COMPARATIVE EVALUATION OF RAW AND PROCESSED *Jatropha curcas* SEEDS MEAL ON PERFORMANCE OF COCKEREL CHICKS

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Abstract: A 28 day study was conducted to evaluate the effects of feeding on raw and processed *Jatropha curcus* seeds meal (JSM) on proximate composition of dry matter, crude protein, crude fibre, ash, and ether extracts,weight gain, feed intake, daily protein intake, protein efficiency ratio and feed conversion ratio of Black Nera cockerel chicks. There were forty day-old cockerel chicks in each of thefour treatments comprising of the control, raw, 30 min boiled and 45 min boiled *Jatropha curcus* seeds meal (JSM) inclusion at 10%, respectively into cockerel diet. A total of 160 birds with an average weight of 28.85 g were completely randomized for the experiment. The results revealed that birds fed on the control diet had higher body weight gain of 299.37 g and feed intake of 498.77 g which were significantly ($p<0.05$) superior compared with birds on raw (48.49 and 299.91 g), 30 min boiled (68.41 and 393.41 g) and 45 min boiled jatropha seed meals (73.53 and 353.11 g), respectively. Similarly, the feed conversion (FCR) (1.67) and protein efficiency ratios (PER) (2.79) of birds on the control diet were superior ($P<0.05$) compared with FCR and PER values of 6.18 and 0.70 for raw treatment, 5.79 and 0.79 for 30 min boiled seeds treatment and 1.81 and 0.91 for 45 min boiled dietary treatments. Cockerels fed raw and processed *Jatropha curcus* seeds meal (JSM) depressedbody weight gain and feed intake. Further research should be embarked upon on other treatment methods or combinations of processing techniques that could detoxify the toxins in *Jatropha curcus* seeds to improve performance.

Keywords: Cockerel chicks, *Jatropha* seed, growth performance, phorbolesters

Introduction

The production of conventional protein and energy sources are still grossly inadequate in most of the developing countries of theworld and often times demand exceed supply. With the increasing human population in Nigeria there are very stiff competition between man and livestock for the available feed resources (Obun & Abia, 2003). The livestock industry is worst hit as the need for human take priority over those of livestock production.

Fajimi *et al*. (1997) had earlier opined that evaluation of non conventional feed resources alongside other strategies would reduce pressure on the conventional feed ingredients and accelerate the attainment of feed security for monogastric animals. In view of the above, efforts are been made to use other protein sources such as pigeon pea (*Cajanus cajan*), locust bean seed (*Parkia biglobosa* and Tallow (*Detarium microcarpun*) seed meal (Obun & Ayanwale, 2007) to reduce over dependency on the limited conventional feed resourcessuch as maize, soybean meal and groundnut cake as key protein and energy feed stuff for livestock.

It is for this reason that *Jatropha curcas* seed was consideredas an alternative source of plant proteinin this research. *Jatropha*, a multipurpose drought resistant shrub is native to tropical America but thrives throughout Africa, Asia and other tropical and subtropical countries. It also grows in a number of climatic zones including areas of low rainfall. Other attributes of *Jatropha* include easiness to establish, relatively quick growth rate, hardy and ability to grow on marginal land and reclaim or restore eroded soils (Makkar and Becker, 2009). Various parts of the plant hold potential for use as animal feed and medicinal value (Makkar and Becker, 2009). Raw *Jatropha* seed meal (free of shells) has been found to have a very high nutritive value (60% crude protein) comparable to that of soybeans meal (45% crude protein with high amino acids composition (Makkar and Becker 1997; Makkar *et al.*, 1998; Martin *et al*., 2006).

