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## b) For books:

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1 SAMPLE 1

2 INFLUENCE OF FEEDING ROASTED LEBBECK (*Albizia lebbbeck*) SEED MEAL DIETS ON THE  
3 GROWTH PERFORMANCE AND SENSORY EVALUATION OF BROILER CHICKENS  
4

5 AUTHOR'S NAMES XXXXXXXXXXXXXXXXXXXXXXXX

6 ADDRESS XXXXXXXXXXXXXXXXXXXXXXXX

7 Corresponding Author: XXXXXXXXXXXXXXXXXXXXXXXX

8  
9 ABSTRACT

10 *This study was conducted to determine the dietary influence of graded levels of roasted lebbbeck (Albizia*  
11 *lebbbeck) seed meal on the growth performance and sensory evaluation of broiler chickens. One hundred and*  
12 *sixty Ross 308 birds were used for the experiment. The birds were randomly allotted to four treatments having*  
13 *forty birds per treatment with four replicates in a completely randomized design. Roasted lebbbeck seed meal*  
14 *(RLS) was included in diets of broilers at 0, 1.5, 3.0, and 4.5 % levels for Treatments 1 (control), 2, 3, and 4,*  
15 *respectively. The diets formulated were isocaloric and isonitrogenous. The results showed that the dry matter*  
16 *and ash contents of the raw and RLS were similar. While the crude protein and nitrogen-free extract contents*  
17 *of the seed were increased upon roasting. The crude protein content increased from 28.03 in the raw to 31.93*  
18 *(12.35 % change). However, crude fibre dropped from 18.50 in the raw seed to 7.50 % in the RLS, producing*  
19 *a drastic change of 59.9 %. There was a decrease in ether extract content from 11.06 in raw to 10.04 % in*  
20 *RLS, which is a 9.22 % decrease. Results revealed that as the inclusion levels of RLS increased in the diets,*  
21 *the daily feed intake, daily weight gain, and final live weight decreased significantly ( $p < 0.05$ ). The feed*  
22 *conversion ratio for all treatments was similar ( $p > 0.05$ ). This result may be because the growth-retarding*  
23 *factors in the RLS were partly eliminated during the processing of the seeds. The sensory attributes like;*  
24 *colour, juiciness, appearance, aroma, and overall acceptability were not significantly ( $p > 0.05$ ) influenced by*  
25 *the dietary treatments. However, flavour and tenderness were significantly ( $p < 0.05$ ) affected. It is, therefore,*  
26 *recommended that RLS be included up to 1.5 % in the diet of broilers for optimum growth performance.*

27 **Keywords:** Antinutritional factors, Performance; Roasted lebbbeck, Ross 308 broilers, Sensory  
28 attributes

29 INTRODUCTION

30 The high cost of conventional feedstuff has compelled animal nutritionists to focus research on unconventional  
31 feed sources, especially protein sources. Therefore, research efforts have been directed at producing quality  
32 feed at affordable prices to increase the net profit of farmers and provide animal protein to meet the daily  
33 protein requirement of the average Nigerian. The use of non-conventional feedstuff will go a long way to  
34 reduce the competition for conventional feedstuff like soybean and groundnut cake (Ukpah *et al.*, 2021). One  
35 way of tackling this challenge is the use of unconventional feedstuff such as *Albizia lebbbeck* which is widely  
36 distributed in Nigeria and can be exploited for feeding monogastrics because of its nutritive composition.

1 *Albizia lebbbeck* is a species of lebbbeck, native to tropical Asia, widely cultivated and naturalized in other  
2 tropical and subtropical regions (Sivakrishnan and Kavitha, 2018). English names for it include Lebbeck, Flea  
3 tree, Frywood, Koko, and Woman's tongues tree. The latter name is a play of sounds the seed makes as they  
4 rattle inside the pods (Chakrabarti, 2014). *Albizia lebbbeck* often called the siris tree or the lebbbeck tree, is  
5 indigenous to Southeast Asia and the Indian subcontinent. It is thought to have originated from the areas that  
6 include modern-day Thailand, Myanmar (Burma), Sri Lanka, India, and Sri Lanka (Balkrishna *et al.*, 2022).  
7 In many other parts of the world, such as Africa, the Americas, and numerous tropical and subtropical climates,  
8 the tree has been extensively farmed and allowed to naturally occur (Petermann and Buzhdygan, 2021).

