***Original Research Article***

# Effect of Feeding Raw kapok (*Ceiba pentandra*) seed meal on the Growth Performance, Nutrient digestibility, carcass and organ weights of Weaner Rabbits

**ABSTRACT**

The study was carried out to evaluate the effects of feeding raw kapok seed meal on growth performance, nutrient digestibility carcass characteristics of weaner rabbit, Thirty (30) weaner rabbits were used for the study. Five diets were compounded using raw kapok seed meal (RKSM) at 0, 5, 10, 15 and 20% inclusion levels. The rabbits were weighed and randomly assigned to the five dietary treatments replicated three times with two rabbits per replicate in a completely randomized design. The proximate composition of kapok seed meal showed it contains 89.96% dry matter, 17.45% crude fibre, 22.63%, crude protein, 9% ether extracts, 6.54%, Ash and 55.51% Nitrogen Free Extract. The seed meal also contains tannin (2.58%), Alkaloid (8.32), phenol (23.14%), flavonoid (5.63%), saponin (3.22%) trypsin inhibitors (28.26%), haemagglutinin (12.12%) and oxalate (2.14%).The result of growth performance and nutrient digestibility decreased significantly ($P<0.01$) as the dietary levels of raw kapok seed meal increases. Similarly carcass and internal organ weights were significant influenced by the dietary levels of RKSM. The relative weights of liver, lungs and kidney significantly ($P<0.01$) increased beyond 10% RKSM inclusion in the diet. It was concluded that RKSM can be fed to weaner rabbit up to 10% inclusion levels without any adverse effect on the rabbit performance.

**Keywords: weaner rabbit, Performance, nutrient digestibility, carcass characteristics, kapok seed,**

## 1. Introduction

Over the years conventional protein and energy sources such as groundnut cake and soybean meal have remained the major protein source in the diets of non- ruminant animals [1]. The ingredients are highly consumed by human beings and industries as such; there is tacit competition between humans and livestock as well as industries for these scarce commodities [1,2]. Hence there prices are becoming exorbitant. There is the need therefore to search for possible alterative protein and energy sources which are cheap, readily available and has comparable nutritive quality to the conventional protein and energy sources. One of such under exploited non-conventional feedstuff is kapok seed.

Kapokis a tropical tree of the order *Malvales*and the family *Malvaceae*native to Mexico, Central America and the Carribean, Northern South America and to tropical West Africa. The tree is also known as the Java cotton, Hara kapok, Silk cotton or Ceiba [3].It is the largest African forest tree

and severally known among some Nigerian ethnic groups as *Rimi* (Hausa), *Bamtami* (Fulani), *Arabaogungun*(Yoruba) and *Akpi* (Igbo) [4]. In Nigeria, the leaves are cooked in form of slurry sauce comparable to Okra. The young leaves or the shoots are normally used for soup (sausage). A powder prepared from dried leaves is used to prepared sauce during the dry season [3].

The proximate composition of kapok seeds on dry matter basis have been reported to contain 20-35% crude protein (CP), 20-26% crude fibre (CF), 5-9% ether extracts (EE), 5-7% total ash and 29 -31% Nitrogen free extracts (NFE) [5,6]. The seed has high potential as protein and energy sources in non- ruminant feed. Studies conducted by ref 7,8 and 9 on the effects of feeding unprocessed kapok seed meal to broiler chicken resulted to depressed in appetite, loss of weight, growth depression and discoloration of the egg yolk in layers. However, there isscanty information on the utilization of raw kapok seed meal in rabbits' diet. The study was therefore carried out to determine effects of raw kapok seed on the growth performance of weaner rabbits.

## 2.Material and methods

### 2.1 Study area:

The study was conducted at the Rabbit unit of Teaching and Research Farm of Federal University Wukari, Taraba State. Wukari is located at longitude $9^0$47'0"E and latitude $7^0$51'0" N longitude 9047' 0"E.The vegetation of the area is predominantly characteristics of savannah zone and with major climatic seasons of wet or rainy seasons, which starts in March or April, and ends in October and the dry season, and the dry season which starts in November and ends in March or April [10].

### 2.2 Source and processing of kapok seeds meal

The seeds were procured from local market in Shelleng, Adamawa State Nigeria. Stones and dirts were picked and ground using 2mm sieve hammer mill to form raw Kapok seed meal (RKSM).

