

GROWTH PERFORMANCE AND CARCASS PARAMETERS OF BROILER FINISHERS FED MULBERRY LEAF (*Morus indica*) MEAL-BASED DIETS

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ABSTRACT

A study was carried out for 4 weeks to evaluate the replacement value of mulberry leaf meal (MBLM) for soybean meal (SBM), using 150 4-week-old Marshal strain of broiler chickens with average initial weight of 658.66g/b. in a completely randomized design. The SBM was substituted with 0, 25, 50, 75 and 100% MBLM (0, 2, 4, 6 and 8% of diets) respectively. There were five treatments of 30 birds each, and 3 replicates of 10 birds per replicate. The highest average daily feed intake, g/b/d (123.50 ± 1.40) recorded for the birds fed the control diet (0% MBLM) reduced ($p < 0.05$) to 119 ± 1.10 (25% MBLM), 115.63 ± 2.19 (50% MBLM), 113.90 ± 2.19 (75% MBLM) and 112.30 ± 1.50 (100% MBLM) respectively. The average daily weight gain, g/b/d (55.87 ± 1.10) of the control was similar ($p > 0.05$) to 54.93 ± 1.10 (25% MBLM) and 49.07 ± 3.59 (50% MBLM), but were higher ($p < 0.05$) than 35.23 ± 2.87 (75% MBLM) and 24.60 ± 1.36 (100% MBLM). The feed conversion ratio values were 2.23 ± 0.07 , 2.20 ± 0.06 , 2.40 ± 0.15 , 3.27 ± 0.27 , and 4.57 ± 0.22 ; and the costs of feed per kg live weight gain (₦/kg) were 562.45 ± 12.34 , 549.60 ± 11.20 , 593.81 ± 21.22 , 801.22 ± 32.70 and $1,108.77 \pm 27.16$ for 0, 25, 50, 75 and 100% replacement by MBLM respectively. The live weight, bled weight and plucked weight were significantly ($p < 0.05$) affected by dietary treatments. It was concluded that MBLM can economically replace 25% of SBM (2% of diets) in broiler finisher diets; and recommended to minimize the effect of high cost of SBM in broiler diets.

Keywords: Mulberry leaf meal, Soybean meal, Broilers; Performance, Replacement.

J. Agric. Prod. & Tech.2023; 12:18-25.

INTRODUCTION

Poultry is probably one of the most-researched species of livestock. It is one of the livestock species with potentials to alleviate the shortage of animal protein for the ever-increasing population in developing countries. The short generation interval, prolific nature, presence of fewer taboos against the consumption of its products (meat and eggs), among other advantages, makes it

one of the best options out of the dearth of protein to the teeming populace. High cost of feeds which in essence depends on the prices of the feed ingredients has marred these advantages of poultry. This is particularly so for the energy and protein ingredients which constitute the bulk of the composition of poultry feeds. Soyabean meal, an important protein ingredient is expensive and there is need for cheaper alternatives. Feed is one of

the challenges of livestock production in Nigeria, especially in the face of competition between feed and food and escalating cost of conventional feed ingredients like maize, soyabean and groundnut cake; which account for about two-third of the total cost of production (Akinmutimi, 2004). The cost of ingredients could be as high as 80% of the total cost of production of finished feed (Longe, 2006). Dhama *et al.* (2015) reported that herbs in monogastric diets significantly influence metabolism by combating microbial activities and stress. This is due to prevention of pathogens colonization and enhancement of the digestive enzymes production and activities by the phytogenic components of the plants' parts (Langhout, 2000; Dhama *et al.* 2015). Several studies were conducted to find suitable cheaper alternative protein to soyabean meal in leaf meals. Asaniyan and Olajide (2020) found out that pawpaw leaf meal can economically and safely substitute up to 75% of soyabean meal in the diets of grower rabbits. Olajide and Garus-Alaka (2018) reported that soyabean meal could economically and safely be replaced by 25% mulberry leaf meal in the diets of growing rabbits. Abegunde *et al.*, (2014) reported that garcinia kola leaf meal could economically and safely replace maize in the diets of growing rabbits.

In this study, the nutritional value of mulberry leaf meal (MBLM) for soybean meal for broilers was investigated.

