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The Physiological Impact on the Consumption of *Albizia saman* Pods by Albino Rats

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Abstract: The impact of using *Albizia saman* in a whole and supplementary feeding of laboratory rats (Sprague Dawley) was investigated in a twelve week experiment. In the first trial, whole pods were presented to the animals, while in the second trial five supplementary diets were formulated using *A.saman* at 0, 15, 20, 25 and 30% supplementation. Upon presentation of the plant materials, there was a rapid response and movement of the rats towards the pods of *A.saman* either as a whole feed or supplementary feed. Despite the fact that the pods were well received and consumed, it did not support the growth and development of the rats. When presented as supplement, there was a good consumption of the feed with a corresponding good growth rate with group C (25%) having the highest consumption rate while Group A (0%) recorded the least. There was a steady weight increase in rats given supplementary feeds; Group D had the highest weight gain while Group A had the lowest. Hematological analysis showed Group B having the highest values for PCV, Hb and RBC and low at 25 and 30%. Total protein, albumin and cholesterol values were highest in Group D and lowest in Group E. There were no significant differences in the values of serum enzymes (ASP, ALT and AP), serum electrolyte concentration and proximate analysis of the experimental rats feed with the different supplementary diets. The result of this study has shown that although the pods of *A. saman* either as raw or milled were well received by the albino rats, it may not be suitable as whole feed except when combined with other feed materials. The pod is best at 15-25% level of supplement, optimizing at 25%.

Key words: *Albizia saman*, albino rats, pods, supplements, consumption

INTRODUCTION

Tree leaves and pods form a natural part of the diet of many ruminant and non ruminant species and have been used traditionally as sources of forage for domesticated livestock in Asia, Africa and the Pacific[1]. The leaves, stems and fruits may be used either as a complete feed or as a supplement to other feeds[2]. Plant species commonly used are from the genera: Acacia, Calliandra, Desmodium, Desmenthus, Sesbania, Gliricidia and Albizia[3].

Albizia saman formerly called *Samanea saman* (family Leguminosae), is a fast growing tree commonly used as a pasture, shade or for ornamental purposes[4]. It can be easily cultivated and the pods are preservable over long periods. The mature trees bear on average 200-250 kg (440-550 lb) of pod per season and they occur in vast quantities[5]. When ripe, the pulp is sweet and sugary with a flavor similar to that of chocolate. It is valued on pasture farms where it shades livestock, provides nutritious pods and encourages the growth of green lush grass[6]. In latin America, the fruit pulp is used to make a beverage and in the Philippines, a decoction of the innerbark is applied to cure diarrhea while in Venezuela, the roots are made into a hot bath for stomach cancer[5]. The pods of A. saman are used as a valuable component of pasture system of animals and make an excellent feed supplement for cattle, goats and sheep[5].

In spite of the potentials of the rain tree, conscious efforts have not been made to utilize it for livestock feeding. Owing to the high cost of raw materials of feeds, the cost of maintaining domesticated animals (including laboratory rats) has gone up and since *A. saman* can be easily sourced, free and is available in vast quantities[5], it is best to try and see if it will be acceptable to some laboratory animals like the albino rats. Recent study by Oduguwa[7] showed that *A. saman* can be included in rabbit diets and that autoclaving eliminated the negative effects of anti-nutritive factors which appeared to impair proper feed utilization in the A. saman pod diets. Therefore, the objectives of this study is to investigate the acceptability of the pods by the albino rat *Sprague dawley* and the consequence effects it would have on the physiology of albino rats when used in complete and supplementary feeding.

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MATERIALS AND METHODS

Collection of pods: Ripe and fresh pods of Albizia saman were collected between January and February, 2005 within the University of Agriculture, Abeokuta (UNAAB) campus.

Feeding trial: Fifty albino rats (average weight of 66.5g) were obtained from the animal house of the Department of Biological Sciences, University of Agriculture. They were weighed using the sensitive electronic weighing machine (Mettler DM 11-K) and grouped into cages. Each group consisted of three females and two males. They were fed daily with ripe and freshly collected A. saman pods in varying treatments (Whole pods; peeled pods without seeds, peeled pods with seed and milled pods) and later in supplements with the control feed and given water ad libitum. The initial feeding trial with fresh pods was conducted for six weeks while the supplementary feeding trial was done for another six weeks. The animals were divided into two groups of twenty-five each for the two experiments. For the supplementary feeding trial, dry and freshly collected pods of A. saman were cleaned, oven dried at 90°C for 2 days and milled into smaller particles. Using standard methods as described by the Association of Official Analytical Chemists AOAC[8], the proximate analysis for crude protein, fat, moisture and carbohydrate content of the control feed and *A. saman* pods were determined. From the results, a feed formulation table was prepared as shown below (Table 1).

