Carcass Characteristics of Broilers fed Mexican Sunflower (*Tithonia diversifolia*) Leaf Meal-based diets

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Abstract: A study was conducted for eight weeks to investigate the effect of feeding Mexican sunflower (Tithonia diversifolia) leaf meal on carcass characteristics of broilers. One hundred and fifty day old Abor Acre broiler chicks were randomly assigned to five treatments (A, B, C, D and E). Treatment A served as control while birds in treatments B, C, D and E received Mexican sunflower Leaf Meal (MSLM) at 2.5, 5.0, 7.5 and 10.0% respectively. Feeds and water were provided ad libitum and the routine vaccination / medication followed the standard procedures. The results showed a significant ($p < 0.05$) decrease in all the parameters measured for carcass characteristics (shank, gizzard, head, crop, thigh, drumstick, wings breast, back, neck, abdominal fats, spleen, heart, lung, liver, intestine and proventriculus) except for the neck weight where birds on treatment B (2.50% MSLM) obtained the highest neck weight (182.31g) and the spleen with highest weight (3.60g) were obtained in treatment C (5.0% MSLM). The carcass qualities were also significantly decreased ($p > 0.05$) except for the neck and spleen weights. Primal cuts of broilers expressed as percentage of dressed weights were similar across treatments. The result of this study showed that inclusion of MSLM at 2.5, 5.0, 7.5, and 10.0% has almost no effect on both the carcass characteristics and carcass quality of the broilers under study.
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Introduction

Africa's ability to feed its ever increasing population with adequate calories and protein remains one of its greatest challenges today. In spite of the numerous natural and human resources at her disposal, Africa still remains amongst the least consumers of animal protein across the six continents. For instance, protein intake by an average Nigerian is about 53.8g/head/day with only 6 - 8.4g of animal origin (Egbunike, 1997; Lamode, 1998). The diminishing animal products in the diet of the average African from year to year has been mainly due to poverty, high cost of animal feeds, political and economic instability with poor infrastructural development.

In an effort to boost human food from animal sources more efficiently and at lower cost to consumers, there has been a stimulated continued search for more suitable combinations of known nutrients which will increase the efficiency and rate of growth and level of production of animals. These efforts have led to the present use of forage legumes in animal diet. The purpose of this study therefore is to investigate the effect of Mexican sunflower (*Tithonia diversifolia*, Hemsley A. Gray) leaf meal-based diets on carcass quality vis-à-vis to identify any side effect or limitations of its use on broiler chicks.

Materials and Methods

Experimental site: The experiment was carried out in a deep litter house at Ologuneru village in Ibadan, South Western Nigeria for a period of eight (8) weeks

Experimental materials: One hundred and fifty (150) day old Abor Acre broiler chicks, drugs, (antibiotics, coccidiostat and vitamins) brooms, plastic bucket, vaccines.

Experimental design: The Completely Randomized Design (CRD) was adopted for the experiment. One hundred and fifty day old broiler chicks were randomly assigned to five (5) treatments, with 30 broilers in each treatment. (i.e. A, B, C, D, and E). Treatment A serves as the control. Each treatment group was further sub-divided into two (2) replicates of fifteen (15) birds and kept in a 4m x 6m compartment.

Ration Formulation: The Mexican Sunflower (*Tithonia diversifolia)* used for this trial were harvested at the Teaching and Research farm, University of Ibadan at approximately 4 weeks by slashing and carrying after the onset of rains. The shoots were cut 50cm above the ground and sorted into leaves (Tarawali *et al*., 1995). The stems were sun-dried on a clean, cemented platform until crisp. The dried leaves were milled using a hammer mill with a sieve size of 3.36mm to produce leaf meal. The samples were bulked together and manually mixed to obtain homogenous product as possible. The MSLM sample was oven dried at 150˚c for 24hours (to constant weight), milled and stored in air tight sealed, polythene bags prior to chemical analysis. A representative

sample was collected from it for proximate analysis using standard methods (AOAC. 1990) to determine the nutrient composition. The Mexican sunflower leaf meal used in this study contained (%) crude protein, 16.3; crude fibre, 21.8; ether extract, 2.8; ash, 14.7; and nitrogen free extract, 44.4.