MATERIALS AND METHODS

Source and preparation of mulberry leaf meal

The source and preparation of MBLM were according to Olajide and Garus (2018). Mulberry leaves were harvested from Sericulture farm site,

Ado-Ekiti, Ekiti State, Nigeria. The leaves were collected and air-dried for some days until they were completely dried. The leaves became crispy but still retained the greenish colour after air-drying. They were then milled to form MBLM.

Experimental diets and Costing

Five diets were formulated that contained 0, 25, 50, 75 and 100% mulberry leaf meal (MBLM) as substitutes for soybean meal (SBM). The experimental diets also contained maize, palm kernel cake, wheat offal, groundnut cake, fish meal, bone meal, oyster shell, common salt, premix, methionine and lysine (table 1). The ME and CP of the diets ranging from 11.56-13.67 MJ/kg and 17.74-18.81%, respectively. The prevailing cost (₦) of the ingredients at the time of purchase was used in calculating the total cost (₦) of 100 kg feed. The cost (₦/kg) feed and cost (₦) of feed/kg live weight gain were calculated.

Experimental Site

The feeding trial was carried out at the Poultry Section, Teaching and Research Farm, Joseph Ayo Babalola University, Ikeji-Arakeji, Osun State, Nigeria.

Management of experimental birds

A total of 150 unsexed day-old Marshal strain of broiler chicks purchased from a reputable hatchery in Osogbo, Osun State, Nigeria was used for this study. The birds were previously raised on a standard broiler starter diet before the commencement of the finisher phase of the study. The experimental birds were allotted randomly into five treatments, each having 30 birds that consists of three replicates and 10 birds per replicate.

The study lasted 4 weeks representing the finisher phase of broiler production. The birds were weighed and feed intake recorded weekly; from which daily weight gain and feed intake calculated. These two parameters were used to calculate the feed conversion ratio (FCR). Feed and water were supplied *ad libitum*.

Carcass analysis

A total of 45 birds were randomly selected at the rate of 15 birds per diet for carcass analysis at the end of the feeding trials which lasted four weeks. The birds were starved overnight but given water and their live weights recorded. The birds were slaughtered, thoroughly bled, scalded, de-feathered and eviscerated according to the procedures of Jones (1984). The carcass, plucked, eviscerated and dressed weights were taken and expressed as percentages of live weight.

Chemical analysis

The proximate composition of the mulberry (*Morus indica*) leaf meal was determined according to the method of AOAC (2005). The reference numbers include crude protein (AOAC, 988.05), ether extract (AOAC, 2003.06), dry matter and moisture (AOAC, 967.08), Ash (AOAC, 942.05), fibre (AOAC, 958.06); and NFE by difference. This was done by subtracting the sum of (Moisture % + % Crude Protein + % Ether Extract + % Crude Fibre + % Ash) from 100 i.e. $(100 - (\% M + \% CP + \% EE + \% CF + \% Ash))$.

The metabolizable energy was calculated according to the procedure of Ponzenga (1985) as: ME (kcal/kg DM) = $37 \times \% \text{protein} + 81.8 \times \% \text{Fat} + 35.5 \times \% \text{NFE}$.

Statistical analysis: All data obtained were subjected to analysis of variance

(ANOVA) using the procedure of SAS (1999) and mean values compared using Duncan Multiple Range Test of the same package.

RESULTS AND DISCUSSION

The proximate composition and metabolizable of the mulberry leaf meal (MBLM) is presented in Table 1. The values were CP (28.56%), CF (4.31%), Ash (2.87%), NFE (58.40%); and ME (14.92 MJ/Kg) respectively. Results of chemical composition of mulberry fractions from various authors indicate that crude protein content in leaves varies from as low as 15% to 28%. Datta (2000) reported that there were about 68 species in the genus *Morus*, with majority of them occurring in Asia and over a thousand varieties under cultivation in China. The chemical composition of mulberry leaves was found to be affected by planting density, cutting height and frequency (Carlos, 2000).