At regular intervals, the body weight of rats in all groups was measured and recorded for the duration of the experimentation. Daily feed consumption rate was determined by subtracting final weights from initial weights of feed given and behavioural changes were noted.

Haematological analysis: At the end of six weeks of treatments blood samples were collected from representative rats of each group by cardiac puncture method. Two sets of blood samples are collected from each animal. Samples for serum analyses were decanted after centrifugation, while Ethylenediamine Tetra Acetic acid (EDTA) was added to samples for whole blood analysis. Parameters determined included serum total protein, its globulin and albumin fractions and serum urea. Parameters determined from whole blood were Packed Cell Volume (PCV), Haemoglobin (HB), Red Blood Cell (RBC), White Blood Cell (WBC), Mean Cell Volume (MCV), Mean Cell Haemoglobin (MCH) and Mean Cell Haemoglobin Concentration (MCHC).

Analytical methods: The serum was analyzed using the reagent kits (Randox Lab, Ltd, Crumlin Co. UK) for total protein, glucose, albumin, cholesterol, triglyceride, Blood Urea Nitrogen (BUN), creatinine, urea, phosphate, serum aspartate aminotransferase(AST), serum alanineaminotrasferase(ALT), alkaline phosphatase, sodium (Na), potassium (K), Chloride (Cl) and Calcium (Ca) at the Clinical Chemistry laboratory of the University of Agriculture, Health Centre, Abeokuta.

Statistical analysis: Tests of significance of difference between treatment means were carried out by Analysis of Variance (ANOVA)

RESULTS

The initial trial feeding of the albino rats with whole or peeled or milled showed that there was an immediate response and movement of the animals towards the container containing *A. saman*. The plant feeds were well received and consumed by the rats. The amount and rate of consumption were higher for milled pods than whole or peeled pods. Initially, there was an increase in the body weight of the rats during the first week of the feeding trial. However, there was a decline in the body weight of the rats as from the second week despite the appreciable increase in the consumption of the plant feeds. The rapid decline in body weights in experimental animals was accompanied by physical changes such as frizzy looking body hairs, scratching of body parts especially the head region and changes in faecal colour from black to brown. Also, a high degree of cannibalism was exhibited among the animals which led to a high mortality before the experiment was aborted at the end of the sixth week.
albizia saman supplematary feeds

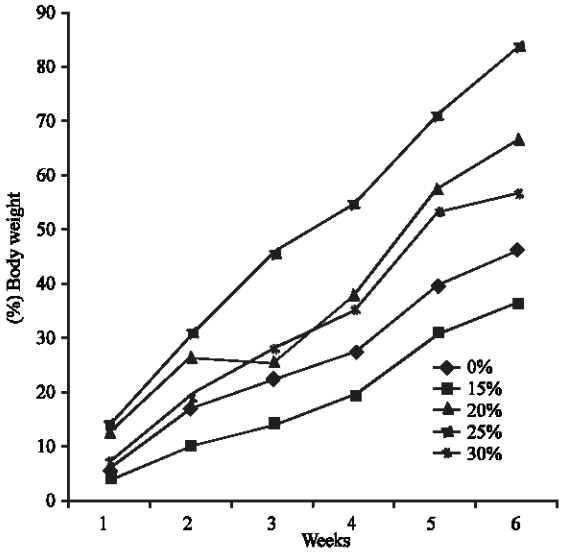

Fig. 1: Percentage body weight gain of albino rat given

Table 1: Proximate and percentage composition of experimental diets

Group ingredients	A Control (0 % inclusion)	B 15 % inclusion	C 20 % inclusion	D 25 % inclusion	E 30 % inclusion
Maize	30	30	30	30	30
Albizia saman	-	15	20	25	30
Groundnut cake	15	15	15	15	15
Wheat offal	15	15	15	15	15
*Palm kernel cake	30	15	10	5	0
Soya bean cake	4	4	4	4	4
Bone meal	3	3	3	3	3
Oyster shell	1.5	1.5	1.5	1.5	1.5
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Fish meal	1.00	1.00	1.00	1.00	1.00
Total (g)	100	100	100	100	100

