Agrosearch
Vol. 2, Nos. 1& 2, 1996. pp 95 - 100

CHEMICAL AND BIOLOGICAL EVALUATION OF THE AFRICAN WALNUT - *Coula edulis* (Baill). Bioavailability of Nutrient, using rat bioassay.

BELEWU, M.A.
Department of Animal Production
University of Ilorin
Ilorin, Kwara State, Nigeria.

ABSTRACT

The biological value of African Walnut (Coula edulis Baill) in the raw, boiled and oven dried forms were assessed. The average crude protein content varied between 8.96 and 21.80 percent which was highest for the oven dried and least for the boiled sample. A considerable amount of ether extract was recorded (41.00%) for the oven dried sample when compared to the other two samples. The observed concentration of energy and other extract content in *Coula edulis* appear to have a favourable effect on the nutritional value of the nut. Boiled sample contained relatively lower quantities of the nutrient determined. The drymatter digestibility of the raw, boiled and oven dried samples was 87.4, 75.8 and 89.0% respectively. Similarly, reduction occurred in the apparent digestibility of crude protein, crude fibre, ether extract and nitrogen free extract. The study revealed increasing in weight gain for animals fed the boiled sample while lower weight gain were recorded for animals on raw and oven dried samples. The potential of consuming the boiled walnut as food by man and animals is evident by its nutrient concentration in term of carbohydrate, fat, crude protein and amino-acid profile.

Key words. African Walnut, Wister rats, feed intake and digestibility.

INTRODUCTION

Nigeria was ranked fourth among the top 10 countries with the highest annual population increase in the World (Vanguard Newspaper, 1994). It is the only African country with an annual population growth of 3.3 million people (Vanguard Newspaper, 1994). Feeding the teeming population has been the major problem in this country. There is therefore, the need to pay more attention to home grown sources of protein and carbohydrate nuts. Among the local and well known nuts are groundnut, cashewnut, barbara nut and coconut, while *Coula edulis* is one of the premier fores. plant of the West Coast of Africa extending from Sierra-Leone to Garbon and British Congo (Itam, *et al*, 1983). It is a rare, deciduous plant having small and yellowish green flower. The fruit is a drupe with a smooth fleshy green husk representing the exocarp and mesocarp. The nut is hard-shelled and cannot be cracked easily while the edible non endosperm part of the cotyledon is distinctly two Lobed. The nut kernels are rich in fat and protein. Research on its biological evaluation for man and animals is lacking. Itam *et al* (1983) reported the earliest information on its chemical evaluation. These scientists found that some of the amino-acids and minerals are comparable with other reports in literature (Fetuga *et al*, 1974). If the

nut is ever to become a well accepted and commercial food, more research is needed to know the potential of the nut in the tropics. Therefore, the objective of this experiment was to determine effects of feeding boiled and oven dried *Coula edulis* samples compared with raw sample on feed intake, digestibility, and liveweight gain in rats.

MATERIALS AND METHODS

Preparation and storage of samples

The Walnuts used for this study were obtained from the local market in Ilorin, Nigeria. The quantity obtained was divided into three equal parts A, B, C corresponding to the three respective treatments. Treatment A was the raw sample, treatment B was boiled sample obtained by boiling for about 45 minutes while treatment C was ovendried sample obtained by drying in a hot air oven at 70°C for 2 days. Therefore, the nut kernels of each sample were cut into pieces, milled in a Wiley press to pass through 0.5mm sieve and separately stored in a sealed Kilner jar, labelled and kept in a deep freezer (-4°C) until needed for feeding and chemical analyses.

Analytical Procedure

Samples of feed, faeces and orts were analysed in duplicate for the proximate composition using the method of the Association of Official Analytical Chemists (1980). Crude protein was calculated from N determined by the Kjeldahl method while ether extract was measured by subjecting the sample to petroleum ether (Bp 60-80°C) extraction using a soxhlet extraction apparatus. Crude fibre was determined by the method prescribed by Cullison (1982).

Feeding and digestibility

The feeding and digestibility trial were carried out with a total of 18 adult male Wistar rats of average initial weight of 29.83g and approximately 4 weeks of age. They were allocated to the raw, boiled and oven dried sample treatments as 100% of their diets. The feeds were fed to appetite for a 4 day adjustment and preliminary periods followed by a 6 day collection period. Water was offered *ad libitum*. Feed refusals were weighed before each morning feeding. The daily faecal output were collected, weighed and oven dried at 70 C for 48 hours. The faeces was later bulked, milled and stored in Kilner bottles for chemical analysis.