Preliminary studies on the nutritional value of *Jatropha* seeds showed that the presence of anti-nutritional factors (Phorbolesters, saponins, tannins, phytates, lectins, hydrocyanides and oxalate) limits it use in animal nutrition in the raw form (Annongu *et al*., 2010; Makkar and Becker, 1997, Makkar *et al*., 1998). Diets containing *Jatropha* meal with 1.5 to 2 mg/g of phorbolester have been found to cause suppression of feeding, lesions on the skin, weight loss and death in both fish and rats (Makkar and Becker, 1999). Toxicity of *Jatropha* seeds has been studied extensively in different animal models like goats, sheep, mice, rats and fish when fed with phorbolesten containing feeds (Goel *et al.*, 2007). Carp (*Cyprinus carpio*) were found to be highly susceptible to phorbolesten present in *Jatropha.*

Investigations on the use of Jatropha seeds have been mainly as potential sources of oil as bio diesel to substitute fossil fuel in automobiles. The seeds contain about 60% oil. The cake remaining after oil extraction is used as manure to enrich soil for crops. Processing by heat treatment has been reported to detoxify the anti-nutritional in *Jatropha* seeds (Becker and Makkar, 1997; Makkar *et al*,. 1997; Makkar and Becker, 1999; Aregheore *et al*., 2003). Hence, this study is aimed investigating the nutritional value of processed *Jatropha curcas* seed meal (JSM) on cockerel chick's performance.

Materials and Methods

Experimental site

The experiment was conducted in the Poultry Unit of Teaching and Research farm of Federal College of Wildlife Management, New Bussa, Niger State.New Bussa is located between latitude 7°31 – 10°00N and longitude 4°30 – 4°33E (Adewetan *et al*., 1980) in the savanna areas of Niger basin.

Source and processing of the ingredients

Jatropha curcas seeds used in this experiment were obtained from ripened fruits harvested from Kaiama, Kwara State of Nigeria. The fruits were manually cracked to remove the seeds (endosperm). The seeds were divided into three (3) parts. One part was milled Raw, second part boiled for 30 min at 100^{o}C and the third part was boiled for 45 min at 100^{o}C, respectively. The raw and processed seeds were milled usinghammer miller into smaller

particles of 2 mm particles size. This formed the *Jatropha curcas* seeds meal (JSM).

Diets formulation

Four (4) diets were formulated with diet 1 to serve as control (No JSM) while diet 2 contained 10% raw *Jatropha curcas* seeds meal (JSM), diet 3 contained 10% 30 min boiled *Jatropha curcas* seeds meal (JSM) and diet 4 contained 45 min boiled *Jatropha curcas* seeds meal (JSM) (Table 1).

Table 1: Composition of the experimental diets (%)

Ingredients	Control (T_1)	RJSM (T_2)	30 min JSM (T_3)	40 min JSM (T_4)
Maize	51.00	51.00	51.00	51.00
Maize Offal	10.00	10.00	10.00	10.00
Fish meal	4.00	4.00	4.00	4.00
GNC	30.00	20.00	20.00	20.00
JSM	0.00	10.00	10.00	10.00
Bone meal	2.50	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50	1.50
Premix	0.25	0.25	0.25	0.25
Salt 0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated analysis				
Crude protein	22.00	21.46	21.44	21.44
ME (Kcal/kg)	2907.74	2915.65	2915.20	2915.31
Analyzed composition				
Crude protein	19.43	22.89	21.85	23.77
Crude fibre	6.00	8.00	8.00	7.00
Ether extracts	6.20	9.00	9.00	8.00

* To provide the following per Kg of feed: vit. A, 100000iu; vit. D_3 2000iu; vit. B, 0.75mg; nicotinic acid 25 mg; Calciumpanthothenate, 12.50mg; vit. B_{12} 2.5mg; vit. K, 2.5mg; vit. E 25mg; Cobalt 0.4mg; Biotin, 0.50mg; Folic acid, 1mg; Cholinchloride, 25mg; Cu, 8.00mg; Mg-64mg; Fe, 32 mg; Zn, 4mg; I, 0.80mg; Flavomycin, 100mg; Spiramycin, 5mg; DL-methionine 50mg; Se, 0.16mg; 1-lysine 120mg; ***JSM**= Jatropha seed meal; **RJSM**= Raw jatropha seed meal; **GNC**=Groundnut cake