### 2.3 Experimental diets

Five dietary treatments were compounded using raw kapok seed meal (RKSM). Diet 1 served as control, while diets 2, 3, 4 and 5contain RKSM at 5.00, 10.00, 15.00 and 20.00 % inclusion levels respectively (Table 1).

Table 1 Ingredient composition of experimental diets

| | Inclusion levels of raw kapok seed meal (%) | | | | |
|---|---|---|---|---|---|
| Ingredient | 0 | 5 | 10 | 15 | 20 |
| Maize | 49.49 | 50.00 | 50.00 | 50.00 | 50.00 |
| Soybean meal | 16.00 | 14.00 | 10.34 | 9.12 | 6.15 |
| Raw Kapok seed meal | 0.00 | 5.00 | 10.00 | 15.00 | 20.00 |
| Fishmeal | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 |
| Maize Offal | 20.00 | 16.49 | 15.15 | 11.37 | 9.34 |
| Wheat offal | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |

| | | | | | |
|---|---|---|---|---|---|
| Premix* | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Total | 100.00 | 100 | 100 | 100 | 100 |
| Determined analysis (%) | | | | | |
| Dry matter | 89.45 | 89.39 | 89.40 | 89.42 | 89.41 |
| Crude protein | 17.22 | 17.10 | 17.10 | 17.11 | 17.10 |
| Crude fibre | 5.34 | 5.30 | 5.33 | 5.31 | 5.32 |
| Ether extracts | 4.38 | 4.32 | 4.36 | 4.35 | 4.33 |
| Ash | 6.23 | 6.24 | 6.22 | 6.23 | 6.24 |
| NFE | 66.83 | 67.04 | 66.99 | 67.00 | 67.01 |
| ME/Kcal/kg | 2802.54 | 2800.01 | 2801.56 | 2802.89 | 2801.78 |

Mineral/ Vitamin Premix manufactured by Animal care LTD contained the following: Vitamin A 1,800IU, Vitamin D 250IU, Vitamin E 8,000IU,Vitamin K 750mg, B1 750mg, B2 1000 mg, B6 800mg, B12 25mg Folic 300mg, Niacin 5000mg, Pantothenate 3000mg, Biotin 25mg, Choline 160g, Thyroxine 300mg, Copper 0.4g, Iron 4g, Manganese 5.5g, Iodine 0.2g, Zinc 5g, Cobalt 0.15g, Selenium 0.15g

### 2.4 Experimental design and animal management

Thirty (30) weaner rabbits with an average weight of 503±0.10 were procured from National Veterinary Research Institute Vom, Plateau State. The rabbits were divided into five groups of six animals per group. Each rabbit was housed in a hutchmeasuring 100 × 120×70cm and raised 100cm from the ground in a three-tier hutch system. Hutches were provided with feeders and drinkers. Animalswere dewormed using Piperazine® before the commencement of the experiment.

### 2.5Data collection

#### 2.5.1 Growth performance

Data collected included initial body weight, weekly body weight, finial body weight, daily feed intake, and feed conversion ratio. The rabbits were weighed at the beginning of the experiment to obtain their initial body weights and then weekly, thereafter. Daily feed intake was determined by subtracting the weight of left over feed from the weight of the feed fed the previous day. Feed intake and weight gain recorded were used to calculate feed conversion ratio as a ratio

#### 2.5.2 Nutrient digestibility study

The nutrient digestibility study was carried out at the end of the 7$^{th}$ week of the experiment. Three rabbits per replicate were selected randomly and transferred to metabolic cages. Two days adaptation period was observed, then five days of feacal collection. The feaces were sun dried, bulked and representative samples taken for chemical analysis as described by [11].

#### 2.5.3Carcassand organ weight s evaluation

At 56$^{th}$ day, three rabbits per treatment (one per replicate) were randomly selected, starved overnight to clear the gut, while water was offered. Thefollowing morning they were weighed to determine their live weight then slaughtered, skinned, eviscerated and dressed. Internal organs were carefully

removed, weighed and expressed as percentage of the live weight. Dressing percent was determined as $\frac{Dressed\ weight}{Live\ weight}\ x\ 100$

### 2.6 Chemical analysis

The proximate composition of raw kapok seed meal, experimental diets and faecal sampleswere determined for CP, CF, EE ash and NFE using[11] methods. Total oxalate was determined according to [12] procedure. Phytate was determined using the method described by [13]. Saponin was determined using the method of [14] as modified by [15]. While tannin was determined using the method of [16]. Phenol, haemagglutinin, flavonoid were determined using the method of [11].