Table 1: Proximate composition of Mulberry leaf meal

Parameters	Percentage (%)
Dry matter	99.48
Crude protein	28.56
Crude fibre	4.31
Ether extract	5.34
Ash	2.87
Nitrogen free extract	58.40
Metabolizable energy (MJ/Kg)	14.92

Table 2 shows the gross composition of experimental broiler finisher diets. The CP and CF reduced, while the EE and ME increased with increasing levels of MBLM in the diets. The values were CP (17.74-18.81%), CF (3.50-3.68%), EE (3.91-4.05%); and ME

Table 2: Gross composition of experimental broiler finisher diets

Ingredients	T1 (0% MBLM)	T2 (25% MBLM)	T3 (50% MBLM)	T4 (75% MBLM)	T5 (100% MBLM)
Maize	54.00	54.00	54.00	54.00	54.00
Soybean meal	8.00	6.00	4.00	2.00	0.00
Mulberry leaf meal	0.00	2.00	4.00	6.00	8.00
Palm kernel cake	5.00	5.00	5.00	5.00	5.00
Wheat offal	11.00	11.00	11.00	11.00	11.00
Groundnut Cake	10.00	10.00	10.00	10.00	10.00
Fish Meal (72%)	4.00	4.00	4.00	4.00	4.00
Bone Meal	3.50	3.50	3.50	3.50	3.50
Oyster Shell	3.25	3.25	3.25	3.25	3.25
Common salt (NaCl)	0.50	0.50	0.50	0.50	0.50
*Premix	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	100.00	100.00	100.00	100.00	100.00
Calculated Analysis:					
Crude Protein (%)	18.81	18.54	18.27	18.00	17.74
Ether Extract (%)	3.91	3.94	3.98	4.02	4.05
Crude Fibre (%)	3.68	3.63	3.59	3.54	3.50
ME (MJ/kg)	11.56	12.09	12.62	13.14	13.67

*Composition of Premix: 2.5kg of premix contained: Retinol acetate (10000000iu), Vit. D3 (2000000iu), Vit. E (15000iu), Vit. B (3000mg), Niacin (15000mg), Vit. B6 (3000mg), Vit. B12 (10mg), Vit. K3 (2000mg), Biotin (20mg), Folic Acid (500mg), Calcium pantothenate (800mg), Chlorine Chloride (250000mg), Manganese (75000mg), Iron (25000mg), Copper (5000mg), Zinc (70000mg), Selenium (150mg), Iodine (1300mg), Magnesium (100mg), Ethoxyquine (500g), BHT (700g).

(11.56-13.67 MJ/Kg). The trends were reflections of the contents of these constituents in soybean meal (SBM) and MBLM which were the only two ingredients substituted and varied in the experimental diets. For example, lower crude protein content of MBLM (28.56%) compared to soybean (44.00%) crude protein level. The diets were formulated to meet the requirements of 9.62-14.64 MJ/kg DM ME; and 15.3-23.3% CP and 4-5% CF recommended (NRC, 1994; Olomu, 1995) for broilers. Olajide (2017) fed broiler finisher diets containing 12.47-12.77 MJ/kg DM and 19.86-20.45% CP to broilers at the finisher phase.

The growth performance indices of the experimental birds are presented in Table 3. All the parameters investigated were significantly ($p < 0.05$) affected by

the substitution of SBM with MBLM in the diets. The highest average daily feed intake, g/b/d (123.50 ± 1.40) was recorded for the birds fed the control diet (0% MBLM). This reduced ($p < 0.05$) to 119 ± 1.10 (25% MBLM), 115.63 ± 2.19 (50% MBLM), 113.90 ± 2.19 (75% MBLM) and 112.30 ± 1.50 (100% MBLM) respectively. The average daily weight gain, g/b/d (55.87 ± 1.10) of the control (0% MBLM) was similar ($p > 0.05$) to 54.93 ± 1.10 (25% MBLM) and 49.07 ± 3.59 (50% MBLM), which were higher ($p < 0.05$) than 35.23 ± 2.87 (75% MBLM) and 24.60 ± 1.36 (100% MBLM). The lowest feed conversion ratio (FCR) value of 2.23 ± 0.07 (0% MBLM) and 2.20 ± 0.06 (25% MBLM) significantly ($p < 0.05$) increased to 2.40 ± 0.15 (50% MBLM), 3.27 ± 0.27 (75% MBLM) and 4.57 ± 0.22 (100% MBLM). The cost (₦)

per kg feed were 252.22, 249.82, 247.42, 245.02 and 242.62 respectively for 0, 25, 50, 75 and 100% replacement with MBLM diets. The corresponding cost of feed per kg live weight gain (₦)/kg) were 562.45 ± 12.34 , 549.60 ± 11.20 , 593.81 ± 21.22 , 801.22 ± 32.70 and $1,108.77 \pm 27.16$ for birds on diets whose soybean meal were replaced with 0, 25, 50 75 and 100% MBLM.

