Article

Moringa leaf meal as a natural feed additives on the growth performance and meat quality of commercial broiler chicken

Abstract: A study was conducted to investigate the effect of dietary moringa leaf meal (MLM) as a natural alternative to antibiotics on the growth performance, meat quality, and carcass yield of broiler chicken. A total of 270 day-old broiler chicks were randomly weighed and assigned to six dietary treatments having 45 birds in each. Each dietary treatment had three replicates of 15 birds and was reared in floor pens. Chicks were distributed in 4 different inclusion levels of MLM in diets; 0.5%, 1.0%, 1.5%, and 2.0% with 2 control diets negative and positive. The birds were fed the experimental diets and water was provided without restriction throughout the experimental period. The results showed a significant ($P<0.05$) effect on final body weight and weight gain in dietary supplementation of 1.5% MLM as compared to that of the control group. Better feed conversion (1.53) was observed in the 1.5% MLM group. Different levels of MLM exhibit significant influence on the meat yield performance of broilers. There was no significant difference ($P>0.05$) observed among the average live weight, thigh meat, wing meat, drumstick meat, gizzard, and abdominal fat of broilers. Breast meat, heart, liver, large intestine, and dressing percentages showed significant differences. Lower mortality was found on a diet supplemented with MLM. It is concluded that 1.5% MLM in broiler diets can be used as a natural feed additive for enhancing growth performance, organ development, meat yield, and serum cholesterol of broilers as well as replacing ~~of~~ oxytetracycline.

Keywords: moringa leaf meal; antibiotic; growth performance; feed conversion ratio; dressing yield

1. Introduction

Moringa oleifera (*M. oleifera*) belongs to the single genus monogeneric family Moringaceae and is well distributed in Africa and Asia. Apart from being a good source of vitamins and amino acids, it has medicinal uses. *Moringa oleifera* is a highly valued plant, distributed in many countries of the tropics and subtropics, where its various parts have been utilized historically as food and medicine. Many researchers (Sarker *et al*., 2009a,b; Griggs and Jacob, 2005; Peeters *et al*., 2006; Zhang *et al*., 2005; Anjum *et al*., 2005) suggested that natural herbal feed additives (plants/probiotic/prebiotic/organic acid, etc.) can be used instead of antibiotic growth promoter in broiler production. Phytochemicals refer to only those chemicals which may have an impact on health, or on the flavor, texture, smell, or color of the plants, but are not required by humans as essential nutrients. The leaves are considered to offer great potential for those who are nutritionally at risk and may be regarded as a protein and calcium supplement. *Moringa* leaves meal in the diets of adult indigenous chickens can be used upto 24% in partial substitution of groundnut cake meal, did not caused any adverse effect on

nutrient retention, and had significantly improved apparent coefficients of crude protein, energy, and minerals utilization(Ossebi, 2010).A total of 250,000speciesof flowering plants are referred to as medicinal plants. The World Health Organization (WHO) enlisted some 21,000 medicinal plant species containing different phytochemicals (Yadav *et al*., 2014; Penso, 1980). The annual growth of the herbal market is about 15 percent and the global herbal market by 2050 is expected to be about US$ 5 trillion (Purohit and Vyas, 2004; WHO, 2002). In Bangladesh, we have about 500 plant species as medicinal plants because of their therapeutic properties (Ghani, 2000). It is revealed that growth performance and meat quality can be enhanced by using medicinal plants and probiotics (Sarker *et al*., 2010a,b and 2011; Kim *et al*., 2002). According to Opara, 1996, leaf meal does not only serve as a protein source but also provides some necessary vitamins, minerals and ~~also~~ oxy carotenoids which cause the yellow colour of broiler skin, shank, and egg yolk. Gadzirayi*et al*. (2012) reported that the highest feed intake was recorded in birds offered a 25% *Moringa oleifera* leaf meal (MOLM) diet. They also noted that MOLM can be supplemented to soya bean meal at a 25% inclusion level in broiler chickens. We intend to use moringa leaf meal in the broiler diet as a feed additive (required up to 2%) but not asfeed supplement (can be used up to 30%) because it is yet to be cultivated as a fodder crop in Bangladesh.
Hence, the present study was conducted to investigate the effect of moringa leaf meal (MLM) as an alternative to antibiotics as natural feed additives on the growth performance, meat quality, and carcass yield of broiler chicken.

2. Materials and Methods

This study was conducted at the broiler experimental shed, Poultry Production Research Division of Bangladesh Livestock Research Institute Savar, Dhaka. Straight run day old as hatched Cobb 500 broilers chicks were used for ~~a period of~~ 35 days to find out the effect of dietary level of moringa leaf meal (MLM) on feed consumption, weight gain, FCR, and mortality of broilers. A total of 270 day-old broiler chicks were randomly weighed and assigned to six dietary treatments in a group of 45 birds each according to the following CRD. Each dietary treatment had 45 birds with three replicates of 15 birds. Broilers were assigned to different inclusion levels of MLM diets; 0.5%, 1.0%, 1.5%, and 2.0% with the basal diet. In the positive control (antibiotic group) 0.05% Oxytetracycline (OTC) was added to the basal diet whereas in the negative control group, no additives were added. The birds were fed the experimental diets as per BSTI standard namely starter (0-21 days) and finisher (22-35 days). Water was provided without restriction throughout the experimental period to the broilers.