Five experimental diets were formulated at the starter and finisher phases with graded levels of 0, 2.5, 5.0, 7.5 and 10.0% MSLM in diets A, B, C, D and E respectively that represents the treatments (Table 1 and 2).

Experimental Procedures: The one hundred and fifty (150) day old Abor Acre broiler chicks were purchased from Chi Farms Ltd., Ajanla, Ibadan. The birds were randomly assigned to the five (5) treatments A, B, C, D, and E. Feed and fresh water were supplied *ad libitum* on daily basis throughout the experimental period and heat was supplied during the brooding state using electric bulbs. Feed intake was recorded daily and the birds were weighed weekly. The feeding trial lasted 8 weeks. All medications and vaccinations were carried out following standard procedures.

Table 1: Composition of experimental diet at the starter phase.

Treatments	A	B	C	D	E
% MSLM	0	2.5	5.0	7.5	10.0
Ingredients:					
Maize	52.50	51.00	49.50	48.00	46.50
SBM	23.00	22.50	22.00	21.50	21.00
GNC	17.00	16.50	16.00	15.50	15.00
MSLM	0.00	2.50	5.00	7.50	10.00
Fish meal (72%)	2.50	2.50	2.50	2.50	2.50
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50	1.50	1.50
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Total (kg)	100.00	100.00	100.00	100.00	100.00
CP	24.36	24.18	24.01	23.83	23.65
ME(kcal/kg)	2944.2	2913.2	2882.2	2851.3	2820.3

MSLM = Mexican Sunflower leaf meal. SBM = Soybean meal. GNC = Groundnut cake. CP = Crude protein.

Table 2: Composition of experimental diets at the finisher phase.

Treatments	A	B	C	D	E
% MSLM	0	2.5	5.0	7.5	10.0
Ingredients:					
Maize	59.50	58.00	56.50	55.00	53.00
SBM	20.00	19.50	19.00	18.50	18.00
GNC	14.00	13.50	13.00	12.50	12.00
MSLM	0.00	2.50	5.00	7.50	10.00
Fish meal (72%)	1.50	1.50	1.50	1.50	1.50
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50	1.50	1.50
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
CP	21.73	21.55	21.38	21.20	21.02
ME(kcal/kg)	2995.7	2964.8	2933.8	2902.9	2871.9

MSLM = Mexican Sunflower leaf meal. SBM = Soybean meal. GNC = Groundnut cake. CP = Crude protein.

Carcass Analysis: At the end of the eighth week, six birds per treatment (i.e. 30 birds) were selected, fasted overnight and slaughtered for carcass analysis. The carcass of thirty birds (6 from each treatment) were cut into parts and carefully weighed. The parts include head, shank, gizzard, heart, liver, spleen, intestine, crop and abdominal fat. Others are proventriculus, neck, wing, drum stick, thigh, back, breast and bile duct.

Statistical Analysis:

Data collected were subjected to analysis of variance procedure of SAS (2000) and their means were separated using the Duncan multiple range test of the same software package.

Results

The live weight and processing values of broilers fed Mexican sunflower leaf meal as shown in table 3.

The live weight of experimented birds fed sunflower leaf meal-based diets significantly decreased from 2641.30g/bird for birds on the control diet without MSLM to 1754.13g/bird for those fed 10% MSLM-based diets. The same trend was obtained for the plucked weight (2419.21g – 1582.97g/ bird).

The highest plucked weight (2419.21g/ bird) was obtained for broilers on treatment A (control diet) which was significantly ($p < 0.05$) highest. The least value for plucked weight (1582.97g/ bird) was obtained for bird on treatment E (10% MSLM). The New York dressing percentage (90.24-91.59%) was similar are broilers on MSLM-based diets.

