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THE POTENTIAL OF DUM PALM (*HYPHAENE THEBAICA*) SEED MEAL AS FEED FOR BROILER CHICKENS

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An 8 week study was conducted to evaluate the effects of *hyphaene thebaica* seed meal (HTSM) as substitute for maize on the growth response of broiler chickens. Five experimental diets were formulated to meet nutrient requirement standards of broilers (NRC, 1994). Diet 1 (0 % HTSM) served as the control while diets 2, 3, 4 and 5 contained 5, 10, 15 and 20 %HTSM respectively replacing maize in the diets of birds. A total of two hundred and twenty five (225) day-old broiler chicks were randomly allotted into five treatment groups with three replicates of fifteen birds each. Each group was assigned to the five experimental diets in completely randomized design (CRD). Throughout the experimental period, feed and water were provided *ad libitum* for all treatment groups. There were significant differences (P<0.05) in the parameters measured except the average initial weight and average feed intake (P>0.05). The average body weight gain and feed conversion ratio of birds fed 0, 5 and 10 % HTSM diets were significantly better (P<0.05) compared to those fed 15 and 20 % HTSM diets. It was concluded that broiler chickens can tolerate up to 10 % raw HTSM in their diets without adverse effect on growth performance. Also, adequate processing of the seed should be carried out to reduce the anti-nutritional factors to a tolerable level before being used in broiler diet.

Keywords: broiler, performance, carcass, *hyphaene thebaica* seed meal

There is increasing demand for poultry products globally (USDA, 2012). This is due to the perceived healthiness of poultry being high in beneficial unsaturated fatty acids, it has high return over a short period, requires low capital for investment, high acceptability in many culinary traditions and increase in human population. The demand is expected to be more in developing countries due to increase in human population in the region (Guyomard *et al.*, 2013). However, the current state of poultry production in the developing regions is incapable of meeting the current protein needs of the masses let alone of meeting future demand. The major problem facing poultry industry in the developing countries is high cost of conventional feedstuffs due to undue competition for conventional feedstuffs between human and livestock making the poultry business unproductive. The foregoing scenario gives impetus to search for alternative, cheaper and less competitive feedstuff for the poultry industry. Indisputably, there exist various indigenous leguminous plants in tropical countries that could be used as poultry feed (Martens *et al.*, 2013). One of such plants that have potential of being inexpensive, locally available and nutritionally dense is Doum palm (*Hyphaene thebaica*), which is an African palm tree, common in Upper Egypt, originally native to the Nile valley, bearing an edible fruit which is glubose quandrangular, about 6 x 5 cm with a shinny orange-brown to deep chestnut skin (epicarp). It belongs to the family *Arecaceae* commonly known as doum palm, Dum Nut or gingerbread tree. It also grows in the Sahel in the hot Savanah between 12-18 N from Senegal to Northern Nigeria, Chad, Zaire and North East Africa. The young leaves are readily eaten by livestock while the old leaves are bitter and unpalatable. The rind (mesocarp) in some palm is unedible but of other, it is very palatable, highly aromatic and sweet with a taste like ginger bread hence the English name. When eaten, it serves as vermifuges and parasite expellant (Burkill, 1997). Research on the fruit pulp has shown that it contains nutritional trace minerals, proteins and fatty acids, particular the nutritionally essential linoleic acid (Cook *et al.*, 2000). Nwosu *et al*. (2008) reported that the mesocarp of Doum palm fruits contains 8.10 % ash, 0.95 %ether extract, 0.01 %protein, 89.25 %carbohydrate, 3655.9 Kcal/kg Metabolizable energy while Eissa *et al.* (2008) showed that the fruit pulp contains 4.91% proteins, 5.26% fat, 4.5% ash and 85.33% total carbohydrate. Doum was reported to lower the blood pressure, when its biological activity was evaluated in rat feeding experiments (Betty *et al*., 2006). There is paucity of information on the nutritional properties of Doum palm (*Hyphaene thebaica*) and its use in poultry feed. The objective of this study was therefore to evaluate the effect of different replacement levels of maize with HTSM on the growth response of broiler chickens.