Bird's allocation and experimental design

One hundred and sixty (160) Black Nera day old cockerel chicks were purchased from commercial dealer at Ibadan, Oyo State. The whole poultry house was thoroughly disinfected with disinfectant before the arrival of the birds. The birds were randomly allotted into four (4) treatments of 40 birds each, replicated four times with ten (10) birds each in a completely randomized design (CRD). The birds were raised on a deep litter pen with wood shaving as letter material. The open side of the poultry house was covered with empty sacks to conserved heat. Heat was provided using a 200 watts bulb; feed and water were given to birds *ad libitum.* The birds were given vitalyte in water for the first three days of their arrival to reduce stress and boost their immunity. The birds were vaccinated with lasota and gumboro vaccine at the first and second week. The birds were treated against infection using neoceryl (antibiotic drug) in water, anti-coccidiosis (Acoban) was used to prevent against coccidiosis diluted in water. The experiment lasted for twenty seven (27) days.

Data collection

Daily records of mortality, feed intake and weekly weight gain were kept. The feed intake and weight gain were used to calculate feed conversion and protein efficiency ratio (PER) according to McDonald (2000).

Chemical analysis

Proximate composition of the crude protein, crude fibre, ash and ether extracts fractions of the experimental diets were determined by AOAC (2002) method.

Statistical analysis

The analyzed data were subjected to analysis of variance (ANOVA) as outlined by Steel and Torrie (1980) while Means were separating using Duncan (1955) method.

Results and Discussion

The proximate composition of raw and processed *Jatropha curcas* seeds meal (JSM) are presented in Table 2. The crude protein values (%) of 30.21 for raw, 35.54 for 30 min boiled and 30.08 for 45 min boiled and crude fibre values (%) of 12, 9 and 10 for raw, 30 min boiled and 45 min boiled were high, respectively. The ash value of 5.79, 5.67 and 6.7% and ether extracts values (%) of 6, 7 and 5 were low. These values are similar to those reported by Makkar and Becker (1997) except for lipid. The crude protein content for the processed *Jatropha curcas* seeds meal (JSM) at 30 minutes was slightly higher (32.54%) compared to the raw (30.21%) and 45 min boiled (30.08%) JSM. Theslight differences of 2% in crude protein of 30 min boiled seeds could be that the heat duration was adequate not leaching the protein in the seed and making the available. The proximate fraction of crude protein obtained in this result is in contrastwith values of 56.4, 61.2 and 63.8%, respectively reported for different varieties of JSM by Makkar and Becker (1997). The crude protein content (CP) of JSM in this study with ranged values of 30.5 – 35.5% crude protein (CP) is not in agreement with reported value by Makkar and Becker (1997). These may probably be attributed to the environmental differences and processing technique.

Table 2: Proximate composition of *Jatropha curcas* seeds meal (% DM basis)

Composition	Raw	30 min boiled JSM	45 min boiled JSM
Dry matter	90.50	92.00	92.01
Crude protein	30.21	32.54	30.08
Crude fibre	42.00	22.00	27.00
Ether extracts	6.00	7.00	5.00
Ash	5.76	5.67	5.34

Table 3: Performance of cockerel chicks fed experimental diet

Parameters	Diets				
	T_1	T_2	T_3	T_4	SEM
Initial Body Weight (g/bird)	27.69^b	28.46^a	28.47^a	30.76^a	–
Final Body Weight (g/bird)	327.41^a	76.85^c	96.88^b	104.29^b	0.54
Body Weight Gain (g/bird)	299.57^a	48.49^c	68.41^b	73.53^b	38.84
Daily Body Weight Gain	11.08^a	1.80^c	2.53^b	2.72^b	1.44
Total Feed Intake (g/bird)	499.77^a	299.91^d	393.41^b	353.11^c	28.04
Daily Feed Intake (g/bird)	18.49^a	11.09^d	14.58^b	13.08^c	1.04
Feed Conversion Ratio (FCR)	1.67^c	6.18^a	5.79^a	4.81^b	0.67
Protein Efficiency Ratio	2.79^a	0.70^c	0.79^c	0.91^b	0.32
Daily Protein Intake	107.10^a	68.96^d	85.95^b	80.07^c	5.25

^{a,b,c,d} = Means on the same row with different superscripts are significantly ($P<0.05$) different.