The highest dressed weight (1935.02g) was obtained for broilers on control diet which decreased significantly across treatments/diets to 1286.05g/ bird for those on treatment E (10% MSLM-based diet).

The dressing percentage varied significantly ($p<0.05$) and the highest value was obtained for broilers on treatment D (7.5 MSLM-based diet) while birds on treatment C (5.0% MSLM-based diets) had the least dressing percentage (72.55%).

Table 3: Live Weight and Processing Values of Broilers fed Mexican Sunflower Leaf Meal

Treatments	A	B	C	D	E	SEM
% MSLM	0	2.5	5.0	7.5	10.0	
Live weight (g)	2641.30^{a}	2526.75^{b}	2413.98^{c}	2153.24^{d}	1754.13^{e}	41.26
Plucked Wt	2419.21^{a}	2326.53^{b}	2195.89^{c}	1955.91^{d}	1582.97^{e}	22.93
New York DW(g)	91.59	90.78	90.97	90.84	90.24	1.43
Dressed weight	1935.02^{a}	1867.60^{b}	1751.24^{c}	1590.49^{d}	1286.05^{e}	23.02
Dressed (%)	73.26^{bc}	72.87^{cd}	72.55^{d}	73.86^{a}	73.32^{b}	0.81

Means on the same row with different superscript are significantly different ($p<0.05$)

Table 4: Head, Shank and Internal Organ of Broilers Fed Mexican Sunflower Leaf Meal.

Treatments	A	B	C	D	E	SEM
% MSLM	0	2.5	5.0	7.5	10.0	
Head (g)	64.73^{a}	64.88^{a}	58.36^{b}	54.01^{c}	43.65^{d}	0.45
Shank (g)	318.92^{a}	127.74^{b}	125.00^{c}	99.98^{d}	80.81^{e}	4.25
Neck (g)	172.82^{b}	182.31^{a}	161.33^{c}	150.45^{d}	121.79^{e}	2.91
Gizzard (g)	72.36^{a}	72.44^{a}	63.30^{b}	59.61^{c}	48.18^{d}	3.80
Heart (g)	13.47^{a}	12.74^{b}	12.43^{c}	9.05^{d}	7.31^{e}	0.25
Liver (g)	43.14^{a}	40.40^{c}	41.61^{b}	29.75^{d}	24.04^{e}	0.61
Intestine (g)	116.97^{a}	112.70^{b}	113.19^{b}	89.20^{c}	7209^{d}	4.52
Crop (g)	14.27^{a}	11.90^{c}	12.95^{b}	8.92^{d}	8.21^{e}	0.34
Bile duct (g)	3.78^{a}	3.54^{b}	3.43^{c}	2.62^{d}	2.12^{e}	0.10
Spleen (g)	3.34^{b}	2.76^{c}	3.60^{a}	2.16^{d}	1.75^{e}	0.10
Proventriculus(g)	12.17^{a}	10.91^{b}	10.79^{c}	7.11^{d}	5.75^{e}	0.08
Abdominal fat(g)	62.31^{a}	58.76^{b}	57.62^{c}	39.99^{d}	32.32^{e}	1.65

Means on the same row with different superscript are significantly different ($p<0.05$)

The head shank, neck and internal organs of broilers fed Mexican sunflower leaf meal were shown in the Table 4. The weight of head, shank, neck and internal organs observed varied significantly across treatments.

Birds on treatment A and B had similar value for the weight of head (64.73 and 64.88g respectively) and gizzard (72.36 and 72.44g) which decreased significantly and higher than what obtained for those on treatments C (58.36 and 63.30 for head and gizzard respectively and D (54.04 and 59.61g). Birds on treatment E had the least value for heart (43.65g) and gizzard (48.18g).

