EFFECTS OF PARTIAL REPLACEMENT OF MAIZE WITH DIOSPYROS MESPILIFORMIS (KANYA) SEED MEAL AS AN ENERGY SOURCE ON THE PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHER BROILER CHICKENS

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ABSTRACT
This study evaluated the impact of replacing maize with Diospyros melisiformis seed meal (DMSM) on growth performance and carcass traits in Cobb 500 finisher broiler chicks. Forty-five four-week-old chicks were divided into three groups (15 per group) in a completely randomized design with three replicates. Group one (control) received no DMSM, while maize was replaced with 5% and 10% DMSM in groups two and three, respectively. The proximate analysis of DMSM revealed ash (3.30%), moisture (4.00%), protein (5.33%), lipids (7.90%), crude fibre (21.54%), and nitrogen-free extract (42.07%). Weekly feed intake varied, with no significant differences between control (1207.43 g) and 5% DMSM (1291.71 g) diets, but both were higher than the 10% DMSM group (1040.71 g). At week eight, birds on 10% DMSM exhibited the highest weekly weight gain (502.85 g), significantly outperforming the control (324.28 g) and 5% DMSM group (314.28 g), suggesting improved feed utilization. Carcass analysis showed no significant effects on cut-up parts yield, though organs like the proventriculus, kidney, and spleen were influenced by DMSM diets. Dressing percentages did not differ significantly ($p<0.05$), but the 10% DMSM group had the highest value. In conclusion, replacing maize with up to 10% DMSM in broiler diets did not negatively affect weight gain, carcass traits, or feed efficiency, making it a viable alternative feed ingredient.
Keywords: *Diosypro smelisiformis*; broiler; performance; carcass characteristics.

INTRODUCTION

The continuous rise in the price of essential raw materials, especially maize, which makes up 50–60% of the ingredients used in poultry diets, is the primary reason behind the escalating costs of poultry feeds and products. The price of maize has risen due to factors like insecurity, climate change, importation bans, bio-fuel production, and the growing demand for chicken feed (*Šuman et al*., 2018; Nortey *et al.,* 2015; Kana *et al.,* 2015). According to Chisoro and Nkukwana (2020) replacing conventional feed ingredients with high-protein and energy alternatives, like oilseeds from native trees, can help reduce feeding costs and improve nutritional value. A survey conducted by Abdulrahman *et al.* (2022) revealed 71.3% of respondents supported using alternative feed sources. *Diospyros mespiliformis* seeds are noted for their high energy content (Elton and Eriwanger 2011), but limited research exists on their use in poultry diets. The objective of this study is to determine the effects of partial replacement of maize with *Diospyros mespiliformis* seed meal on growth performance and carcass characteristics of broiler finisher.

MATERIALS AND METHODS:

Experimental Site.

The study was carried out at the Federal University Gashua in Yobe State, Nigeria, at the Poultry Research Unit. Gashua has a height of 299 meters above sea level, a temperature range of 38 to 43 degrees from months March to May, a relative humidity of 13.06 to 71.09 percent, and an annual rainfall of 500 to 1000 mm. It is situated between latitude 12º 52' º N and longitude 11º 2'º E.(Wikipedia, 2011).

Experimentaldiets.

Forty-five four-week-old Ross 500 broiler chickens were divided into three groups of fifteen, with each group replicated three times (five birds per replicate). The control group received a basal diet without DMSM, while the other two groups had maize replaced with 5% and 10% DMSM, respectively.

Experimental Birds and Management

A total of forty-five four-week-old Cobb 500 broilers were randomly divided into three groups of 15 birds, each replicated in batches of five. Before the experiment, they were brooded for 28 days. Birds were weighed at the start and assigned to three diets (T1, T2 and T3) with 0%, 5%, and 10% maize replaced by DMSM. They were raised on a cement floor in an open-sided, deep-litter system with wood shavings, and the house was cleaned and disinfected a week prior to their arrival.