Statistical analysis

All data were subjected to analysis of variance using the model of a latin square design. Significant differences between means were separated by Duncan multiple range test (1955).

RESULTS AND DISCUSSION

The results of the proximate composition are shown in Table 1. Oven drying improved the chemical composition of the diet as compared to the boiled sample. The crude protein content in the treatments ranged from 8.96% for the boiled to 21.80% for the oven dried samples. Boiling of walnut resulted in a loss of crude protein content. The loss could be attributed to the dissolution of soluble nitrogen into the boiling water.

Appreciable increase in crude protein content was observed in treatment C after oven drying. The variation in the crude protein content of treatment C compared to other treatments A and B could probably be due to the differences in the percentage of dry matter content of the samples. It

was also noted that treatment C led to a higher fat content than treatment A. The reverse was true however, in the case with treatment B. It was also noteworthy that the nut contained between 3.91 and 5.68 Kcal. of energy. The observation that the nut contain a relatively higher percentage of fat (ether extractable) is consistent with the previous results in literature (Item *et al*, 1983).

The African Walnut is of great nutritional value since the high fat and protein content of the kernel would to some extent compensate for and complement the low and poor protein diets consumed in the tropics. Despite its potential as fat and protein sources the nut has not assumed any considerable importance in the nutrition of man and animals in Nigeria due solely to lack of information on its biological value.

Feed intake and digestibility studies

There were significant differences in the dry matter intake of rats on boiled sample compared with those on the other two samples. This could be attributed to the energy density of this diet as well as the protein content (Table 1). The results of the biological value (Table 2) with rats showed that raw nut did not support growth and gave significantly ($P<0.05$) lower feed intake. This could be due to the presence of some anti-nutritional factor (Oxalate, 2695mg/kg; Tannin, 89.7mg/kg; HCN, 4.32mg/kg) in the raw nut as reported in literature (Item *et al*, 1983). The negative effect of feeding tannin on the growth performance of rat was reported by Handler and Baker (1944). Facts abound in literature on the negative effect of HCN on growth performance of livestock (Arguedas & Cooke, 1982; Ifut, 1987, Adeneye, 1991 and Belewu 1992). This is due to the reaction of HCN with various nutrients (Vitamin B , thiosulphate and metcaptopyraviate) during metabolic processes in the body of the animal. Boiling improved the consumption of the nut compared to oven drying. This is due to the solubility and denaturation of some anti-nutritional factors (tannin and HCN) by this process. This agreed with the report that tannin and HCN are water soluble glucosides (Oyenuga, 1968). The boiled nuts resulted in a gain with higher efficiency (2.67) compared with the other two treatments. It will, therefore, appear from this study that boiling confers measurable beneficial effects on the feed intake and growth rate of the rats.

The results of the apparent digestibility coefficient of the nutrients in raw, boiled and oven dried samples are shown in Table 3. The digestibility coefficients of ether extract of diets A, B and C were similar however, there were higher changes in the apparent digestibility of the other nutrients of the treatments. Heat treatment improved the protein content in African Walnut although the protein digestibility values obtained were rather low, compared to the value recorded for the boiled sample. The comparatively lower nutritive value of oven dried and raw samples could be due to the anti-nutritional factors in these samples not denatured by heat. Boiled nuts gave the best results of nitrogen ether extract digestibility. The presence of undigested and unabsorbed food (metabolic faecal nitrogen) in this study could affect the absolute value recorded. The results however, demonstrated that boiling treatment reduced the anti-nutritional factors as well as improved the apparent digestibility of all nutrients of the nut.

Mortality

Two rats each on treatments A and C died during the experiment. However, no pathological study was done on the dead rats but the death could be attributed to the toxicity of tannin and HCN contents of diets A and C. This agreed with the work of Whailey (1959) who reported similar mortality when chicks, rodents and ruminants were fed carob leaves and fruits containing tannin while Akanji (1994) reported the pathogenesis of certain metabolic disorder (Cytotoxic hypoxia, dysfunction and final death) due to the high concentration of HCN in the diet. They concluded that tannic acid and HCN have deleterious properties which depressed feed intake, poor growth, reduced efficiency of feed utilization and death of livestock (Hill, 1977).

CONCLUSION

The results for the treatments indicate that the nut is highly nutritive and digestible and should be encouraged in the diet of Nigeria populace. This finding is an encouraging one for providing concentrated digestible food in pralines, sandwiches, candies, bakery good as well as flavouring in confectionery and ice-cream.