The highest weight for shank (138.92g), heart (13.47g), liver (43.14g), intestines (116.97g), crop (14.27g), bile duct (3.78g), proventriculus (12.17g) and abdominal fat (62.31g) were obtained for broilers on 0%MSLM-based diet and the value decreased significantly ($p<0.05$) across treatments as the level of MSLM increased in the diets.

Birds on treatment E had the least values for these parameters. Birds on treatment B had the highest ($p < 0.05$) neck weight while those on 5.0%MSLM-based diet (treatment C) had the highest weight for spleen (3.60g). For all the parameters examined (Table 5), birds on treatment E (10% MSLM-based diet) had the least values. The highest significant ($p < 0.05$) value for the neck weight (182.31g) and spleen weight (3.60g) was obtained for birds on 2.5 and 5.0% MSLM-based diets respectively.

The primal cuts of broilers fed Mexican sunflower leaf meal expressed as percentage of dressed weight is as shown in Table 5. The results showed that the treatment effect on the parameter studied which are percentage weight of breast (21.50 – 21.87%), wings (11.98 – 12.50%), drumstick (13.86 – 14.19%), thigh (17.00 – 18.15%) and back (21.59 -22.66%) were not significant ($p > 0.05$).

Table 5: Primal cuts of broilers fed Mexican sunflower leaf meal expressed as percentage of dressed weight.

Treatment	A	B	C	D	E	SEM
% MSLM	0	2.5	5.0	7.5	10.0	
Breast	21.87	21.27	21.68	21.51	21.50	0.16
Wings	12.18	12.40	11.98	12.49	12.50	0.12
Drumstick	14.19	14.08	13.85	14.14	14.13	0.14
Thigh	17.00	17.63	17.51	18.15	18.14	0.10
Back	22.66	21.64	22.46	21.74	21.59	1.25

Discussion

The live weight obtained for broilers in this study were higher than the value (2480.39±9.75g) reported for broilers by Omojola and Fagbuaro (2005). However, live weight of broilers on treatments C, D and E (1754.13 – 2413.98g) were significantly lower. The significant decrease in live weight, plucked weight and dressed weight observed in broilers across treatments with increasing level of MSLM could be attributed to the presence of anti-nutritional factors like tannin and saponnin in MSLM that makes it bitter as it increased across treatments. These could decrease the feed intake and consequently the live weight. Tannin, an anti- nutritional factor can bind dietary proteins and digestive enzymes into complexes which are not readily digestible. It can also bind with the proteins of saliva and mucosal membranes (Helsper *et al*, 1993). Prince et al, (1980) had observed depression of growth rates of chicks when fed diet containing high tannin sorghum.

Odunsi *et al*. (1999) had reported broiler finishers fed wild sunflower leaf meal to show depressed feed intake most especially at 7.5 and 10.0% inclusion level.

The increment in the level of MSLM in the diets did not produce a corresponding linear change in the dressing percentage of experimental birds as those on treatments D and E had significantly higher dressing percentage than those on other treatments.

The significant ($p < 0.05$) decrease in the weights of the head, shank, gizzard, heart, liver, intestine, bile duct, proventriculus and abdominal fat obtained for broilers as the level of MSLM increased in the diets can be related to the bird's live weight that followed the same trend across treatments. These organs could be proportional to their respective live weights as may be fixed by their genetic makeup since the experimental birds are of the same breed (Abor Acre).

The primal cuts (i.e the breast, wings, drumstick, thigh and back)expressed as percentage of dressed weight of experimental birds (broiler finishers) that were similar ($p > 0.05$) across treatments is an indication that inclusion of MSLM in the diet of broiler up to 10% level had no significantly negative effect on these parameters and the carcass characteristics.

Conclusion:

Inclusion of MSLM in the diet of broilers up to 10% level decreased the live weights, weights of head, shank and the internal organs but had no adverse effect on proportion of primal cuts expressed as percentage of dressed weight.

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