The decreasing feed intake with the increasing MBLM in the diets could probably be as a result of increasing ME. Several reports have established ME as the determinant of feed intake, such that the higher the energy the lower the feed intake. Similar average daily weight gain of the control, 25 and 50% MBLM-based diets which declined at the higher (75 and 100% MBLM) levels of substitution could mean that the nutrients and energy were not optimally utilized at those higher levels. This was also the case with the FCR, the best values obtained for the 0 and 25% MBLM; beyond which the values increased markedly. Although the fibre levels decreased with increasing levels of MBLM in the diets, presence of other anti-nutrients in the MBLM could be implicated. Reports show MBLM contain anti-nutrients. Adeduntan and Oyerinde, (2010) reported that the three varieties of mulberry leaves (S_{36} , S_{54} , and K_2) contain phytate, cyanide and tannin. Six (6) genotypes of mulberry were found to contain 0.04-0.08% and 0.13-0.36% tannic acid in fresh leaves and dried leaf powder in that order (Srivastava *et al.*, 2006). These anti-nutrients have been implicated in the digestion, absorption and utilization of nutrients. Absence of these ANFs in the control diet and minimal content in 25% MBLM-based diets could have been responsible for the lower FCR, an efficient and effective

utilization of nutrients by the experimental birds at these levels. Anti-nutritional factors have been found to reduce weight gain and increase FCR in broilers (Ahmad *et al.*, 2000; Kumar, 2003). Older birds (finishers) were reported to have better ability to tolerate anti-nutrients than the starters (Olajide, 2012; Bedford, 2006; Panda, 2006).

Although the cost per kg of the feed declined with higher levels of substitution of MBLM for SBM, due to higher price of the latter. This did not translate to consistent reduction of the cost of feed per kg weight gain of the experimental birds. The least cost of feed per kg live weight gain was obtained at 25% MBLM, lower than the control (0% MBLM) and other experimental diets. This could be as a result of the good average daily weight gain and the best (lowest) FCR obtained at 25% MBLM-based diets. Economically, this level of substitution (25% MBLM) can be adopted in place of SBM for broiler finishers. Similar lower feed cost per kg live weight gain of broilers fed palm kernel cake-based diets and maize offal-based diets compared with the control was reported (Ezienshi and Olomu, 2004).

The carcass characteristics of the experimental birds are presented in Table 4. The live weight, bled weight and plucked weight were significantly ($p < 0.05$) affected by dietary treatments. The highest live weight gain (kg), 1.90 ± 0.06 (0% MBLM), decreased significantly ($p < 0.05$) to 1.60 ± 0.06 , 1.45 ± 0.03 , 1.15 ± 0.05 , and 1.03 ± 0.03 at 25, 50, 75 and 100% substitution by MBLM respectively. The bled weight (%) were 94.77 ± 1.48 (0% MBLM), 94.83 ± 0.89 (25% MBLM), 95.47 ± 1.09

(50% MBLM), 92.87 ± 1.17 (75% MBLM) and 87.27 ± 2.73 (100% MBLM). The plucked weight (%) were 87.87 ± 3.27 (0% MBLM), 89.67 ± 1.83 (25% MBLM), 86.37 ± 0.33 (50% MBLM), 78.17 ± 2.59 (75% MBLM) and 82.43 ± 2.57 (100% MBLM). The eviscerated and dressed

weight were similar across the treatments. Carcass parts (head, neck, leg, drumstick, thigh, wing, breast, upper back and lower back) were also not significantly ($p < 0.05$) affected by the dietary substitution of SBM with MBLM.

Table 3: Growth performance characteristics of broiler finishers fed graded levels of mulberry leaf meal as substitutes for soybean meal

Parameters	T1 (0% MBLM)	T2 (25% MBLM)	T3 (50% MBLM)	T4 (75% MBLM)	T5 (100% MBLM)
Feed intake (g/b/d)	123.50 ± 1.40^a	119.27 ± 1.10^{ab}	115.63 ± 2.19^{bc}	113.90 ± 2.19^c	112.30 ± 1.50^c
Weight gain (g/b/d)	55.87 ± 1.10^a	54.93 ± 1.10^a	49.07 ± 3.59^a	35.23 ± 2.87^b	24.60 ± 1.36^c
FCR	2.23 ± 0.07^c	2.20 ± 0.06^c	2.40 ± 0.15^{ab}	3.27 ± 0.27^b	4.57 ± 0.22^a
Cost (₦) per kg feed	252.22 ± 00	249.82 ± 00	247.42 ± 00	245.02 ± 00	242.62 ± 00
Cost (₦) of feed per kg weight gain	562.45 ± 12.34^d	549.60 ± 11.20^c	593.81 ± 21.22^c	801.22 ± 32.70^b	1108.77 ± 27.16^a

^{a-c}Means on the same row with different superscripts are significantly ($p < 0.05$) different.