9  
10 *Albizia lebbbeck* has been used for many purposes; Arya and Pandey (2009) found that the tree of *Albizia*  
11 *lebbbeck* has a wide range of medicinal properties, including anti-inflammatory, antipyretic, and antidiarrheal  
12 effects. Mohan and Singh (2006) evaluated the nutritive value of *Albizia lebbbeck* leaves for feeding to  
13 ruminants. They found that the leaves are a good source of protein and fibre, and they can be used as a substitute  
14 for conventional fodders. The leaves, pods, and seeds of *Albizia lebbbeck* can all be fed to animals. The leaves  
15 are particularly high in protein and fibre. Singh and Singh (2009) reported that the lambs that were fed *Albizia*  
16 *lebbbeck* leaf meal had similar growth rates and feed intake as the lambs that were fed a conventional diet.

17  
18 Conventional feedstuffs are expensive, this has brought about the need to search for alternative feedstuffs that  
19 can replace the exorbitant ones to reduce the cost of livestock production, as well as the cost of meat and other  
20 animal products (FAO, 2014). Nutritional information and feeding trial using roasted *Albizia* is scanty. There  
21 is little or no information on feeding trials and nutritional information on roasted lebbbeck seeds. Therefore,  
22 this study was conducted to evaluate the influence of feeding graded levels of roasted lebbbeck (*Albizia lebbbeck*)  
23 seed meal diets on the performance of broiler chickens.

## 24 25 **METHODOLOGY**

### 26 **Location of the Study and Source of Experimental Test Ingredient**

27 The research work was carried out at the Poultry Unit of the Department of Animal Production Teaching and  
28 Research Farm, Gidan Kwano Campus, Federal University of Technology Minna, Niger State. Mature and dry  
29 pods were harvested from lebbbeck trees in Minna town. Raw seeds of lebbbeck (*Albizia lebbbeck*) were removed  
30 from the pods by threshing in a mortar using a pestle.

### 31 32 **Processing Method (roasting)**

33 Seeds of *Albizia lebbbeck* were collected and sorted to remove undesirable particles (foreign materials). Raw  
34 seeds of lebbbeck were ground to powder with the use of a hammer mill. A pot was heated to 120 °C before  
35 pouring 100 g of grounded lebbbeck seed meal and stirring for 4-5 minutes until it turned light brown and gave  
36 an aroma similar to roasted beans. It was poured on a clean tray to cool and stored in an airtight container and

1 labelled as roasted lebbeck seed meal (RLS) until ready for use.

2

### 3 **Proximate Analyses**

4 The proximate analyses of lebbeck seeds (both raw and roasted seeds) were carried out at the Animal  
5 Production Laboratory, Federal University of Technology, Minna, Niger State, Nigeria using the methods  
6 outlined by the Association of Official Analytical Chemists (AOAC, 2000).

7

### 8 **Experimental Design**

9 A total of one hundred and sixty Ross 308 mixed-sex day-old broiler chicks were purchased. These  
10 experiments were carried out using a completely randomized design (CRD). Roasted lebbeck seed meal was  
11 included in diets of broiler chicken at 0, 1.5, 3.0, and 4.5 % levels for Treatments 1, 2, 3, and 4, respectively,  
12 in a single-phase feeding. The birds were randomly assigned to four dietary treatments with four replicates (40  
13 birds per treatment). The diets were formulated as isocaloric and isonitrogenous.

