moment of introduction into the oven. The roasted sample was removed from the oven; allowed to cool in air and ground in a mill to pass through a 30mesh sieve.
The two groups were stored in airtight containers labeled Portion X (Raw) and Portion Y (Roasted) from which required quantities were used for biological determinations.

**Experimental animals:** A total of thirty (30) weanling albino rats aged 35-38 days and weight between 70-75 g were used as experimental animals. Within this weight and growth these animals are almost linear. Males were preferred to females because of the ease to collect faecal and urinary waste separately with the males (Flatt, 1985). All the rats were docile and in good health; and were obtained from the Pharmacy Department of University of Uyo, Akwa Ibom State. The animals were divided into three groups of 10 each. Animals in group A were used as control group while those in group B and C were used as test groups I and II respectively. All the animals were marked differently, weighed and confined in three different metabolic cages (marked A, B, C) which separated faeces and urine by arrangement of sieve and provided enough space for free movement of the animals.

**Preparation of samples/diets:** The basal diet for the control group was the commercially prepared pellet (Vital Feeds) manufactured in August, 2009 by Grand Cereals and Oil Mills Ltd., Jos. Approximately, 99 dry matter of the basal diet contained 14.50% crude protein, 7.00% crude fat, 8.00% crude ash, 7.20% crude fibre and 250Kcal/Kg of metabolisable energy. The diet of the test group I (Group B) animals had 70% of the basal diet plus 30% of the raw cashew nut meal while that of test group II (Group C) animals had 70% of the basal diet plus 30% of the roasted cashew nut meal.

**Feeding of the animals:** The feeding required for the trial test (test sample 1 and 2) were thoroughly mixed to obtain a uniform composition and given to the animals for 5 days to accustom the animals to the diet and to clear from the tract the residues of the previous feed (Schneider & Flatt, 1983). The preliminary period was followed by a period when weight gain, food nitrogen intake together with that voided in faeces and urine were measured. Rats in group A were fed with commercially prepared pellets while those in Group B and C were fed at 10% protein level of the test sample for 28 days (Mitchel, 1985). Meals were given at the same time each day and the amount of feed given did not vary from day to day.

**Weighing of animals & collection of nitrogen containing by-products:** Growth responses of the experimental animals were closely monitored by weight determination using chemical balance. This was done every morning before administering the day’s feed. Faecal waste was collected, put in airtight container and stored in cool dry place (Temperature 30°C) prior to protein quality evaluation. Daily urinary collection was also made by making the animal to squirt their urine on absorbent foil which were later suspended in a corked flask containing 10mls conc. HNO₃ as preservative prior to biological evaluation.

**Biological determinations:** The gain or loss in weight of the animals were determined by subtracting the initial weights from final weights. The urinary and fecal nitrogen were determined by modification of technique originally devised by Kjeldahl (A.O.A.C, 1984). The nitrogen balance was obtained by finding and differences between nitrogen intake and that voided in faeces and urine (Watt, 1980). The PER was estimated by accurately measuring the dietary intake and the weight gained by the animals and then finding their ratio. (Osborne et al., 1979). The GPD was determined by expressing the weight of the nutrients digested as proportions of weight consumed. The TPD were reported as the percentage of nitrogen that is digested. The NPU was estimated by expressing the retained nitrogen in the body and the nitrogen intake as percentage while the BV was determined by expressing the ratio of NPU and TPD as percentage (Campbell, 1983).

**Data analysis:** The data obtained were analyzed using ANOVA statistical method of analysis.

## RESULTS

The results obtained from the study are presented in Table 1.

### Table 1: Results of Biological Evaluation of Protein Quality of raw and roasted cashew nuts in growing rats

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight gain (g)</td>
<td>3.55±0.23</td>
<td>2.75±0.31</td>
<td>3.68±0.19</td>
</tr>
<tr>
<td>Nitrogen Balance (%)</td>
<td>1.40±0.20</td>
<td>2.22±0.11</td>
<td>3.16±0.13</td>
</tr>
<tr>
<td>PER (%)</td>
<td>6.86±0.52</td>
<td>2.37±0.38</td>
<td>2.87±0.26</td>
</tr>
<tr>
<td>GPD (%)</td>
<td>87.0±0.24</td>
<td>57.00±0.21</td>
<td>66.00±0.14</td>
</tr>
<tr>
<td>NPU (%)</td>
<td>60.34±0.33</td>
<td>42.77±0.23</td>
<td>60.98±0.20</td>
</tr>
<tr>
<td>TPD (%)</td>
<td>98.60±0.33</td>
<td>63.30±0.20</td>
<td>71.00±0.13</td>
</tr>
<tr>
<td>BV (%)</td>
<td>50.00±0.20</td>
<td>58.00±0.11</td>
<td>76.00±0.10</td>
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</table>

All values are means of duplicate determination ±S.D; Group A = Animals fed with basal diet (Control); Group B = Animals fed with mixture of basal diet and raw; cashew nuts; Group C = Animals fed with mixture of basal diet and roasted cashew nuts.
DISCUSSION

The effects of feeding growing rats with raw and roasted cashew nut based diet showed average weight gain of 3.55g±0.23g, 2.74±0.31g and 3.68g±0.19g for groups A, B and C respectively. Since growth is indicated by weight gain and increase in size (Silva, 1982) weight lose or reduction in size shows that the taste diet is either not supporting growth or that it has some interferences. Less feeding can lead to weight loss but this condition can be improved if there is a boost in the appetite of the organism in question. Church (1980) reported that the combination of various types of vegetables proteins provides palatable food with adequate amino acid balance. Equally roasted cashew nuts have been shown to contain less toxicants including chelators of bone minerals (Edet, 2007); they are also reported to be tastier and to improve appetite (Penny & Suess, 2000). These advantages offered by the pellets mixed with roasted cashew nut cake might be the reason behind the adequate consumption and subsequent increase in weight of the group C animals; even more than the control group. The result of nitrogen balance of the three groups of experimental animals as shown in the table indicate that the quantity of nitrogen excreted by the rats in the test groups was not so much to have resulted in negative nitrogen balance. It means therefore that tissue synthesis, replacement and growth actually occurred in the animals. The results also showed that PER of the test diet (roasted) was higher than that of the raw diet (2.37±0.38) FAO/WHO, (1986) reported PER of 2.4% and 1.20% for groundnut and soybeans. Drying and storing of legumes and nuts have been reported to reduce their PER; but low moisture increases it (Bjorn & Maria, 1993). PER values is also affected by health of animals, palatability of diet, selectivity and other parameters (Ulyat, 1984). The result obtained for GPD of the test diets confirmed what Saucer and Lange (1992) reported; that heat treatment are most effective in improving digestibility when used for specific purposes of inactivating the digestive enzyme inhibitors present in foods. The NPU values obtained in the study were within the 76-70% RDA of FAO/WHO (1986) for use in protein quality evaluation. The decrease values of TPD of the raw and roasted cashew nut based diets might be attributed to the composition of the cashew nut diets. Edet (2007) reported that cashew nut cake is high in crude fibre and crude fat. Vanhoest (1982) claimed that foods low in fibre are well digested by ruminants and non ruminants but a dietary excess of lipids will inhibit rumen micro-organisms thus reducing digestibility. As shown in the results, a remarkable increase in BV for the roasted nuts is a clear indication of the protein quality for maintenance and growth in the growing animals.

CONCLUSION

From the study, it is clear that roasting seems to be desirable to obtain a cashew nut meal that has improved characteristics. Thus incorporation of cashew nuts in roasted form in animal feed can contribute to their maintenance and growth.

REFERENCES