### 2.7 Statistical analysis

All data obtained during the experiment wereanalysed according to the ANOVA model, using the ONEWAY procedure of [17].Where significant difference exist. Duncan's Multiple range test was used to separate means.

## 3. Results and discussion

### 3.1 Proximate composition and anti-nutrients of raw kapok seed meal

The proximate composition and anti-nutrients of raw kapok seed meal is shown in Table 2.The high dry matter (89.96%) content of the raw kapok seeds is an indication that they can be stored for a long time and less prone to microbial attack during storage [18 and 19]. Ether extracts (10.05%) is lower than 34% reported by [18] and 21-29 % reported by [20] The crude protein content recorded is however lower than 36.70% reported by [19] but similar to 23-30% reported by [18]. The observed variations in proximate composition could be attributed to climatic conditions, edaphic factors as well as methods of processing and laboratory analysis [21].

The tannin content (2.58%) of raw kapok seed observed is higher than 0.34% in African oil bean seed reported by [22], 0.94g reported for winged bean [23], 0.42 % in raw lablab seed by [24] and 1.41% found in mucuna [25]. The value of saponin recorded in the present study is higher than 1.1% observed in mucuna seed [25] and also higher than 0.23-0.57mg reported by [26] and 0.96-1.33% for raw lablab. The high concentration of tannins implies possibilities of poor protein digestibility caused by formation of protein tannin complexes which irreversibly bind digestive enzymes, thus inhibiting the activities of the enzymes making them unavailable for breaking down proteins and other nutrients [27 and 28].

Saponin in seeds imposes an astringent taste that affects feed palatability, reduce feed intake, utilization of protein and consequently body growth [29]. The raw kapok seed also contain trypsin inhibitor similar to 28.96mg obtained by [24] for raw lablab seed. The haemaglutinin value recorded in this study is lower than the range of 41.37-53.64HU/mg reportedby [30] for raw lablab seed but high higher than 4.0HU/mgN for winged bean [23] and 8.0 HU/mgN for *M. pruriens* seed flour [31].The binding of hemagglutinins to intestinal membrane of animals is believed to impair the normal absorption of dietary nutrients when feed stuffs containing these factors are consumed.Oxalate content is higher than 1.95% found in raw mucuna seed [25]. Ref [32] reported that high concentration of oxalates bind calcium present in feed thereby rendering calcium unavailable for normal

physiological and biochemical roles.The concentration of phytateis higher than 1.56% reported for mucuna by [25] and the range of 1.25 -2.04% reported for raw lablab seed by Shaabu, (2015).High phytate contents have been reported to retard growth,cause abnormalities in the intestinal histology, reduce the bioavailability of dietary phosphorus, inhibit dietary proteins and activity of trypsin and pepsin and reduces the solubility of starch [33 and 34].

Table 2 proximate and anti- nutrients composition of raw kapok seed meal

| Nutrients | Composition (%) |
|---|---|
| Dry matter | 89.51 |
| Crude protein | 22.59 |
| Crude fibre | 17.45 |
| Ether extracts | 10.05 |
| Ash | 6.53 |
| Nitrogen free extracts | 43.38 |
| ME Kcal/kg | 3180 |
| *Anti- nutrients composition* | |
| Phenol | 23.14 |
| Alkaloid | 8.32 |
| Flavonoid | 56.24 |
| Tannin | 2.58 |
| Saponin | 3.35 |
| Phytate | 3.22 |
| Trypsin inhibitors | 28.36 |
| Hemagglutinin | 12.25 |
| Oxalate | 2.14 |

### 3.2 Growth performance of weaner rabbits fed raw kapok seed meal (RKSM)

The growth performance of weaner rabbits fed RKSM is presented in Table 3. The result showedsignificant ($p<0.01$) difference across inclusion levels. The final body weight, total feed intake and total weight gain of the rabbits decreased as the levels of RKSM increased in the diets. The result is in consonant with the observations of [35;36] on broiler chickenwhen they fed raw jack bean and raw tallow seed meals respectively.The decrease in final body weight, total feed intake and total weight gain could be attributed to inherent anti-nutrients in the raw kapok seed meal which probably reached a threshold level beyond the tolerance levels of the rabbits. Several studies have attributed impaired feed utilization, depressed growth, loss of appetite and pancreatic hypertrophy in the experimental animals to anti-nutritional factors [25, 36,37,38,39 and 40]. Rabbits on 0%, 5% and 10% inclusion levels had superior ($p<0.05$) feed conversion ratio suggesting there was better absorption and utilization of nutrients by the rabbits.