14

15 **Table 1: Experimental Composition of Varying Levels of Roasted *Albizia lebbeck* Seed Meal Diets**

<b>Ingredients</b>	<b>0 % (T1)</b>	<b>1.5% (T2)</b>	<b>3.0% (T3)</b>	<b>4.5% (T4)</b>
Maize	45.85	45.85	45.85	45.85
Soybeans (full fat)	40.00	38.50	37.00	35.50
Maize offal	6.00	6.00	6.00	6.00
Roasted lebbeck seed meal	0.00	1.50	3.00	4.50
Fish meal	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25
Toxin binder	0.15	0.15	0.15	0.15
Total	100	100	100	100
<b>Calculated</b>				
Crude protein %	22.42	22.33	22.24	22.15
ME (kcal /kg)	3044.22	3041.69	3039.15	3036.62

16 ME= Metabolizable energy

17

### 18 **Management of Experimental Birds**

19 Birds were raised on deep litter. The pen was washed and disinfected with Izal. Drinkers and feeders were  
20 thoroughly washed and made ready for use. Before the arrival of the birds, wood shavings were spread on the  
21 floor, a heat source was made available for brooding the chicks and a foot dip was provided at the entrance of  
22 the poultry house. On arrival of the chicks, they were weighed to obtain their initial weights after which they  
23 were randomly distributed to the various treatment groups. The birds were vaccinated against the prevailing

1 diseases; the first dose of the Gumboro vaccine was administered at week one against Gumboro disease, and  
2 at week two the first dose of the Lasota vaccine was administered to the birds against Newcastle disease. When  
3 the birds were three weeks old the second dose of the Gumboro vaccine was given. The last dose of the Lasota  
4 vaccine was administered in the fourth week. The feeding trial was conducted for seven weeks. Feed intake  
5 was measured daily while the weighing of birds was done weekly.

## 6 7 **Sensory Evaluation**

8 Meat samples of broiler breast portions that had been frozen were thawed at room temperature for sensory  
9 evaluation. The meat samples were cut into smaller pieces of about 3-5 grammes of about 1-2 cm according  
10 to their treatments and replicates. The meat samples were then boiled in a pot containing 150ml of water for  
11 ten minutes, and one gram of salt was added.

12  
13 Thirty semi-trained taste panelists from the Federal University of Technology, Minna Gidan Kwano Campus  
14 community were used for the meat sensory evaluation. This evaluation was performed according to the method  
15 described by Grunert *et al.* (2004) using a 9-point hedonic scale rated as follows: 9= like extremely, 8= like  
16 very much, 7= like moderately, 6= like slightly, 5= neither like nor dislike, 4= dislike slightly, 3= dislike  
17 moderately, 2= dislike very much, 1= dislike extremely. The meat samples given to the panelists were  
18 evaluated for sensory attributes such as meat colour, appearance, juiciness, tenderness, taste, aroma,  
19 texture, and overall acceptability. Each panelist was given cracker biscuits and water to rinse their mouth with  
20 after tasting each sample to eliminate flavour carryover from previous samples.

## 21 22 **Data Analysis**

23 All data collected during the experiment from the measured parameters were subjected to one-way analysis of  
24 variance (ANOVA) using IBM SPSS version 23.0. The significant means were separated using Duncan's  
25 multiple range test.

## 26 27 **RESULTS AND DISCUSSION**

28 The proximate composition of raw roasted *Albizia lebbbeck* seed meal on the growth performance of broiler  
29 chickens is presented in Table 2. The result showed that the dry matter and ash contents of the raw and roasted  
30 seeds were similar. While the protein and nitrogen-free extract content of the seed was increased upon roasting.  
31 The crude protein content increased from 28.03 % in the raw to 31.93 % (12.35 % change). However, crude  
32 fibre dropped from 18.50 % in the raw seed to 7.50 % in the roasted seed, producing a drastic change of 59.9  
33 %. There was a decrease in ether extract content from 11.06 % in raw to 10.04 % in roasted seed, which is a  
34 9.22 % decrease.



1 **Table 2: Proximate Composition of Raw and Roasted Lebbeck (*Albizia lebbeck*) Seeds**

Nutrients	Raw lebbeck seeds	Roasted lebbeck seeds	Percentage change
Dry matter	91.81	91.28	0.58
Crude protein	28.03	31.98	12.35
Crude fibre	18.50	7.50	59.46
Ash	4.52	4.50	0.44
Ether extract	11.06	10.04	9.22
Nitrogen free extract	29.70	37.26	20.29

2

3

4 **Growth Performance of Broiler Chickens Fed Varying Levels of Roasted *Albizia Lebbeck* Seed Meal**