Source of test ingredient
Ripe fruits of DMSM were procured from Gashua, Bade local government of Yobe state. It was processed by removing the seeds and sun-dried for 7 days, milled, and used for the experimental trial.

Experimental design
A completely randomized design (CRD) with three treatments and three replications was used in the study. Forty-five four-week-old finisher broiler chicks were randomly assigned to three treatments, with each treatment further divided into three replicates of five birds each. The dietary treatment groups were given test ingredients as replacements for maize as follows: T1 = 0% DMSM, T2 = 5% DMSM, and T3 = 10% DMSM.

Data Collection
Proximate analysis of the test ingredient (DMSM) was conducted according to AOAC methods for the determination of crude fibre, ash, crude fat, moisture, crude protein, and carbohydrates. Feed intake was measured weekly by subtracting leftovers from the total feed provided. Birds were individually weighed at the start and then weekly, with weight gain calculated as the difference between successive weights. The weekly feed conversion ratio was determined by dividing feed consumption by weight gain. At the end of the trial, three birds per treatment were randomly selected, fasted for 12 hours (with water provided), tagged, and weighed before and after slaughter. They were then scalded, defeathered, and eviscerated. Organ weights and cut-up parts were measured using a sensitive scale, and intestinal length was recorded with a measuring tape.

Statistical Analysis
Data generated during the feeding trial were subjected to analysis of variance (ANOVA) using the Statistical Package for Social Sciences (SPSS) version 20. Where there are significant differences in the means of the various treatments, means were separated using Duncan's multiple range tests at a 5% level as described by Obi (2002).

RESULTS AND DISCUSSION
The proximate composition of DMSM revealed ash (3.30%), moisture (4.00%), protein (5.33%), lipids (7.90%), crude fibre (21.54%), and carbohydrates (42.07%). The moisture content was lower than previously reported values of 4.64% and 9.00% by Ilouno *et al.* (2018) and Vinceti *et al. (*2022) for DMSM. The moisture content remained below the 15% limit for microbial resistance, enhancing shelf life. The ash content was also lower than 5.13% and 3.82% reported by Ilouno *et al.* (2018) and Vinceti *et al.* (2022), indicating a lower inorganic matter presence. The crude protein content (5.33%) was similar to the value of 5.45% previously reported by Vinceti *et al.* (2022) but higher than the 4.68% reported by Ilouno *et al.* (2018). The crude fat content (7.90%) was higher than 2.00% and 3.84% reported by Ilouno *et al*. (2018) and Vinceti *et al*. (2022). The crude fibre level of 21.54% recorded in this study was significantly higher than the 2.67%, 3.48%, and 5.46% reported by Vinceti *et al.* (2022), Ilouno*et al.* (2018), and Ikechukwu*et al.* (2024), respectively. The nitrogen-free extract (42.07%) aligned with prior research by Umoren *et al*. (2005) for *Milletiaobanensis*. The differences in value reported in this study and previous studies are likely due to environmental and climatic differences.At week five, birds fed 10% DMSM (T3) showed comparable feed intake to the control group but differed significantly ($P < 0.05$) from those on T2. By week six, birds on the control diet (T1) had the highest feed intake (1103.00±50.40), significantly differing from T2 (1039.29±53.01) and T3 (994.29±56.82). At week seven, feed intake was statistically similar between T2 (1170.83±20.83) and T3 (1335.63±19.93). In week eight, T1 (1104.29±41.96) and T2 (1116.14±20.62) had similar values but were significantly different from T3 (1093.14±12.23). Feed consumption was influenced by bird age and dietary treatment ($P < 0.05$). Previous research indicates that feed intake affects growth performance, with inadequate intake leading to lower weight gain (Forbes, 2007). Factors like calorie density, fibre content, digestibility, and physical characteristics of feed impact consumption (Rehrahie *et al.,* 2003).

