POTENTIAL OF AFRICAN LOCUST BEAN (*Parkia biglobosa* Benth) SEED WASTE AS A FEED RESOURCE USING THE ALBINO RAT

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ABSTRACT

The aim of the study carried out was to test the effect of raw and processed ALB seed on the feed intake, body weight changes, haematology and organ weights of albino rats. Twenty five albino rats weighing 70-90g were assigned to five treatments with five replicates each, and the rats were fed respective diets for 21 days. Crude protein increased in of iru (32.2%) compared with the raw ALB (30.45%) and locust bean waste (19.90%). Rats fed ALB waste and protein free diets had the highest liver (3.6) and lungs (0.83) relative to body weights. While the rats fed ALB waste had the heaviest kidney. The pancreas of rats fed raw ALB had the heaviest pancreas while rats on protein free diet had the least pancreas organ-weight ratio. *Parkia biglobosa* seed waste did not appear as a suitable protein feed resource for monogastrics as confirmed by reduction in body weights of rats so fed.

Keywords: African locust bean, Polyphenols, Nutritive value, Tannins, Growth

INTRODUCTION

The African locust bean (ALB) tree (*Parkia biglobosa)* is a deciduous perennial leguminous plant that grows in the Savannah to the southern edge of Sahel zone of Nigeria (Oyenuga, 1968 and Sobande, 2013). African locust bean (ALB) tree is very important in agroforestry systems. The common important use of African locust bean is found in its seed, which has both food and non - food uses).African locust bean seed is rich in protein and is used as a flavour intensifier for soups and stew (Odunfa, 1996).The CP% of seeds varies between 25 and 30% and has the potential to be utilized in livestock feeding (Olomu, 2011). The seed is however high in lysine but low in methionine and tryptophan. The presence of anti-nutritional factors such as tannins, phytic acid, saponins, cyanide and oxalate limits its utilisation for food and feed (Yahaya *et al*., 2018). Processing techniques for reducing the anti-nutritive factors include soaking in water or alkaline solutions or ordinary water, boiling in water, sprouting, autoclaving, roasting, dehulling, microwave treatment, blanching and fermentation.

MATERIALS AND METHODS

Sources of test ingredient and Experimental site

African locust bean seeds were purchased from an open market in Ibadan. This rat study was conducted at the Animal House, Department of Physiology and Biochemistry, Faculty of Veterinary Medicine, University of Ibadan.

Proximate Analysis

The *iru* was produced according to a local method. The yield of *iru* produced was measured relative to the weight of raw African locust bean used. The proximate composition of the raw and differently processed African locust bean seed samples were carried out according to the method of AOAC (1995).

Qualitative estimation of phytochemicals in raw African locust bean

About 3ml of 10% lead acetate was added to extract and formation of cloudy white colour indicative of presence of phenols. Formation of foam when extract is shaken is indicative of presence of saponins. Sodium hydroxide is added to the extract to give a yellow colouration (flavonoids). For tannins dissolved ferric chloride drops to the extract form greenish coloration.

Housing and Management of experimental animals

Twenty-five weanling rats of body weight 70-90g were individually housed and allowed an adaptation period for 3 days, then rats were weighed individually randomly assigned to five treatment groups. T_1 (Diet with casein as protein source), T_2 (Diet with raw African locust bean seed as a source of protein) T_3 (Diet with fermented African locust bean seed as a source of protein), T_4 (Diet with African locust bean waste) and T_5 (protein free diet). The rats were fed once daily on pelleted experimental diets (table 1) and watered *ad libitum*. The daily feed intake were determined over 21 days.

Table 1: **Gross composition of the experimental diets**

Ingredients (%)	T1	T2	T3	T4	T5
Casein	10	-	-	-	-
Raw locust beans	-	35.8	-	-	-
Fermented locust beans	-	-	24.7	-	-
Locust bean Waste	-	-	-	24	-
Corn starch	50	40	45	44	55
Sucrose	10	6	7.5	8	11
Glucose	10	6	7.5	8	11
Groundnut oil	10	6	7.5	8	11
Non-nutritive cellulose	5	3	4	4	6
Cassava starch	4.4	2.6	3.2	3.4	5.4
Premix	0.3	0.3	0.3	0.3	0.3
Table salt	0.3	0.3	0.3	0.3	0.3
Total	**100**	**100**	**100**	**100**	**100**

Parameters investigated

Body weight changes were recorded. At the end of 21 days, blood samples were collected with capillary tubes by ocular for haematological and serum analyses respectively. The rats were then euthanized, eviscerated and kidneys, lungs, liver, and heart were weighed warm.

Statistical analysis

The results were analysed using one way analysis of variance (ANOVA). Significant differences were separated by Duncan's Multiple Range Test ($p < 0.05$)

RESULTS AND DISCUSSION

The proximate composition of test ingredients are presented in table 2. The CP increased in of iru compared with the raw ALB and locust bean waste. Ibrahim *et al*. (2020) reported 32.2% CP while Egbebi *et a.* (2016) reported 16.98% CP. Fermentation was responsible for the increased in CP of *iru*, and in addition production of ammonia-N could also be of significance (Ikenebomah and Ingram, 1986). Removal of cotyledons of ALB caused reduced CP in the waste. The CP of raw was higher than 27.9% reported by Elemo *et al*. (2011). Yayaha *et al*. (2018) reported a lower value of 6.8% for processed fermented *iru*.