MBLM = Mulberry leaf meal

The decreasing live weight changes obtained were perhaps reflections of the poor performance of the experimental birds as level of MBLM increased in the diets. The bled weight is indication of blood removed from carcass and the volume left in the carcass has a great impact on the shelf life of the carcass. The volumes in the present study were 5.23, 5.17, 4.53, 7.13 and 12.73% for birds on diets with 0, 25, 50, 75 and 100% substitution with MBLM respectively. Mitruka and Rawnsley (1977) recommended blood volume

range of 2.5-6.6% of the body weight for normal chickens. The plucked weight (proportion of feathers) differed but did not follow a particular trend to be totally linked to the effect of diets. The eviscerated and dressed weights (% of live weight) were similar across the treatments. The dressed weight is the most saleable and economic part of the carcass. It is desirable that this is not negatively affected by the diets. The higher the dressed weight the more the edible meat. The carcass parts were also similar across the dietary treatments.

Table 4: Carcass parameters of broiler finishers fed graded levels of mulberry leaf meal as substitutes for soybean meal

Parameters	T1 (0% MBLM)	T2 (25% MBLM)	T3 (50% MBLM)	T4 (75% MBLM)	T5 (100% MBLM)
Live weight (kg)	1.90 ± 0.06 ^a	1.60 ± 0.06 ^b	1.45 ± 0.03 ^b	1.15 ± 0.05 ^c	1.03 ± 0.03 ^c
Bled weight (%)	94.77 ± 1.48 ^a	94.83 ± 0.89 ^a	95.47 ± 1.09 ^a	92.87 ± 1.17 ^a	87.27 ± 2.73 ^b
Plucked weight (%)	87.87 ± 3.27 ^a	89.67 ± 1.83 ^a	86.37 ± 0.33 ^{ab}	78.17 ± 2.59 ^c	82.43 ± 2.57 ^b
Eviscerated weight (%)	72.33 ± 6.76	75.20 ± 2.71	73.80 ± 1.55	78.57 ± 5.97	77.57 ± 2.43
Dressed weight (%)	56.43 ± 5.19	60.43 ± 1.09	59.03 ± 1.00	63.90 ± 2.80	58.50 ± 6.50
Carcass parts (%)					
Head	3.17 ± 0.18	3.27 ± 0.17	2.57 ± 0.78	3.53 ± 0.27	3.63 ± 0.33
Neck	4.5 ± 0.36	4.7 ± 0.12	4.23 ± 0.30	4.60 ± 0.17	4.30 ± 0.53
Leg	4.73 ± 0.50	5.07 ± 0.12	4.73 ± 0.32	5.37 ± 0.42	4.83 ± 0.48
Drumstick	9.67 ± 0.82	10.17 ± 0.33	9.77 ± 0.26	10.23 ± 0.38	9.50 ± 0.85
Thigh	9.77 ± 0.69	9.67 ± 0.43	9.23 ± 0.35	9.57 ± 0.56	9.00 ± 0.81
Wing	8.97 ± 0.58	8.60 ± 0.15	8.47 ± 0.12	8.77 ± 0.13	8.53 ± 0.84
Breast	14.93 ± 1.17	15.60 ± 1.05	15.63 ± 0.23	15.37 ± 1.23	13.93 ± 0.84
Upper back	5.33 ± 0.38	5.73 ± 0.19	5.73 ± 0.58	6.20 ± 0.15	6.07 ± 0.59
Lower back	7.00 ± 1.48	7.17 ± 0.32	7.03 ± 0.94	7.23 ± 0.77	6.43 ± 1.05

^{a-c}Means on the same row with different superscripts are significantly (p<0.05) different.

MBLM = Mulberry leaf meal

CONCLUSION

- Soybean meal could economically be replaced with 25% Mulberry leaf meal (2% of the diet) without any adverse effects on their performance and carcass quality.

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