3. Results and Discussion

The results in Table 1, show that significant ($P<0.05$) effect on final body weight and weight gain in dietary supplementation of 1.5% MLM as compared to that of control as well as other MLM supplementary groups. Significantly lowest feed conversion ratio was (1.53) observed at 1.5% MLM fed dietary group. Our result in the feed conversion ratio of the birds fed moringa leaf meal-based diets showed similarity with the result of El Tazi (2010). This might me the birds fed moringa-based diets adequately utilized the nutrients they consumed. The results also coincided with the finding of Ebenebe *et al*. (2012) who reported chicks fed moringa-based diets performed significantly ($P<0.05$) better than that of the control group in terms of higher weight gain and better feed conversion ratio. This improvement in body weight gain and feed conversion ratio may be attributed to the rich content of nutrients in moringa (Sarwatt *et al*., 2004; Kakengi *et al*., 2003).
Different levels of MLM exhibit a significant influence on the dressing percentage and breast meat of broilers (Table 2 and Figure 1). There were no significant differences ($P>0.05$) observed in the live weight, drumstick meat, thigh meat, wing meat, and dressing yield of broilers among the dietary feed additive groups (Table 2). Ologhobo *et al*. (2014) mentioned that, higher mean values of slaughter weights were recorded for birds fed diets containing *Moringa oleifera* leaf meat as compared to those fed on the control diet.
In Table 3, heart, liver, large intestine, and neck weight showed significant differences ($P<0.05$) among the treatments. No significant differences were observed in crop, gizzard, small intestine, and abdominal fat among the groups. Although we didn't find a significant difference in abdominal fat except a reducing trend compared to controls but significant reduction of abdominal fat with the increment of moringa leaf meal addition was revealed by Aderinola *et al*., (2013).
Blood lipid profile has an important role in the performance and carcass quality of broilers. Physiological studies have been adapted to correlate some of the blood parameters with the degree of fatness in broiler chickens. In this regard, it can be indicated that plasma very low-density lipoprotein (VLDL) is a useful parameter to infer the degree of fatness in chickens. It is reported from ~~the~~ Table 4 that decreasing plasma (VLDL) level in broiler chicken by addition of MLM in the diet, which in directly revealed about the hypo

cholesterolemic effect of moringa. Similar statement was also made by Olugbemi *et al*., (2010) who stated the reason could probably be attributed to the hypocholesterolemic property of the moringa leaf meal.

Table1. Effects of moringa leaf meal as a feed additive on growth of broiler at 5th weeks of age.

Treatment	Control	Antibiotic (0.05%OTC)	MLM(Moringa Leaf Meal) 0.5%	1.0%	1.5%	2.0%	LS
IBW(g)	42.58^{ab}±0.15	42.66^{ab}±0.10	42.44^{ab}±0.15	42.93^{a}±0.13	42.37^{b}±0.18	42.88^{a}±0.15	*
FW(g)	2162.05^{b}±43	2139.57^{b}±12	2091.29^{b}±24	2074.46^{b}±20	2357.48^{a} ±72	2118.82^{b}±40	*
WG(g)	2119.47^{b}±43	2096.91^{b}±12	2048.84^{b}±24	2074.46^{b}±20	2315.10^{a} ±72	2075.94^{b}±40	*
FI(g)	3529.80±49	3437.60±12	3389.35±4	3380.43±27	3524.66±58	3460.53±75	NS
FCR	1.66^{a}±0.01	1.64^{a}±0.00	1.65^{a}±0.01	1.62^{a}±0.01	1.53^{b}±0.07	1.66^{a}±0.01	*

IBW=Initial body weight, FW=Final weight,WG=Weight gain,FI=Feed intake,OTC-Oxytetracycline
^{abc}means having differentsuperscriptsinthesamerowdiffersignificantly,*:P<0.05,NS:P>0.05

Table2.Effectsofmoringaleafmealasfeedadditiveonmeatyieldtraitsofbroilerat5th weeksofage.

	Control	Antibiotic (0.05%OTC)	0.5	1.0	1.5	2.0	LS
Livewt.(g/bird)	2012±70	1944.67±73	2006.67±41	2054.67±40	2039±26	2017.33±21	NS
Drumstickmeat(g)	159±7	155.33±5	161±5	168.33±9	163.66±9	166.66±3	NS
Thighmeat(g)	198.33±8	191.33±6	191.33±12	212.66±12	191.66±10	212.33±5	NS
Breastmeat(g)	479.6^{b}±12	476.33^{b}±30	522^{ab}±31	559.33^{a}±14	509.33^{ab}±8	528^{ab}±11	*
Wingmeat(g)	146±14.42	136.66±9.83	146.33±17.45	150±6.65	151.33±4.91	121±3.05	NS
Dressingyield	1309.33±36	1306.33±72	1363.33±40	1428±35	1367.67±42	1348.33±16	NS
Dressing(%)	70.67^{b}±1.52	73.2^{ab} ±0.92	76.75^{a}±3.12	74.75^{ab}±0.25	73.74^{ab}±0.98	73.01^{ab}±0.27	*

^{ab}meanshavingdifferentsuperscriptsinthesamerowdiffersignificantly,*:P<0.05; NS: P> 0.05

Table3.Effectsofmoringaleafmeal(MLM)ondevelopmentofintestinalorgansinbroilerchickens.