Table 2: Proximate composition of the experimental diets

	DM (%)	CP (%)	CF (%)	EE (%)	Ash (%)
Raw locust bean	97.60	30.45	8.50	8.70	4.40
Processed locust bean	98.10	43.05	3.10	18.50	4.50
Locust bean waste	96.90	19.25	3.50	10.20	6.70

The qualitative presence of phytochemicals in raw, processed and waste of ALB is presented in table 3. Tannins may possibly be present in the seed coat hence indicated in raw and the iru waste. Flavonoids and saponins appear to the present in the cotyledons of ALB while the hulls contain most of the tannins.

Table 3: Qualitative presence of phytochemicals in samples of African locust bean

Phytochemicals	Raw African locust bean	Fermented African locust bean	African locust bean waste
Phenols	+	+	+
Saponins	+	+	-
Tannins	+	-	+
Flavonoids	+	+	-

The feed intake and final body weight are presented in table 4. Rats on casein based diet had best final body weight while rats on ALB waste and protein free diet had the least final body weights. The haematological profile of the rats are presented in table 5.

Table 4:Feed intake and final body weight of rats

	Treatment					
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Feed intake/day (g)	22.77^{a}	19.87^{abc}	21.80^{ab}	17.67^{bc}	16.10^{c}	0.83
Final Body wt (g)	113.52^{a}	95.925^{c}	80.62^{b}	74.98^{c}	84.06^{c}	7.51
Wt changes, g/wk	19.10^{a}	-4.05^{c}	6.85^{b}	-9.06^{c}	-11.12^{c}	2.51

a, b means with different superscript on the same row are significantly different (P< 0.05)

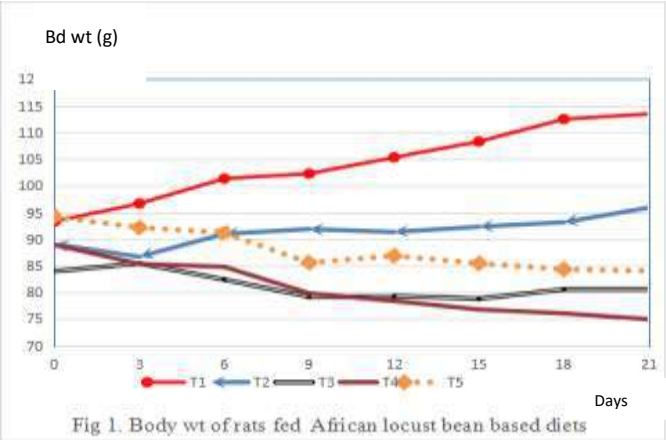

Fig 1. Body wt of rats fed African locust bean based diets

The growth pattern of rat on the treatments are represented in figure 1. Interestingly, rats fed raw ALB had better growth pattern compared with rats on iru and iru waste. Rats fed ALB waste had the worst growth pattern, which may be attributed possibly to high concentrations of tannins in

Table 5: Haematological profile of rats in different treatment fed experimental diets

	Treatments					
Parameters	1	2	3	4	5	SEM
Packed cell volume (%)	44.67	45.33	46.00	46.33	43.00	0.57
Haemoglobin, g/dl	14.90	15.07	15.50	15.63	14.40	0.21
Red blood cells $x10^{6}$/µl	3.19	3.39	3.46	3.07	3.42	0.07
White blood cells $x10^{7}$/µl	1.40b	1.39b	1.42^{b}	1.65^{a}	1.93^{a}	0.00
Platelets $x10^{5/}$ µl	1.71^{a}	1.93^{a}	1.47^{b}	1.19^{c}	1.39^{b}	0.00

a,b,c. means with different superscript on the same row are significantly different (P< 0.05)

*lymphocytes, neutrophils, monocytes, esophils and basophils were not significant.

Rats on casein based diet had the highest body weight gain followed by the fermented locust bean diet while the rats in the other treatments experienced weight losses. The rats on no protein diet had a highest body weight loss and also lowest feed intake followed by the waste diet treatment and then the rats in raw locust bean treatment.

Organ to body weight ratio of rats are presented in Table 8. The relative weights of the heart, liver, kidney, lungs and pancreas were the parameters used to determine the relative organ characteristics of the rats.

Table 8: Organ to body weight ratio of rats on experimental diets

Parameters (%)	T1	T2	T3	T4	T5	SEM
Heart	0.29^{b}	0.43^{ab}	0.40^{ab}	0.50^{a}	0.41^{ab}	0.02
Liver	2.56^{b}	2.45^{b}	2.45^{b}	3.60^{a}	3.23^{a}	0.03
Kidney	0.72^{c}	0.86^{b}	0.80^{b}	0.98^{a}	0.80^{b}	0.10
Lungs	0.60^{b}	0.68^{b}	0.66^{b}	0.83^{a}	0.81^{a}	0.15
Pancreas	0.41^{bc}	0.67^{a}	0.43^{b}	0.32^{bc}	0.17^{d}	0.16

a,b,c. means with different superscript on the same row are significantly different ($P< 0.05$)

Rats fed ALB waste and protein free diets had the highest liver and lungs relative to body weights. While the rats fed ALB waste had the heaviest kidney. The pancreas of rats fed raw ALB had the heaviest pancreas while rats on protein free diet had the least pancreas organ-weight ratio. Presence of trypsin inhibitors have been implicated in protein digestion and this may trigger heavier pancreas as a result of pressure on the pancreas.

CONCLUSION AND RECOMMENDATION

Parkia biglobosa seed waste did not appear as a suitable protein feed resource for monogastrics as confirmed by reduction in body weights of rats so fed. However since ruminants are capable of using phytochemicals to their advantage. Rats on iru showed improved however, iru is better channelled into human food chain rather than for livestock feeding because of its significance in human diets. For ALB waste to be desirous for monogastric feeding a processing technique will come to play. Most probably soaking ALB waste in wood-ash slurry (alkaline medium) may remove further tannins.

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