5 The results of the effect of varying levels of roasted *Albizia lebbeck* seed meal on the growth performance of  
6 broiler chickens are presented in Table 3. The results showed that as the level of inclusion of roasted *Albizia*  
7 *lebbeck* seed meal diet increases, there was a significant ( $p < 0.05$ ) decrease in the final live weight, average  
8 weight gain, and average feed intake except the feed conversion ratio which was not significantly different  
9 ( $p > 0.05$ ) across dietary treatments. However, the result revealed that Treatment 2 with 1.5 % roasted *Albizia*  
10 *lebbeck* was statistically the same ( $p > 0.05$ ) as the control in terms of final live weight, average weight gain,  
11 and average feed intake.

12

13 The final weight of broiler chickens fed 1.5% roasted *Albizia lebbeck* seed meal diet was 1868.75g and the  
14 birds on the control had 1898.13g was significantly ( $p < 0.05$ ) higher than broilers fed 3.0 and 4.5 % roasted  
15 *Albizia lebbeck* seed meal diet which recorded 1570.88 and 1357.50 g, respectively. Similarly, broiler chickens  
16 fed 1.5 % of roasted *Albizia lebbeck* seed meal diet (1830.75 g) and the control (1850.50 g) recorded  
17 statistically ( $p < 0.05$ ) higher average weight gain compared to those fed 3.0 and 4.5 % of roasted *Albizia*  
18 *lebbeck* seed meal supplemented diet that had 1532.50 and 1319.50 g, respectively. The same trend was also  
19 observed in average feed intake as the control (3162.28 g) and broiler birds fed 1.50 % of roasted *Albizia*  
20 *lebbeck* seed meal supplemented diet (3052.89) consumed significantly ( $p < 0.05$ ) higher than those fed 3.0 and  
21 4.5% of roasted *Albizia lebbeck* seed meal supplemented diet (2561.36 and 1319.50 g). The significant  
22 decrease in these growth parameters may be because *Albizia lebbeck* contained antinutrients, such as tannins  
23 and phytates that inhibited the absorption of nutrients and thus, led to the reduction in growth. The findings of  
24 this study are consistent with the findings of previous studies conducted by Olorunsanya *et al.* (2009) found  
25 that final live weight, average weight gain, and average feed intake of broiler chickens decreased significantly  
26 as the level of *Albizia lebbeck* inclusion increased from 0 % to 15 %.

27

28 The feed conversion ratio which was not significantly ( $p > 0.05$ ) different across dietary treatment, means that  
29 the amount of feed required to produce a unit of weight gain was not significantly different for broilers fed  
30 different levels of *Albizia lebbeck*. These findings agree with reports of Olorunsanya *et al.* (2009); Chand *et*  
31 *al.* (2014) and Agboola *et al.* (2015) when they fed varying inclusion levels of *Albizia lebbeck* to birds.

1 Therefore, the non-significant ( $p>0.05$ ) effect recorded in the feed conversion ratio of this research work  
 2 showed that *Albizia lebbbeck* is a potential feed ingredient in broiler chicken diets.

3

4 **Sensory Evaluation of Meat of Broiler Chickens Fed Graded Levels of Roasted *Albizia Lebbbeck* Seed**  
 5 **Meal Diets**

6 The organoleptic evaluation of meat of broiler chickens fed graded levels of roasted *Albizia lebbbeck* seed meal  
 7 diets is presented in Table 1. From the results, the sensory attributes like; colour, juiciness, appearance, aroma,  
 8 and overall acceptability were not significantly ( $p>0.05$ ) influenced the different treatment groups. However,  
 9 flavour and tenderness were significantly ( $p<0.05$ ) affected.

10 The result obtained from this study showed that flavour and tenderness were significantly affected by dietary  
 11 treatments. The differences observed as pertains to the meat flavour and tenderness across groups could be  
 12 attributed to the effect of the dietary inclusion of roasted *Albizia lebbbeck* seed meal in the diets, although the  
 13 mechanism or mode of this effect may be unknown. This result agrees with the findings of Tsado *et al.* (2018),  
 14 who observed a significant ( $p<0.05$ ) effect of boiled *Albizia lebbbeck* on the flavour of the meat of rabbits.

