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EFFECT OF DIFFERENT PROCESSING METHODS ON THE UTILIZATION OF *Jatropha curcas (*Linn) KERNEL MEALS ON WEANER RABBITS (*Oryctolagus cuniculus*)

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ABSTRACT

There is great competition between the usage of most grains as food or feed hence there is need to identify more livestock feed resources that are not directly consumed by human being. Jatropha curcas kernel is one of such options that can replace some protein sources in livestock diets. Twelve weaner rabbits (Oryctolagus cuniculus) housed individually in cages were used to appraise the effect of different processing methods (cooked once and cooked twice) on the utilization of Jatropha curcas kernel meals (JKM) based diets by weaner rabbits. The experimental animals were allocated to three dietary treatment groups marked T1 (control), T2 (cooked once) and T3 (cooked twice) in a completely randomized design. The preliminary determination of the chemical compositions of processed Jatropha curcas kernel meals revealed that the double cooked sample had higher crude protein (38.20%), and energy (1238Kcal/kg) values over the cooked once which had (32.29%) and (1126Kcal/kg), respectively. It was also shown that the anti-nutritional factors in the sample of the double cooked were lower in value over the cooked once that had higher values. There were significant (p<0.05) differences among the treatment means in terms of daily weight gain and average final weight. The apparent crude protein, crude fiber, ether, and ash digestibility were not significantly affected by the dietary inclusion of the test ingredient irrespective of the processing method did not impose any ill-effect on the experimental animals.

Keywords: *Jatropha curcas*, weaner rabbits, processing methods.

INTRODUCTION

The products of livestock such as beef, mutton, pork, egg as well as rabbits meats are highly essential for man`s protein intake. Rabbit meat is high in protein and low in fat, cholesterol, sodium and calories (Amagbade, 2006). Rabbit is reared purposely to achieve protein self-sufficiency for the home. As a result of this, its production has remained in the hands of children and micro-scale producers in most countries. The situation therefore calls for expansion and higher efficiency in production of rabbit and its meat.The level of animal meat consumption has direct influence on the general well-being and health of the populace; protein especially of animal origin has no substitute in the growth development, replacement and repair of the body tissue because protoplasm is mainly protein. Despite concerted efforts to increase food production in the most countries over 800million people still suffer from malnutrition (Amagbade, 2006). The 2011 National Agricultural Sample Survey indicated that Nigeria was endowed with an estimated 19.5 million cattle, 72.5 million goats, 41.3 million sheep, 7.1 million pigs and 28,000 camels, 145 million chickens, 11.6 million ducks, 1.2 million turkeys and 974, 499 donkeys (Audu 2019)

Jatropha curcas is known to be among the non-timber plants of the forest species of the genus *Jatropha curcas* and are known to be very toxic. It is commonly known as *physic nut*. It belongs to the family Euphobiacaea. It is known as Binita suga or chinida suga in Hausa, Odoala in Igbo and Lapalapa or Butuje in Yoruba. It is a small tree which can reach a height up to 60cm. The plants grows quickly, survives in poor string soil and it is resistant to drought. It is considered to have originated from Central America but presently grown in most of the tropics(Duke, 1986).Stewart(1989) reported that *Jatropha curcas* seed is toxic to rats, mice and ruminant but a well prepared meal after detoxification may contain about 32 – 35% of protein contains high quality of lysine, methionine and other essential amino acids.

The seeds of *Jatropha curcas* are good sources of oil of about 27 – 40% which when processed produce a high quality of bio-diesel, usable in standard diesel engines (Venkateshi, 1978). Different products of *Jatropha curcas* trees have been used in the treatment of toothache, carrtha, running nose, cough and so on. This study was carried out to determine the effect of different processing methods on the utilization of *Jatropha curcas* kernel meal (JKM) by weaner rabbits.

MATERIALS AND METHODS

The experiment was carried out at Agriculture Extension and Management Teaching and Research farm of the Federal College Forestry, Ibadan. The site is on latitude N7^{o} 23$^{'}$43$^{"}$ and longitude E 3^{o} 51’44, located in the rain forest vegetation of the South Western part of Nigeria. It receives a mean annual rainfall of 1300 to1500mm and average relative humidity of about 80-85%. Twelve weaner rabbits (6-8 weeks old) weighing 615-616g were used for the feeding trial. The rabbits were assigned to three treatments with four replicates each in a completely randomized design arrangement.

The *Jatropha curcas* kernel was prepared from *Jatropha curcas* fruit harvested from life *Jatropha curcas* trees used for boundary demarcation behind the Nigerian Police Barracks, Dugbe, Ibadan. The fruits were decortified and later shelled to remove the kernel. Then the kernels were shared into two equal parts. One part was boiled for forty minutes. The second part was boiled for first forty minutes before the water was poured away; then same kernels were washed and poured into clean iron pot and boiled for another forty minutes. The two sets of the kernels were then wrapped with *Thaumatococcus daniellii* (Katemfe) leaves treated with Methelated spirit. The wrapped kernels were allowed to ferment for 7 days so as to reduce the alkaloid as well as the moisture contents. They were sun-dried for four days to make them easily milled. The kernels were milled to size which was possible for it to mix adequately with other ingredients to form the experimental diet. The meal from the *Jatropha curcas* kernels boiled once were used to replace soybean meal in treatment 2 (T_2) at 25%.those that were boiled twice were used to replace soybean meal in treatment 3 (T_3) at 25% respectively, while treatment 1 (T_1) did not have either of the test ingredients. Hence it served as the control.