MATERIALS AND METHODS

The research was carried out at the Poultry unit of the Teaching and Research Farm of the Department of Animal Science, Federal University, Gashua, Yobe State, Nigeria. It has an area of $772km^2$ and Coordinates: 12°52′5″N 11°2′47″E. The hottest months are March and April with temperature ranges of 38-40^{o}C. In the rainy season, June-September, temperatures fall to 23-28^{o}C, with rainfall of 500 to 1000 mm (Climatemp, 2018).

Preparation of *Hyphaene thebaica* seed meal (HTSM)

The dried *H. thebaica* fruits were purchased from Gashua market, Yobe state, in the North Eastern part of Nigeria. The fruits were crushed with machine and the kernels were discarded. The mesocarps were then milled to particle sizes to pass through a 3mm sieve, using a hammer mill. Other feed ingredients such as maize, soyabean, wheat offal, maize bran etc were purchased from Gashua market.

Proximate Analyses and Metabolisable Energy Determination of HTSM

Samples of the meal were subjected to proximate analysis using the methods described by

A.O.A.C (2006) to determine the following proximate fractions: Moisture content, dry matter (DM), Crude protein (CP), Crude fibre (CF), Ether extract (EE), Ash, Nitrogen free extract (NFE). The metabolisable energy (ME) of the seed meal was calculated, using the methods of Pauzenga (1985).

Phytochemical Analysis

The following phytochemicals were determined using the standard procedures (AOAC, 2006): flavonoids, tannin, oxalate and saponin.

Experimental Diets

The experiment was in two phases (starter and finisher), five diets were formulated to meet nutrient requirement standards of broilers (NRC, 1994). Diet 1 (0 % HTSM) served as the control while diets 2, 3, 4 and 5 contained 5, 10, 15 and 20 %HTSM respectively replacing maize in the diets of birds. The gross composition of the experimental diets and their analysed nutrient contents are presented in Table 1.

Experimental Birds and Design

A total of two hundred and twenty five (225) day-old broiler chicks were purchased from a reputable distributor. They were raised on commercial broiler starter diet for one week, after which they were randomly allotted into five treatment groups with three replicates of fifteen birds each. Each group was assigned to the five experimental diets in completely randomized design (CRD). Throughout the experimental period, feed and water were provided *ad libitum* for all treatment groups. This was accompanied by necessary prophylactic medication and vaccination. The experiment lasted for a total of 56 days.

Growth performance data

Daily feed consumption was recorded as difference of feed offered and the left-over. Weight gain was measured weekly. The feed intake and weight gain recorded were used to estimate feed conversion ratio as a ratio of feed/gain of each replicate.

Table 1: Gross Composition of the Experimental Diets

	Dietary levels of *Hyphaene thebaica* seed meal (%)									
	Starter diets					**Finisher diets**				
Ingredients, Kg	**0**	**5**	**10**	**15**	**20**	**0**	**5**	**10**	**15**	**20**
Maize	54.00	51.30	48.60	45.90	43.20	56.00	53.20	50.40	47.60	44.80
*HTSM	0.00	2.70	5.40	8.10	10.80	0.00	2.80	5.60	8.40	11.20
Soyabean meal	27.00	27.00	27.00	27.00	27.00	24.00	24.00	24.00	24.00	24.00
Maize offal	5.95	5.95	5.95	5.95	5.95	6.80	6.80	6.80	6.80	6.80
Palm kernel cake	6.00	6.00	6.00	6.00	6.00	5.00	5.00	5.00	5.00	5.00
Fish meal (48%)	2.00	2.00	2.00	2.00	2.00	1.50	1.50	1.50	1.50	1.50
Limestone	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65	0.65	0.65
Bonemeal	2.50	2.50	2.50	2.50	2.50	3.00	3.00	3.00	3.00	3.00
Palm oil	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00
Common salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
**Vit/Min Premix	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Calculated analysis (%)										
Crude protein	22.57	22.26	22.35	22.51	22.09	20.04	20.12	20.17	20.08	20.14
Crude fibre	3.76	3.85	3.90	4.11	4.17	3.62	3.75	3.97	4.01	4.05
Energy (Kcal/Kg ME)	2887	2883	2880	2875	2872	3058	3046	3040	3038	3031
Ether extract	5.36	5.33	5.38	5.34	5.37	6.12	6.07	6.11	6.18	6.09
Available P.	0.57	0.58	0.55	0.56	0.54	0.62	0.68	0.64	0.66	0.60
Proximate analysis (%)										
Dry matter	88.24	88.67	87.91	88.34	87.89	89.02	90.15	89.50	88.67	90.00
Crude protein	22.57	21.34	22.09	23.00	22.61	20.04	20.41	20.02	20.11	20.19
Crude fibre	3.76	3.89	3.93	3.98	4.00	3.52	3.70	3.78	3.88	3.97
Ether extract	5.36	4.90	5.21	5.09	4.98	6.12	6.37	6.00	6.04	6.57
Ash	5.62	6.01	6.20	6.09	6.17	5.53	5.86	6.17	6.90	6.14
NFE	62.69	63.86	62.57	61.84	62.24	64.79	63.66	64.03	63.07	63.13