153 Table 3 Growth performance of weaner rabbits fed raw kapok seed meal

| | Inclusion levels of raw kapok seed meal (%) | | | | | |
|---|---|---|---|---|---|---|
| Parameters | 0 | 5 | 10 | 15 | 20 | SEM |
| Initial body weight (g) | 503.66 | 503.33 | 503.61 | 503.00 | 504.01 | 12.26$^{ns}$ |
| Final body weight (g) | 1831.22$^{a}$ | 1750.30$^{ab}$ | 1660.36$^{b}$ | 933.67$^{c}$ | 905.91$^{c}$ | 41.01$^{**}$ |
| Total weight gain (g) | 1327.56$^{a}$ | 1246.97$^{ab}$ | 1156.75$^{b}$ | 430.67$^{c}$ | 401.90$^{c}$ | 40.19$^{**}$ |
| Average weight gain (g) | 23.70$^{a}$ | 22.26$^{a}$ | 20.65$^{b}$ | 7.69$^{c}$ | 7.17$^{c}$ | 0.71$^{**}$ |
| Total feed intake (g) | 2527.92$^{a}$ | 2385.39$^{a}$ | 2368.37$^{a}$ | 1093.73$^{c}$ | 1046.41$^{c}$ | 63.75$^{**}$ |
| Average daily feed intake (g) | 45.14$^{a}$ | 42.59$^{a}$ | 42.29$^{a}$ | 19.53$^{c}$ | 18.68$^{c}$ | 1.13$^{**}$ |
| Feed conversion ratio | 1.90$^{b}$ | 1.91$^{b}$ | 2.04$^{b}$ | 2.53$^{a}$ | 2.60$^{a}$ | 0.16$^{**}$ |

154 Means in the same row bearing different superscripts differ significantly (P<0.01), **=Significantly
155 different (P<0.01), Ns = not significant different (P>0.01),SEM = Standard error mean

156 **3.3 Nutrient digestibility of weaner rabbits fed raw kapok seed meal**

157 Table 4 showed the nutrient digestibility of weaner rabbits fed RKSM. There was significant (P<0.01)
158 decrease in the digestibility of nutrients with increasing levels of RKSM in the diets. Rabbits fed 0%
159 and 5% and 10% diets had similar nutrient digestibility which implied that they could tolerate up to
160 10% RKSM level of inclusion. The reduction in nutrient digestibility beyond 10% isascribed to the
161 presence of the anti-nutritional factors in RKSM.Ref[41] reported that anti-nutritional factors (ANFs)
162 interfere with metabolic process such that growth and bioavailability of nutrients are negatively
163 influenced.

164 Table 4: Nutrient digestibility of weaner rabbits fed raw kapok seed meal

| | Inclusion levels of raw kapok seed meal (%) | | | | | |
|---|---|---|---|---|---|---|
| Parameters | 0 | 5 | 10 | 15 | 20 | SEM |
| Dry matter | 88.89$^{a}$ | 85.45$^{a}$ | 71.78$^{b}$ | 60.90$^{b}$ | 60.45$^{b}$ | 0.77$^{**}$ |
| Crude Protein | 84.84$^{a}$ | 80.92$^{a}$ | 79.99$^{a}$ | 61.34$^{b}$ | 60.45$^{b}$ | 0.40$^{**}$ |
| Ether Extracts | 74.47$^{a}$ | 72.32$^{a}$ | 71.10$^{a}$ | 58.91$^{c}$ | 57.27$^{c}$ | 0.64$^{**}$ |
| Crude fibre | 76.09$^{a}$ | 73.20$^{a}$ | 72.48$^{a}$ | 60.16$^{b}$ | 58.14$^{c}$ | 1.21$^{**}$ |
| Ash | 84.17$^{a}$ | 80.18$^{a}$ | 79.32$^{a}$ | 59.56$^{b}$ | 56.15$^{b}$ | 1.25$^{**}$ |
| Nitrogen free extracts | 74.18$^{a}$ | 73.89$^{b}$ | 70.57$^{a}$ | 61.54$^{b}$ | 58.97$^{c}$ | 0.43$^{**}$ |

165 Means in the same row bearing different superscripts differ significantly (P<0.01), **=significantly
166 different (P<0.01), SEM = Standard error mean