15

16 **Table 3: Effect of Roasted *Lebbbeck* Seed Meal Diets on Growth Performance of Broiler Chickens**

Parameters	Treatments				SEM	P-value	LS
	0%	1.5%	3.0%	4.5%			
	T1	T2	T3	T4			
Initial weight (g)	37.63	38.00	38.38	38.00	0.144	0.365	NS
Final weight (g)	1898.13 <sup>a</sup>	1868.75 <sup>a</sup>	1570.88 <sup>b</sup>	1357.50 <sup>c</sup>	59.877	0.001	*
Average weight gain (g)	1850.50 <sup>a</sup>	1830.75 <sup>a</sup>	1532.50 <sup>b</sup>	1319.50 <sup>c</sup>	59.900	0.001	*
Average feed intake (g)	3162.28 <sup>a</sup>	3052.89 <sup>a</sup>	2561.36 <sup>b</sup>	2187.11 <sup>c</sup>	114.436	0.001	*
Feed conversion ratio	1.72	1.67	1.67	1.66	0.269	0.962	NS

17 <sup>abc</sup>; means with different superscripts along the row are significantly ( $p\leq 0.05$ ) different, NS = Not significant,  
 18 \* =Significant, SEM = Standard error of mean, P-value = Probability value, LS = Level of significant. T1 =  
 19 Diet supplemented with 0 % *lebbbeck* seed meal (RLS) control, T2 = Diet supplemented with 1.5 % *lebbbeck*  
 20 seed meal (RLS), T3 = Diet supplemented with 3.5 % *lebbbeck* seed meal (RLS), T4 = Diet supplemented with  
 21 4.0 % *lebbbeck* seed meal (RLS)

22

23

1 **Table 4: Sensory Evaluation of Meat of Broiler Chickens Fed Graded Levels of Roasted *Albizia***  
 2 ***lebbeck* Seed Meal**

Parameters	T1	T2	T3	T4	SEM	P-value	LS
Colour	5.80	6.18	6.13	5.97	0.27	0.67	NS
Juiciness	6.36	6.69	6.39	6.50	0.15	0.42	NS
Appearance	6.74	7.01	7.01	6.87	0.13	0.70	NS
Flavour	6.76 <sup>ab</sup>	7.15 <sup>a</sup>	6.50 <sup>4b</sup>	6.81 <sup>ab</sup>	0.06	0.04	*
Aroma	6.93	7.20	6.80	6.88	0.09	0.35	NS
Tenderness	7.13 <sup>a</sup>	6.97 <sup>ab</sup>	6.98 <sup>ab</sup>	6.84 <sup>b</sup>	0.08	0.05	*
Overall acceptability	7.25	7.39	7.11	7.26	0.09	0.47	NS

3 <sup>abc</sup>; means with different superscripts along the row are significantly ( $p \leq 0.05$ ) different, SEM = Standard error  
 4 of mean, P-value = Probability value, LS = Level of significance, NS = Not significant, \* =Significant, . T1 =  
 5 Diet supplemented with 0 % *lebbeck* seed meal (RLS) control, T2 = Diet supplemented with 1.5 % *lebbeck*  
 6 seed meal (RLS), T3 = Diet supplemented with 3.5 % *lebbeck* seed meal (RLS), T4 = Diet supplemented with  
 7 4.0 % *lebbeck* seed meal (RLS)  
 8

## 9 CONCLUSION AND RECOMMENDATIONS

10 Overall, the findings of this study suggest that *Albizia lebbeck* in poultry feed should be limited to low levels.  
 11 It is, therefore, recommended that roasted *Albizia lebbeck*, an unconventional feedstuff, can be included up to  
 12 1.50 % in the diet of broiler chickens for optimum growth performance. Further research is needed to identify  
 13 ways to mitigate the effects of higher inclusion levels of roasted lebbeck in broiler diets. In addition, there is a  
 14 need to examine the effect of different roasting durations of *Albizia lebbeck* on the growth performance and  
 15 sensory evaluation of broiler chickens and the combination of two processing methods for lebbeck.  
 16

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