Note:*The replacement of palm kernel cake with *A..saman* was varied according to the percentage of supplementation

Table 2: feed consumption and growth rate of rats given *A.samon* supplements

Diets/weeks	1	2	3	4	5	6	Overall growth rate
A	88.56	79.27	85.89	75.87	86.78	86.07	0.9850
B	91.74	80.71	82.27	84.10	87.79	85.53	0.9750
C	93.88	85.11	81.99	87.75	89.08	85.82	0.9445
D	90.12	84.39	83.39	83.32	87.33	87.31	0.9948
E	88.58	78.03	77.78	84.58	86.36	83.09	0.9806

Table 3: Effects of supplementary feeding on blood parameters of albino rats

Parameter	0%	I5%	20%	25%	30%
PCV %	39	4.1	40	25	27
Haemoglobin g/dl	12.89	13.67	13.30	7.89	8.90
Red blood cell mm/ml	3.10	5.02	4.40	3.47	3.43
White blood cell No/mm^3	2.05	2.75	7.50	9.15	7.60
Mean Cell Volume (MCV)U^3	12.58	8.17	9.10	7.20	7.87
Mean Cell Haemoglobin(MCH)	4.16	2.72	3.02	2.27	2.60
Mean Cell Hae Conc(MCHC) %	0.33	0.33	0.33	0.32	0.33
Glucose	80	149	104	79	101
Total protein	43	40	45	46	27
Albumin	26	24	27	28	16
Cholesterol	124	115	129	133	78
Blood urea nitrogen	11	10	12	12	7
Creatinine	1.0	0.9	1.1	1.0	0.6
Phosphate	2.2	2.1	2.3	2.4	1.4
AST	6	5	6	7	3
ALT	5	4	5	6	3
Alkaline phosphate	40	43	48	49	29
Sodium (nmol/l)	97	90	101	104	61
Potassium (nmol/l)	2.6	2.4	2.6	2.7	1.6
Chloride (nmol/l)	70	65	73	75	44
Calcium (mg/dl)	5.2	4.8	5.4	5.6	3.3

AST---Aspartate aminotransferase ALT---Alanine aminotransferase

Feed supplementation: The *A. saman* pods supplemented feed were well received by the animals. Feed consumption rates were observed to be higher than when the rats were fed with whole pods and consumption rate was highest in group C (20% supplementation) and lowest in the control group A (0% supplementation) following the order C > D> B > E > A (Fig. 1). However, group D (25% supplementation) recorded the highest body weight gain while group A (0% supplementation) recorded the lowest body weight gain following the order (Table 2). Unlike, the initial feeding trial, there was no observable negative change in the physical appearance and body weight of rats in all groups. There was a steady increase in body weight of animals fed with *A. saman* supplemented feed, despite the unpredictable pattern in feed consumption (Table 2). There were no observation of scratching neither was there any change in faecal colour. During the course of the experiment, births were recorded among animals in groups A, B and C (O, 15 and 20% supplementation) while no birth was recorded in groups D and E (25 and 30% supplementation).

Haematological assay: Rats fed with 15% of *A.saman* supplementary feed had the highest red blood cells count (RBC) while those fed at 25 and 30% had comparatively low PCV. The white blood cell (WBC) counts were however high for 20, 25 and 30% while that of 0 and 15 were very low.

Blood serum chemistry: Analysis of the rats fed on *A. aman* supplementary feed is shown in Table 3 below. High glucose value was observed in group B (15%) following the trend of haematological assay but values of total protein, albumin and cholesterol was seen to be highest in Group D (25%). Low values were generally recorded for group E (30%) except glucose value.

Enzyme concentration: The enzyme analysis of the rats fed supplementary diet of *A. saman* showed similar values of enzyme concentration: serum aspartate aminotransferase(AST), serum alanine aminotrasferase(ALT), alkaline phosphatase, in groups A-D with group E (30% supplementation) showing relatively low values.