Table 1: Ingredient composition (%, as fed) of the experimental diets

Ingredients	Composition		
	T1	T2	T3
Maize	45.75	45.75	45.75
Soybeans	18.00	13.50	13.50
*JKM	0.00	4.50	4.50
Fish Meal	1.00	1.00	1.00
Blood Meal	0.50	0.50	0.50
Wheat Meal	29.25	29.25	29.25
Bone Meal	3.00	3.00	3.00
Oysters Shell	2.00	2.00	2.00
Premix	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Total	100	100	100
Calculated			
Crude Protein	17.54	17.01	17.20
ME (Kcal/kg)	2.74	2.63	2.71
Ether extract	4.73	5.23	7.32
Crude Fiber	5.25	6.20	6.04

Key: JKM= *Jatropha curcas Meal*

T_1= Diet containing no *Jatropha curcas* Meal
T_2 = Diet containing once cooked *Jatropha curcas* Meal *at 25% replacement of soybean meal*
T_3= Diet containing twice cooked *Jatropha curcas* Meal *at 25% replacement of soybean meal*

The hutches were cleaned and disinfected using Izalas disinfectant at 7 days before the rabbits were stocked. The feeder and drinker were washed and disinfected before the commencement of the experiment. The floor of the metal cage permits dropping of the feaces. These animals were de-wormed using ALBIDOL®. Antibiotics and vitamins were appropriately used as occasion demanded. The rabbit were acclimatized for one week before the introduction of the experimental diets. The three formulated diet were kept in polythene bags, away from rats. The rabbit were served with the experimental diets twice daily between 7:00am-7:30am and 6:30-7:30pm. Water was offered *ad libitum*.

Data collection for the experiment was centered on the followings:-
Daily feed intake was calculated as;

$$DFI(g) = (FG - FL) \ldots\ldots\ldots\ldots\ldots 1$$

Where,
DIF = Daily feed intake
FG = Feed gift
FL = Feed left-over

Average weight gain per treatment group was calculated at the end of every week as thus:-

$$AWG(g) = (FBW - IBW)/7 \ldots 2$$

Where:
AWG = Average weight gain,
FBW =Final body live weight
IBW= Initial body weight

Feed Efficiency was determined using,

$$FE = WG/FC \ldots\ldots\ldots\ldots\ldots 3$$

Where:
FE = Feed efficiency
WG = Weight gain (g)
FC = Feed consumed (g)

At the fourth week of the experiment rabbits were moved to separate cages already cleaned and disinfected for digestibility and metabolic trials. Three days adjustment was made prior to four days collection period. Rabbits were fed their respective diets while the feed intake was recorded. Faeces collected from the replicates for each day were

weighed and oven dried at 80^0C to constant weight. Thereafter the proximate composition was determined according to the procedures of AOAC (2012). Nutrient digestibility was then computed as follows.

$$ND(\%) = (NI - NV/NI)\, x\, 100 \ldots. 4$$

Where:
ND = Nutrient Digestibility (%),
NI =Nutrient intake
NV= Nutrient voided

Chemical analysis

Ground (1 mm) samples of the experimental diets were analyzed for dry matter (DM), ash, total N as Kjeldahl N and fat contents as well as Ash were determined using standard procedures (AOAC, 2012). Crude protein (CP) was calculated as Kjeldahl N x 6.25 (AOAC, 2012). Ether extract (EE) was determined by extracting the sample with petroleum ether using a Soxtec System HT (AOAC, 2012). Crude fibre (CF) was determined as the insoluble organic residue after digestion (AOAC, 2012).

Data Analysis

All data generated were subjected statistical analyses using SAS (SAS, 2000). The effect of JKM inclusion levels on performance and diet digestibility was examined by one-way analysis of variance (ANOVA) while the differences in mean were separated using the Duncan Multiple Range Test (1995) at 5% probability.

RESULTS

Table 2 below shows the chemical composition of processed *Jatropha curcas* kernels meals. It revealed that the double cooked sample had higher crude protein (38.20%) and energy (1236 Kcal/kg). Samples of JKM cooked once had higher nitrogen free extract (54.95%) over the double cooked twice (48.84%).