REFERENCES

Adeneye, J.A. (1991). Souring livestock feed production: Another look at cassava. Paper presented at the workshop on expanding cassava processing option. Cassava programme at Gateway Hotel, Ijebu Ode, Ogun State from 14 - 17th October, 1991.

Akanji, O.A. (1994) Cassava intake chronic sublethal cyanide intoxication and risk of metabolic disease in humans. Incomplete International Workshop on Cassava safety 1 - 4 March, 1994.

Arguedas, P. and R.D. Cooke (1982) Residual Cynide concentration during the extraction of cassava starch. *J. Feed Technol.* 17: 251 - 262.

Association of Official Analytical Chemists. A.O.A.C. (1980). Official methods of Analysis, 13th edn. Washington, D.C.

Belewu, M.A. (1992) Evaluation of broiler litter and cassava wastes as feeds for the White Fulani Cattle. Ph.D. Thesis, University of Ibadan, Nigeria.

Cullison, A.E. (1982) Feed and Feeding, 3rd edn. Reston, VA, U.S.A., Reston Publishing Company Inc.

Duncan, D.B. (1955). Multiple range and multiple F-test, *Biometrics* 11; 1-42.

Fetuga, B.L., G.M. Babatunde and V.A. Oyenuga (1974) Protein quality of some unusual protein foodstuffs. Studies on the African locust bean seed, Parkia filicolidea. *Brit. J. Nutri* 32: 32.

Handler, P., and R.D. Baker (1944) Toxicity of orally administered tannic acid. *Science* 99: 393 - 394.

Hill, D.C. (1977) Physiological and Biochemical Response of Rats. Given potassium cyanide or Linamarin. In Cassava as Animal Feed. pp. 33 - 42.

Ifut, O.J. (1987) The nutritional value of *Oliricidia sepium* Panicum maximum and peels of *Manihot spp* fed to West African dwarf goats. Ph.D. Thesis, University of Ibadan, Ibadan.

Itam, E.E., O.U. Eka and E.T. Ifon (1983). Chemical evaluation of nutritive value of African Walnut *Coula edulis*(Baill). *Nig. J. Sci.* 17: 11 - 19.

Oyenuga, V.A. (1968) *Nigeria's Foods and Feeding Stuffs Their Chemistry and nutritive value.* Ibadan University Press p. 20 - 27.

Vanguard Newspaper (Nigeria) (1994) Nigeria, India's population rank highest. September, 8th, 1994.

Vailey, W.B. (1959) The toxicity of plant phenolic (ed. T.W. Fairhairn). Academic Press, New York p. 27 - 31.

Table 1: Proximate composition of raw and processed African walnut* Coula edulis (Baill).

Parameters	Raw	Boiled	Oven dried
Moisture	30.48	40.39	19.13
Crude protein	12.50	8.96	21.80
Crude fibre	2.73	2.74	2.73
Ether extract	29.00	27.00	41.00
Ash	2.67	2.65	3.73
Nitrogen free extract	22.51	18.26	1.61
Gross energy (Kcal/g)**	4.94	3.91	5.68

* Mean of 4 determinations
** Calculated from the proximate composition.

Table 2. Performance characteristics of rats fed African walnut - *Coula edulis*(Baill)

Parameters	Raw	Boiled	Oven dried	±SE
Dry matter intake (g)	1.43[a]	2.94[b]	1.42[a]	±1.03*
Initial body weight (g)	31.63	28.70	29.17	±2.31ns
Final body weight (g)	27.38[a]	39.67[b]	26.32[a]	±2.35*
Weight gain (g/day)	-4.25[a]	1.10[b]	-2.85[a]	+0.80*
Feed efficiency	-0.34[a]	2.67[b]	-0.50[a]	±0.83*

Mean with the same superscript in the same row are not significantly different from each other (P>0.05).

Table 3. Apparent digestibility coefficient of nutrients in raw, boiled and oven dried African walnut fed to rats.

% Digestibility	Raw	Boiled	Oven dried	+SE
Dry matter	87.41	75.81	88.97	+1.50ns
Crude protein	44.44[a]	76.92[b]	48.39[a]	+2.80*
Crude fibre	75.00	70.00	73.00	+1.65ns
Ether extract	92.68	93.67	96.55	+3.75ns
Energy	59.48	63.30	60.14	+1.40ns

Mean with the same superscript in the same row are not significantly different from each other (P>0.05).