Table 4 presents the weekly weight gain of finisher broilers fed diets with *Diospyros melisiformis* seed meal as a partial maize replacement. There were significant differences ($p < 0.05$) in average weekly weight gain across treatments. Birds in treatment 3 (10% DMSM) had the highest final weight gain (502.85 g/bird), significantly differing from treatments 1 (0% DMSM) and 2 (5% DMSM), which had statistically similar weight gains (324.28 g/bird and 314.28 g/bird, respectively). The improved growth in treatment 3 may be due to better nutrient availability and feed utilization. A similar study conducted by Ihsan (2017) has shown that pumpkin seeds, black cumin, and black seed improve weight gain, feed conversion, and carcass quality. This result aligns with earlier findings by Mokhtar *et al.* (2023), whose study showed a significant ($p < 0.05$) effect on weight gain and carcass quality of broilers fed black cumin (*Nigella sativa*) seed meal. Similarly, Kesab *et al.* (2023) observed significant ($p < 0.05$) improvements in final body weight, weight gain, feed conversion ratio, carcass weight, and dressing percentage of quails fed black seed. In contrast, Arielle *et al.* (2023) reported no significant ($p > 0.05$) effects on

the body weight gain of broilers fed *Dioscorea bulbifera* flour as a replacement for maize.The feed conversion ratio (FCR) was significantly influenced by bird age and dietary treatments ($P < 0.05$). In week five, FCR was statistically similar for birds on T1 and T2 but significantly different from T3. In week six, T1 had the best FCR. The lowest FCR was observed in birds fed T3 at week eight, indicating improved feed efficiency in this group.Most of the carcass parameters assessed were unaffected by dietary treatments, except for the kidney, proventriculus, and spleen, which showed significant variations ($p < 0.05$), likely due to anti-nutritional factors. The non-significant differences ($p > 0.05$) in other carcass traits suggest that replacing maize with *Diospyros melisiformis* did not hinder the growth of prime cuts. This finding aligns with the study conducted by Bobadoye *et al*. (2008), which reported no significant effects on key carcass traits when maize was substituted with palm oil sludge. However, it contrasts with Attia (2018), who found significant increases ($p < 0.05$) in breast meat yield, heart, liver, abdominal fat, spleen, and bursa when black seed was included in broiler diets.

Table: 1 Gross composition of experimental broiler finisher diets

Ingredients	T1 (0% DMSM)	T2 (5% DMSM)	T3 (10% DMSM)
Maize	54.11	51.44	48.76
Wheat bran	8.39	9.05	9.00
Soya bean meal	26.80	26.80	26.80
DMSM	0.00	2.67	5.35
Fish meal	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00
Palm oil	2.00	1.34	2.20
Common salt	0.10	0.10	0.10
DL- Methionine	0.20	0.20	0.20
L- Lysine	0.20	0.20	0.20
Broiler Finisher premix	0.20	0.20	0.20
Total	100	100	100
Calculated values			
Crude protein	19.33	19.25	19.18
ME/Kcal/kg	3091	3075	3033
Crude fibre	3.85	4.36	4.91

DMSM= *Diospyros mespiliformis* seed meal.

Table:2 Proximate composition of *Diosypyros melisiformis* seed

Nutrients	Values
Moisture	4.00
Crude protein	5.33
Crude fibre	21.54
Ether extract	7.90
Nitrogen free extract	42.07
Ash	3.30

Values are means of triplicate samples

Table : 3 Average weekly feed intake

	Treatments			
Weeks	T1(0 DMSM)	T2(5% DMSM)	T3(10% DMSM)	LS @ 5%
5	1207.43±91.24^{a}	1040.71±69.19^{b}	1291.71±100.8^{a}	*
6	1103.00±50.40^{a}	1039.29±53.01^{b}	994.29±56.82^{c}	*
7	1060.00±34.56^{b}	1170.83±20.83^{a}	1335.83±19.93^{a}	*
8	1104.29±41.96^{a}	1116.14±20.62^{a}	1093.14±12.23^{b}	*

abcd means in a row with different superscripts differ significantly.