*HTSM=Hyphaene thebiaca seed meal **To provide the following per kilogram of feed: Vit. A, 10,000 iu, Vit. D3, 2000 iu, Vit. E, 5iu; Vit.K, 2mg; Riboflavin, 4.20mg; Vit. B12, 0.01mg; Panthotenic acid, 5mg; Nicotnic acid, 20mg; Folic acid, 0.5mg; choline, 3mg; Mg, 56mg; Fe, 20mg; Cu, 10mg; Zn, 50mg; Co.125mg. NFE: Nitrogen Free Extract =100-(%CP+%CF+%EE+%Ash).

Carcass analysis

At the end of the feeding trial (56 days), three birds per replicate were randomly selected, starved overnight, weighed and slaughtered. The birds were bled and dipped into a warm water (60^{o}C) bath for 5 minutes, feather-plucked after scalding and eviscerated. The dressed carcasses were weighed and dressing percentage was calculated as a percentage of the dressed weight using the formula:

Dressing percentage (%) = $\frac{\text{Dressed weight}}{\text{Live weight}} \times 100$

The carcass and cut parts were removed and expressed as percentage of dressed weight while the weights of the visceral organs (liver, spleen, heart, kidney, gizzard) were taken and expressed as percentage of live weight according to Abe *et al.* (1996) procedure.

Statistical Analysis

Data generated from the study were subjected to one-way analysis of variance (ANOVA) using software (SAS, 2008). Means were separated with Duncan multiple range test at 5% level of significance.

RESULTS

Chemical Composition of HTSM

The proximate/phytochemical composition of HTSM is shown in Table 2. The percentage composition of proximate fractions on dry matter basis was: crude protein, 6.09; ether extract 1.75 and ash, 6.26. Others were crude fibre, 11.49 and

Table 2: Chemical Composition of *Hyphaene thebaica* seed meal

Nutrients (%)	**Concentration**
Dry matter	93.08
Crude protein	6.09
Ether extract	1.75
Ash	6.26
Crude fibre	11.49
Nitrogen free extract	68.39
Metabolizable energy (Kcal/kg)	2796.33
Phytochemicals (%)	
Tannin	0.31
Saponin	1.02
Oxalate	0.67
Phytate	1.13
Flavonoids	0.78

NFE: Nitrogen Free Extract =100-(%CP+%CF+%EE+%Ash). *ME: Metabolizable Energy ME (Kcal/kg) = 37 x % CP + 81.8 x % EE + 35.5 x %NFE (Pauzenga, 1985).