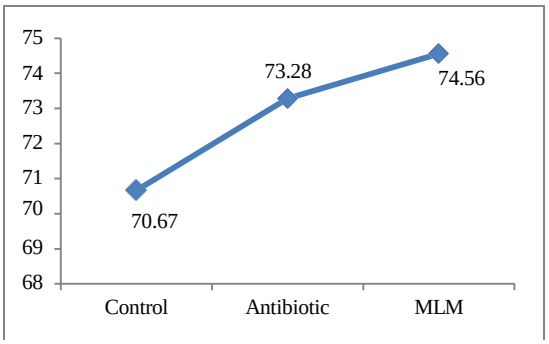
Organwt(g)	Control	Antibiotic	0.5%	1.0%	1.5%	2.0%	LevelofSig.
Cropwt.	17.66	13.33	13.00	16.00	18.00	9.00	NS
Heartwt.	12.00^{a}	9.66^{b}	9.00^{b}	9.33^{b}	9.00^{b}	11.66^{a}	*
Liverwt.	51.66^{a}	41.00^{ab}	42.33^{ab}	40.00^{ab}	41.66^{ab}	39.00^{b}	*
Gizzardwt.	31.66	32.00	33.33	29.00	32.00	26.66	NS
SmallIntes. wt.	58.33	53.66	56.66	41.33	52.00	43.66	NS
LargeIntes.wt.	19.00^{a}	12.33^{b}	16.66^{ab}	15.66^{ab}	16.66^{ab}	13.00^{ab}	*
Abdomfatwt.	25.00	25.33	18.00	17.66	22.00	16.33	NS
Neckweight	48.00^{b}	54.33^{ab}	56.00^{ab}	61.33^{a}	57.33^{ab}	53.33^{ab}	*

^{ab}meanshavingdifferentsuperscriptsinthesamerowdiffersignificantly,*:p<0.05.NS:P>0.05

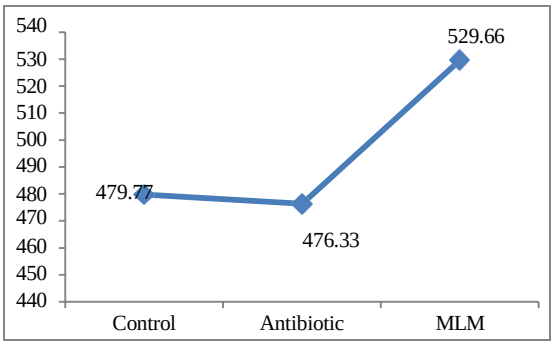
Table4.Effectsofmoringaleafmealasnaturalfeedadditiveonserumlipidprofilelevelofbroilerat5th weeksofage.

Parameter	Control	Antibiotic (0.05% OTC)	MLM(MoringaLeafMeal) 0.5%	1.0%	1.5%	2.0%	Level
Total Cholesterol (mg/dl)	143.33±9.06	131.33±5.89	130.00±5.19	127.33±6.56	138.00±6.55	133.33±3.28	NS
HDL(mg/dl)	41.66±2.18	41.00±1.00	42.33±2.02	43.33±2.96	42.66±1.20	40.33±2.72	NS
LDL(mg/dl)	73.66±31.97	82.33±3.84	91.33±3.84	87.66±3.38	88.66±3.52	71.00±1.15	NS
VLDL(mg/dl)	31.86±3.42^{a}	22.93±1.87^{bc}	29.06±1.21^{ab}	25.53±2.49^{abc}	25.60±0.90^{abc}	19.20±2.53^{c}	*
TG (mg/dl)	159.33±17.13^{a}	114.66±9.38^{bc}	145.33±6.06^{ab}	127.66±12.46^{abc}	128.00±4.50^{abc}	96.00±12.66^{c}	*

HDL–Highdensitylipoprotein,LDL-Lowdensitylipoprotein,VLDL-Verylowdensitylipoprotein,TG-Triglyceride
^{a,b,c,}Meanwithdifferentsuperscriptsaresignificantlydifferent;*,P<0.05;NS:P>0.05



Dressingyield(%)



Breastmeat(g)

Figure 1. Trend of dressing yield percent and breast meat of broilers in control, antibiotic and MLM added groups.

4. Conclusions

Improvement in weight gain and feed conversion ratio was observed in the 1.5% MLM-supplemented group compared to other groups including antibiotic-fed birds. The addition of moringa leaf meal didn't affect (≥0.05) ~~on~~ internal organ development but rather improved dressing and dressing yield. Considering the findings it can be concluded that 1.5% moringa leaf meal is replaceable in place of antibiotics in terms of growth performance, internal organ development, and meat yield traits.

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