Table 2: Chemical Composition of processed *Jatropha curcas* Kernel Meal

Component	Cooked once	Cooked twice
Crude Protein	32.29	38.20
Crude Fiber	3.22	4.01
Ether Extract	7.40	6.92
Ash	2.13	3.04
Nitrogen Free Extract	54.95	48.84
Metabolizable Energy (Kcal/kg)	1126.00	1238.00
Anti-nutritional factors (ANF)		
Saponin	1.46	0.84
Trypsin	0.70	0.52
Agglutinin	0.47	0.31
Phobolester	0.26	0.16
Tannin	0.147	0.130

The growth performance characteristics of weaner rabbits fed the experimental diets are summarized in Table 3. There were significant ($p<0.05$) differences among the treatment means in terms of average final weight, average total weight gain and average daily weight gain. The improvement in the total weight and average daily weight gain of rabbits fed diet 3, followed by those of diets 2 indicated that the test ingredients affected both feed intake and body weight gain of the rabbits. This could be as a result of the higher crude protein content and energy contents of the test ingredients as contained in the diets. Rabbits fed diets 3 (25% JKM double boiled) had the highest weight gain (505.40g), followed by rabbits fed diet 2 (470.00g), while rabbits fed diets 1 (330.10g) had the least weight gain.

Table 3: Growth performance characteristics of weaner rabbits fed diets containing differently processed *Jatropha curcas*.

Parameter	T_1	T_2	T_3	SEM
Average Initial Live weight (g)	616.00	616.00	615.00	2.94
Average Final Live weight (g)	951.13^c	1090.00^b	1120.4^a	18.77
Average Daily weight gain (g)	230.10^c	470.00^b	505.4^a	57.27
Average Feed Intake	55.30	60.00	65.97	0.95
Average Feed Efficiency	0.20	0.24	0.26	0.04

Means on the same rows with different superscripts are significantly ($p<0.05$) different.
SEM = Standard Error of Mean

The crude protein, crude fiber, ether extract, and ash digestibility were not affected by the dietary inclusion of JKM as they were similar among all the treatments with animals fed diet containing once cooked *Jatropha curcas* meal *at 25%* replacement of soybean meal having the best Crude protein digestibility (85%) and Ether Extract digestibility (89%).

Table 4: Apparent nutrients digestibility of weaner; rabbits fed differently processed *Jatropha curcas* based diets

Parameter	T_1	T_2	T_3	SEM
Crude protein digestibility (%)	74.60	74.00	85.00	0.70
Crude fiber digestibility (%)	38.00	39.00	37.20	0.55
Ether Extract digestibility (%)	84.20	88.90	89.00	0.60
Soluble Carbohydrate (%)	74.00	78.00	78.00	0.48
Ash Digestibility (%)	52.30	56.40	56.00	0.42
NDF	52.01	54.31	45.10	0.33
ADF	44.50	46.10	45.10	0.24
ADL	39.50	39.10	39.22	0.22

Key: NDF – Neutral Detergent Fiber ; ADF - Acid detergent Fiber; ADL - Acid Detergent Lignin

DISCUSSION

The anti-nutritional factors in double cooked sample were lower in values when compared with the sample of the one cooked once. This may make it safer to be consumed by livestock. The weight gain been higher in double cooked JKM is in agreement with the findings of Jang *et al.,* (2018) who reported that growing pigs fed JKM as substitute for soybean meal gained more weight and Maidala *et al.,* (2016) who reported that rabbits fed cooked soyabean significantly gained more weight. The better performance of rabbits fed diets with cooked JKM could be attributed to the processing method (cooked once and cooked twice) of the test ingredients in the diets that may have possibly reduced Anti-Nutritional Factors to amounts that were not deleteriousbut promoted growth of the rabbits. According to Elemele *et al.*.(2007), fermentation process improves digestibility of nutrients by breaking down nutrients into simpler forms, as well as removing inhibitory chemicals.

The rabbits in diet 1, 2 and 3 consumed an average of 55.30,60.70 and 65.97g respectively of the diets daily. These values were however not significant ($P<0.05$). This is similar to the findings of Matondi *et al,.*(2015) who also reported no significant difference in intake of rabbits fed soybeans. However, Gabriel *et al.,* (2006) reported that rate of feed intake in animals depends on the age, sex, physical condition, health and activity of the animal.

It is commonly accepted that an increased in crude protein content of a feed-stuff increases it crude protein digestibility because the proportional contribution of endogenous nitrogen to total faecal nitrogen had increased (Fraga, 1998). The crude protein, crude fiber, ether extract, and ash digestibility were not affected ($p<0.05$) by the dietary inclusion of JKM. This implies that JKM inclusion did not impose any significant effect ($p>0.05$) on nutrition digestibility irrespective of the processing method. This result is unlike the result of Maidala *et al.,* (2016) who reported higher protein and other nutrients in the diet containing processed cowpea (Fakolade and Adetomiwa, 2018) who also reported lower protein and higher crude fibre and ash levels respectively,in the diet of rabbits fed sun flower seed meal.

CONCLUSION

The result of this study showed that *Jatropha curcas* meals (JKMs) had effect on the growth performance of weaner rabbits, as there are significant ($p<0.05$) differences in daily weight gained and final live weight. No adverse effect in growth performance of weaner rabbits was observed when JKM was used to replace soya bean meal at 25%.

Recommendations

Based on the results of this research work it is important to recommend that:

i. Inclusion of *Jatropha curcas* at 25% (cooked twice) that gave better result in weaner rabbits could be used as replacement for soya bean meal in livestock diets.
ii. More research should be carried out on further processing and increased levels of inclusion of *Jatropha curcas* in livestock diet.

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