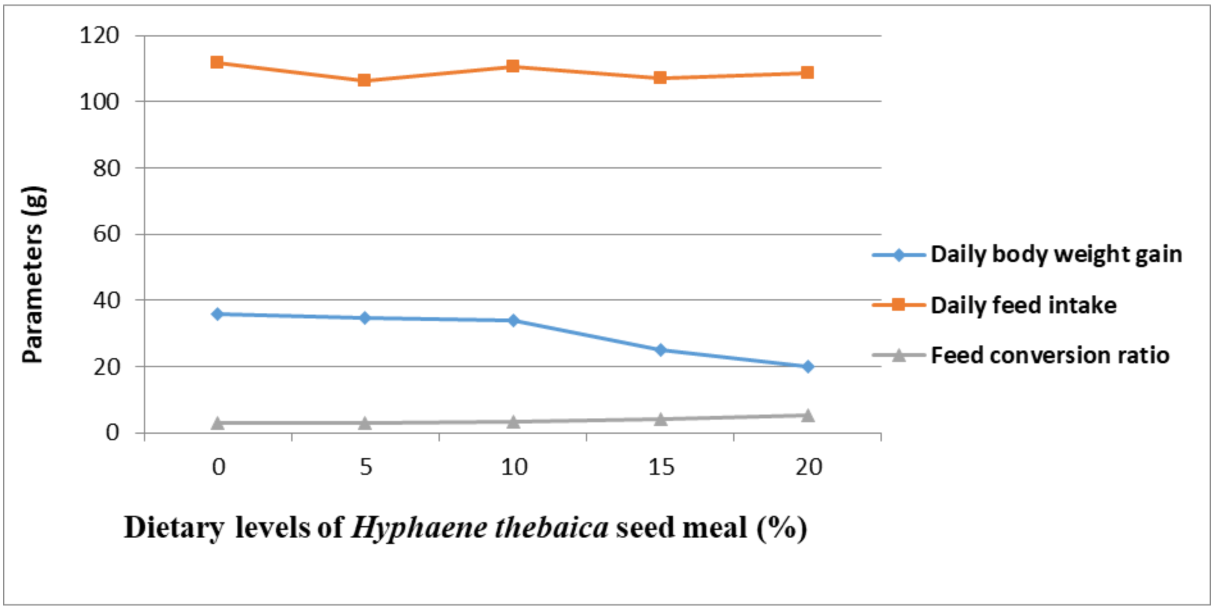

Figure 1: Growth response of Broiler chickens fed HTSM diets

nitrogen free extract, 68.39. The results of the phytochemicals analysed were tannin (0.31 %), saponin (1.02 %), oxalate (0.67 %), phytate (1.13 %), and flavonoids (0.78 %).

The results of the growth response of broiler chickens fed HTSM diet is shown in Figure 1 and Table 3. There were significant differences (P<0.05) in the parameters measured except the average initial weight and average feed intake (P>0.05). The average body weight gain and feed conversion ratio of birds fed 0, 5 and 10 % HTSM diets were significantly better (P<0.05) compared to those fed 15 and 20 % HTSM diets.

The results of carcass and organ weights of broiler chickens fed HTSM diet is shown in Table 4. There were significant differences (P<0.05) in all the parameters measured. The carcass and organ weights of birds fed 0, 5 and 10 % HTSM diets were significantly (P<0.05) higher than those fed 15 and 20 % HTSM diets.

DISCUSSION

Increasing levels of the raw HTSM in the broiler's diets resulted in decreased (p<0.05) body weight gain and increased poor feed conversion ratio as observed among birds fed 15 and 20 % HTSM diets. This observation could be attributed to higher

Table 3: Effects of Different Dietary Levels of HTSM on Performance of Broiler chickens

	Dietary levels of *Hyphaene thebaica* seed meal (%)					
Parameters	**0**	**5**	**10**	**15**	**20**	**SEM**
Av. initial body weight (g)	100.05	100.02	100.08	100.05	100.03	0.04
Av. final body (g)	2100.02[a]	2041.95[a]	1995.68[a]	1500.03[b]	1217.58[c]	121.61
Av. body weight gain (g)	1999.97[a]	1941.93[a]	1895.63[a]	1399.98[b]	1117.55[c]	120.03
Av. daily body weight gain (g)	35.71[a]	34.68[a]	33.86[a]	24.99[b]	19.96[c]	1.98
Av. daily feed intake (g)	111.56	106.18	110.54	106.91	108.50	2.85
Feed conversion ratio	3.12[a]	3.06[a]	3.26[a]	4.28[b]	5.44[c]	0.21
Mortality (%)	0.00	0.05	1.05	0.00	3.16	-

[ab]means in the same row with different superscripts are significantly different (P<0.05). SEM=Standard error of mean.