Table :4 Average weekly weight gain

	Treatments			
Weeks	**T1(0% DSSM)**	**T2(5%DSSM)**	**T3(10%DSSM)**	**LS @ 5%**
5	541.42±0.82[a]	341.42±0.59[c]	494. 28±0.82[b]	*
6	621.42±0.82[a]	427.14± 0.88[b]	302.00 ± 0.87[c]	*
7	311.42± 0.82[c]	405.14± 1.4[a]	354.28±0.82[b]	*
8	324.28± 0.82[b]	314.28 ± 8.2[b]	502.85 ±0.82 [a]	*

abcd means in a row with different superscripts differ significantly

Table: 5 Feed conversion ratios.

	Treatments			
Weeks	**T1(0 DSSM)**	**T2(5%DSSM)**	**T3(10% DSSM)**	**LS @ 5%**
5	2.23±0.06[a]	3.04±0.00[b]	2.61±0.05[a]	*
6	1.77 ±0.05[a]	2.43 ±0.00 [b]	3.29±0.05[b]	*
7	3.40±0.05[b]	2.88 ±0.10[a]	3.77±0.05[b]	*
8	3.40±0.05[b]	3.55 ±0.05[b]	2.17 ±0.05[a]	*

abcd means in a row with different superscripts differ significantly

Table 6: Averages and Standard errors of Carcass Characteristics

	TREATMENTS			
PARAMETER	**I(0 DMSM)**	**II(5% DMSM)**	**II (10% DMSM)**	**LS @ 5%**
Live weight	1658.67±99.02	1583.67±215.06	1795.67±211.14	Ns
Slaughter weight	1604.33±115.55	1557.67±209.40	1747.67±213.53	Ns
Plucked weight	1559.67±144.05	1513.67±205.77	1697.00±215.31	Ns
Carcass weight	1030.67±78.35	929.33±135.52	1124.67±108.20	Ns
Dressing %	61.63±1.78	58.67±3.53	63.00±1.53	Ns
Head	36.00±4.58	39.00±3.21	37.00±3.61	Ns
Heart	6.67±1.45	6.67±1.67	6.67±1.20	Ns
Neck	53.33±9.02	52.33±8.68	57.33±10.39	Ns
Lungs	5.67±0.88	6.33±1.45	5.33±0.67	Ns
Liver	24.33±2.96	20.67±1.85	21.67±1.45	Ns
Proventriculus	7.33±0.88[b]	10.00±1.00[a]	7.00±0.00[b]	*
Shank	49.00±7.57	51.00±3.78	49.00±4.62	Ns
Small intestine	16.33±2.03	21.00±5.29	15.33±0.67	Ns
Gizzard	30.67±7.45	29.67±5.24	27.00±6.08	Ns
Large intestine	57.33±7.42	72.67±13.86	44.38±7.51	Ns
Wings	94.67±13.33	98.33±16.73	104.67±18.27	Ns
Thigh	111.00±20.29	123.67±20.41	110.33±20.37	Ns
Drum stick	111.67±18.56	125.00±25.17	107.00±22.11	Ns
Kidney	3.33±0.33[a]	2.33±0.33[b]	3.00±0.00[a]	*
Spleen	3.00±0.00[a]	2.00±0.00[b]	3.00±0.00[a]	*

LS=level of significance, ns=not significant, %=percent, * = P<0.05 and abcd means in a row with different superscripts differ significantly

Photo 1: Fruits and seed of *Diospyrosmespiliformis*

CONCLUSION

*Diospyrosmelisiformis seed meal (*DMSM) can replace maize up to 10% in finisher broiler diets without negatively affecting growth performance or carcass traits. However, its impact on the kidney and spleen may be due to anti-nutritional factors. Therefore, processing the seed before feeding is recommended for higher inclusion levels.

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