Electrolyte concentration: The result of the electrolyte concentration of the blood of rats fed supplementary diet

Table 4: Proximate analysis of feeds, albizia saman pods and rats fed on supplemented feed

Sample	Moisture	Dry matter	Fat	Crude protein	Crude fibre	Ash	Nitrogen	Carbohydrate
0%	75.66	24.34	2.86	16.50	1.21	1.43	2.64	2.34
15%	75.32	24.18	3.18	16.20	1.22	1.57	2.59	2.51
20%	76.81	23.19	3.15	16.80	0.92	1.55	2.69	0.41
25%	74.20	25.80	3.68	16.31	1.32	1.78	2.61	2.71
30%	75.88	24.12	6.89	16.35	0.48	1.28	2.62	0.42
A. salmon	26.32	73.68	4.18	18.90	27.76	9.74	3.02	10.1
Control feed	7.62	92.38	4.21	18.81	4.43	4.43	7.03	57.90

showed similar values of sodium, potassium, chloride and calcium in groups A-D with group E (30% supplementation) showing relatively low values.

It was observed that result of blood serum chemistry. Enzyme concentration and electrolyte concentration followed the same trend: D>C>A>B>E with low values recorded at 30% supplementation (group E).

Proximate analysis: The results of the proximate analysis conducted on the control feed and *A. saman* pods is shown in Table 4. Similar values of crude protein were observed in both samples with varying amounts of other parameters.

Results of proximate analysis of rats in group A-E are also shown in Table 4. Values of crude protein, nitrogen content and fat content, dry matter content were similar in groups A-E, except that group E (30%) had a comparatively higher fat content.

DISCUSSION

A. saman pod either as whole or supplementary feeds is acceptable and readily consumed on presentation to albino rats as shown in this study. The *A. saman* pod emits a strong aroma which was well perceived by the rats as their search for food is guided majorly by their olfactory senses. When ripe, the pulp of A. saman is sweet and sugary with a flavor similar to that of chocolate[6]. The sweet taste of the pods as reported by Morrison[9] may have further contributed to its good consumption.

Feed consumption during feeding with *A. saman* pods only was not commensurate with bodyweight gain by the rats (Table 2). Also, the brownish faecal color reflects the color of the pods indicating the fact that the rat could no totally process or digest the plant parts. An envisaged limitation to the use of rain tree and other leguminous crops is the presence of toxic factors in their products. Asserted that these antinutritional factors like protease inhibitors, tannins, saponins, lecithins and alkaloids are almost ubiquitous in leguminous plants. However, when the pods were used as feed supplements, there was an appreciable gain in body weight of the rats. Similar results were obtained by Chicco[10,11] reported that many of the toxic factors can be removed by simple processing methods like dehulling, soaking, fermentation, heating, or treatment with acid, alkali, or sodium bicarbonate. Thus, any of these treatments will make the pods readily acceptable and useful to the animals. Percentage weight gain was highest at 25% (group D) and fed consumption was highest at 20% (group C). Comparatively, weight gain at 30% was higher than at 15% (Table2). Chicco[10] also observed a decline in body weight at 30% feed supplementation for pigs.

Blood serum and chemistry results revealed relatively high values of glucose level at 15,20 and 30% (B,C,E) (Table 3). Showing possible increased hyperglycemic properties of *A. saman* pods. Levels of total protein, albumin and cholesterol followed the same trend with the highest values at 25% (group D) and lowest values at 30% (Table 3).Same trend was also observed for ions. The low level of these constituents in rats fed 30% further confirmed that inclusion of *A. saman* at 30% level of supplementation may be injurious to rats.

There was no toxic effect of the pods on the rats in groups B-D as revealed by similar values of serum aspartate aminotransferase (AST), serum alanine aminotrasferase (ALT), alkaline phosphatase and Electrolyte Concentrations Generally, low values of enzyme concentration and electrolyte concentration was obtained at 30% (group E) showing possible effects on liver functions.

Proximate analysis results revealed similar values of crude protein, ash and nitrogen in all groups but a low crude fibre level was observed at 30% (group E) indicating poor feed conversion abilities at this level.

CONCLUSION

From the reports of this study it can be concluded that pods of *Albizia saman* are readily acceptable by albino rats and although it cannot be used as a sole feeding agent, it can be included in their feed as a good plant protein supplement at inclusion rates as high 20% with no adverse effect on body weight and other physiological parameters.

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