167 **3.4 Carcass yield, cut-up parts and internal organs of broiler chickens**

168 Live weightsand dressing percent were significantly higher (P <0.05) in rabbits fed T1, T2 and T3
169 diets. Live weight and dressing percent were lower than the range of 1375.00 - 1650.00g and 73.01-
170 76.20% reported by [42 and 43] respectively for tropical rabbits.The poor dressing percentobserved in
171 rabbits fed T4 and T5 diets might be due to reduction in feed intake and impairednutrient
172 utilizationattributed by the high ANFs in the raw kapok seeds. The development of carcass trait,
173 organs and muscular growth in animals depend on nutrition among other factors [44].The weight of
174 the heart of rabbits fed T1, T2 and T3 diets were significantly lower (P<0.05) compared with those of

T4 and T5. The relative higher weights of liver and kidney of rabbits on T4 and T5 dietsimplies thatinclusion of RKSM up to 20% in the rabbit diet illicittoxic response as liver and kidney which are the major organs of detoxification has undergo hypertrophy [45]

Table 5 Carcass yield and internal organs of weaner rabbits fed raw kapok seed meal

| | Dietary treatments | | | | | |
|---|---|---|---|---|---|---|
| Parameters | T1 | T2 | T3 | T4 | T5 | SEM |
| Live weight (g) | 1416.89$^{a}$ | 1430.23$^{a}$ | 1267.32$^{ab}$ | 1100.17$^{b}$ | 900.00$^{c}$ | 64.76$^{**}$ |
| Pelt weight (g) | 122.33$^{abc}$ | 116.14$^{c}$ | 124.12$^{ab}$ | 119.26$^{bc}$ | 126.78$^{a}$ | 2.12$^{**}$ |
| Head weight (g) | 119.26$^{ab}$ | 114.88$^{ab}$ | 109.52$^{b}$ | 126.26$^{ab}$ | 131.68$^{a}$ | 5.38$^{**}$ |
| dressed weight (g) | 882.74$^{a}$ | 782.66$^{b}$ | 740.67$^{b}$ | 440.19$^{c}$ | 431.88$^{c}$ | 21.46$^{**}$ |
| Dressing (%) | 63.03$^{a}$ | 58.47$^{a}$ | 54.74$^{a}$ | 40.01$^{c}$ | 47.98$^{c}$ | 0.52$^{**}$ |
| S I length (cm) | 118.58$^{c}$ | 125.56$^{c}$ | 160.11$^{b}$ | 169.57$^{b}$ | 209.40$^{a}$ | 8.79$^{**}$ |
| S I weight (g) | 9.02 | 9.54 | 9.43 | 9.34 | 10.15 | 0.65$^{ns}$ |
| L I length (cm) | 102.69$^{b}$ | 105.87$^{b}$ | 104.73$^{b}$ | 108.76$^{b}$ | 115.30$^{a}$ | 2.69$^{**}$ |
| L I weight (g) | 17.75 | 19.90 | 23.76 | 26.76 | 26.24 | 2.05$^{ns}$ |
| Caecal length (cm) | 17.33 | 17.31 | 17.72 | 19.41 | 20.16 | 1.73$^{ns}$ |
| Caecal weight (g) | 83.75 | 104.83 | 107.33 | 109.72 | 115.98 | 0.83$^{ns}$ |
| Internal organs % live weight | | | | | | |
| Liver | 2.52$^{b}$ | 2.92$^{b}$ | 2.31$^{b}$ | 5.86$^{a}$ | 6.56$^{a}$ | 0.15$^{ns}$ |
| Heart | 0.32 | 0.27 | 0.26 | 0.29 | 0.35 | 0.11$^{ns}$ |
| Lungs | 0.67$^{c}$ | 0.72$^{c}$ | 0.99$^{c}$ | 1.19$^{ab}$ | 1.39$^{a}$ | 0.10$^{**}$ |
| Kidney | 0.67$^{c}$ | 0.67$^{c}$ | 0.95$^{b}$ | 1.12$^{a}$ | 1.22$^{a}$ | 0.14$^{**}$ |

Means in the same row bearing different superscripts differ significantly (P<0.01), **=significantly different (P<0.01), Ns = not significant different (P>0.01), SEM = Standard error mean

## Conclusion

The study showed that raw kapok seed meal has rich nutrients composition and ant- nutritional factors. The raw seed meals can be fed to weaner rabbit up to 10% inclusion levels in the diet without any adverse effect on the rabbit performance

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