Table 4: Effects of Different Dietary Levels of HTSM on Carcass and Organ weights of Broiler chickens (0-8weeks)

	Dietary levels of *Hyphaene thebaica* seed meal (%)					
Parameters	**0**	**5**	**10**	**15**	**20**	**SEM**
Live weight, g	2100.02[a]	2041.95[a]	1995.68[a]	1500.03[b]	1217.58[c]	121.61
Slaughter weight, g	2083.16[a]	1985.72[a]	1923.33[a]	1447.15[b]	1164.29[c]	96.57
Dressed weight, g	1688.15[a]	1632.86[a]	1582.07[a]	1092.23[b]	803.65[c]	68.04
Dressing %	80.39[a]	79.97[a]	79.27[a]	72.81[b]	66.00[c]	1.87
Thigh	22.15[a]	21.04[a]	21.10[a]	17.90[b]	13.99[c]	1.63
Drumstick	9.23[a]	8.75[a]	8.00[a]	6.42[b]	5.10[c]	0.83
Breast	24.83[a]	24.00[a]	22.97[a]	18.65[b]	14.59[c]	1.71
Back	15.61[a]	14.95[a]	13.88[a]	12.89[b]	10.00[c]	1.12
Wings	8.92[a]	7.05[a]	7.11[a]	5.14[b]	4.03[c]	0.82
Organ weights (%)						
Heart	0.76[a]	0.69[a]	0.65[a]	0.54[b]	0.43[c]	0.06
Gizzard	3.01[a]	2.79[a]	2.55[a]	1.74[b]	1.29[c]	0.34
Kidney	0.58[a]	0.52[a]	0.49[a]	0.40[b]	0.35[c]	0.05
Liver	2.79[a]	2.35[a]	2.01[a]	1.89[b]	1.55[c]	0.25
Spleen	0.23[a]	0.21[a]	0.19[a]	0.15[b]	0.10[c]	0.03

[ab]Means in the same row with different superscripts are significantly different (P<0.05).

amount of phytochemicals and poor feed utilization of the birds fed these two diets compared to diets 1, 2 and 3. Makinde *et al*. (2017) had earlier reported that phytochemicals elicit toxic biological responses with possible physiological implications. These findings corroborate the report of Obun and Adeyemi (2012) who observed reduced weight gain among birds fed higher amount of raw *Daniellia oliveri* seed meal based diets. The negative effects of phytochemicals on the performance of birds cannot be overemphasized. For instance, oxalate is a concern because of its negative effect on mineral availability, presence of oxalate in food causes irritation in the gut (Onyeike and Omubo-Dede, 2002) and interfere with absorption of divalent minerals particularly Calcium by forming insoluble salts with them (Guil and Isasa, 1997). High oxalate diet can increase the risk of renal calcium absorption and has been implicated as a source of kidney stones (Chai and Liebman, 2004). Also, the problem with phytate in food is that it can bind some essential mineral nutrients in the digestive tract and can result in mineral deficiencies (Bello *et al*., 2008). Jenkins and

Atwal (1994) reported that saponins reduce growth, feed efficiency and interfere with the absorption of dietary lipids, cholesterol, bile acids, vitamins A and E in chicks. The observed insignificant differences in mortality rate among birds fed the control diet and HTSM diets (P>0.05) may suggest that poultry could tolerate high inclusion of the test feedstuff in their diet and better if the test ingredient is adequately processed.
The poor carcass yield observed among birds fed 15 and 20 % HTSM diets might be due to poor utilization of nutrients attributed to the high ANFs in these two diets compared to other diets (Makinde *et al*., 2018). This may be explained by high mortality observed among birds fed 20% HTSM diet. Schrews (2000) demonstrated that nutrition exert several influence on the development of carcass traits, organs and muscular growth in broilers.
The values obtained for all the internal organs (kidney, spleen, liver, gizzard and heart) for all the diets were significantly (P>0.05) different. The weight of the internal organs of birds fed 15 % and 20 %HTSM diets were significantly (P<0.05) lower compared with those fed the 0 %, 5 % and 10 % HTSM diets. This also indicates the effect of the degree of differences in the anti-nutrients in the raw seeds. Obun *et al.* (2011) however reported that the higher weight of liver observed among birds fed 10, 15 and 20 % raw *Detarium microcarpum* seed meal diets may be due to the effects of saponin toxicity in the feed causing inflammation and friable liver.

CONCLUSION

It was concluded that broiler chickens can tolerate up to 10 % raw HTSM in their diets without adverse effect on growth performance and carcass characteristics. Also, adequate processing of the seed should be carried out to reduce the anti-nutritional factors to a tolerable level before being used in broiler diet.

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