Performance of cockerel chicks fed raw and processed *Jatropha curcas* seeds meal (JSM) is presented in Table 3.The final body weight of the birds on diets T_1, T_2, T_3 and T_4 were 327.41, 76.85, 96.88 and 104.29 g, respectively. The body weight gain and daily weight gain on T_1, T_2, T_3 and T_4 were 299.57, 48.49, 68.41 and 73.53g and 11.08, 2.53 and 2.72 g, respectively. The results revealed that birds fed the control diet (0% JSM) had the highest feed

intake (299.57g) and weight gain (327.41 g) which were significantly ($p<0.05$) higher than those fed raw and processed JSM. The best final body weight, weight gain and daily weight gain of birds on T_1 may be due to the superiority of GNC diet compared with those on T_2, T_3 and T_4. The decreased in final body weight (FBW) and daily weight gain (DWG) of birds on T_2, T_3 and T_4 could be attributed to the processing technique which may possibly not eliminate the anti-nutritional factors in the seeds. This results are in conformity with the work of Annongu *et al.* (2010), who reported that the marginal differences in feed utilization efficiency and the highest mortality rate observe on the diet with JSM with boiled, roasted and fermented in their study could be explained in terms of the degree of efficiency of the various methods adopted to detoxify JSM.

The total feed intake and daily feed intake of birds on T_1, T_2, T_3 and T_4 were 499.77, 299.91, 393.41 and 353.11 g and 18.49, 11.09, 14.58 and 13.08 g, respectively. The difference in feed intake between T_1 and T_2, T_3 and T_4 may be an indication of unpalatability and inefficiency in the detoxification processes of *Jatropha curcas* seeds meal (JSM). Makkar and Becker (1997) reported that *Jatropha curcsa* contained some anti-nutritional factors such as phorbolesters, saponins, tannins, phytates, lectins, hydrocyanides and oxalate which may reduce palatability of the diet. The decrease in body weight and feed intake of cockerel chicks fed the raw and processed *Jatropha* seed meal in this study agrees with previous reports by Makkar and Becker (1997) and Makkar and Becker (1999) that phorbolester in *Jatropha* seed causes suppression of feeding, lesions on the skin, weight loss and death in both fish and rats. The feed conversion ratio (FCR) and daily protein intake of birds on T_1, T_2, T_3 and T_4 were 1.67, 6.18, 5.79 and 4.81 and 107.10, 68.96, 85.95 and 80.07, respectively. The protein efficiency ratio of birds on the T_1, T_2, T_3 and T_4 were 2.79, 0.70, 0.79 and 80.07, respectively. Feed conversion and protein efficiency ratios showed significant ($P<0.05$) difference among the treatments. The feed conversion ratio was better in birds fed control diet (0% JSM) than those fed JSM even though the seeds were boiled for 30 and 45 min, respectively. This result agrees Annongu *et al*. (2010) who also reported lower feed conversion ratio (FCR) and protein efficiency ratio in cockerel fed *Jatropha curcas* seeds meal (JSM).

Conclusion

In this study, 30 min boiled seeds enhanced proximate fractions of crude protein, crude fibre, ash and ether extracts. The body weight gain, feed intake, feed conversion and protein efficiency ratios of cockerel chicks were adversely affected by the test ingredient. Further research work should be carried out to investigate the processing technique(s) that will eliminate the toxins which pose a constraint to *Jatropha curcas* seeds meal (JSM) for its full utilization as feed resources.

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