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Research Article

EFFECT OF *MORINGA OLEIFERA* LEAF EXTRACTS ON GROWTH PERFORMANCE AND HAEMATO-BIOCHEMICAL INDICES OF BROILER CHICKENS

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ABSTRACT

The present study was aimed to assess the influence of *Moringa oleifera* leaf extracts on growth and haemato-biochemical indices of broiler chickens. Dietary treatments were; NC (Negative control) and basal diet with antibiotics (PC-positive control), aqueous extract of 1.5% *Moringa* powder (MOAQE), ether extract of 1.5% *Moringa* powder (MOEE) and alcoholic extract of 1.5% Moringa powder (MOALE). The body weight gain of *Moringa* extract supplemented groups were significantly ($P<0.05$) higher than PC and NC group birds. FCR values of *Moringa* extract and PC group was significantly ($P<0.05$) lower than NC group. Highest profit per bird was observed in MOAQE group broilers. It was concluded that supplementation of aqueous extract of 1.5% *Moringa oleifera* leaf powder improved the performance of birds without any detrimental effect on their health.

Keywords: Broiler, Extract, Growth performance, haemato-biochemical, Moringa

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The health of the poultry is affected by its surrounding environment. Harmful infectious agent can easily infect broiler with weak immune system, leading to huge economic loss in poultry sector. The use of antibiotic is prohibited due to antimicrobial resistance and antibiotic residue in meat and eggs. So, there is urgent need of herbal substitutes to promote health and performance of broilers. *Moringa oleifera* is such an herbal plant with multiple utility as every part of plant has beneficial effects. The unique features of *M. oleifera* are its rich in protein, carbohydrate and fibres with low fat. *Moringa oleifera* also an excellent source of amino acids that boosts immune system (Olugbemi *et al.*, 2010). The active principles of Moringa plant possess antioxidant, anti-inflammatory, antimutagenic and anticancer properties (Verma *et al.*, 2013). Therefore, the present study was conducted to investigate the effects of *M. oleifera* leaf extracts as dietary supplement on growth performance of broiler birds.

MATERIALS AND METHODS

For conducting the present experiment an approval from "Institutional animal ethical committee (IAEC)" was obtained vide reference number IAEC/CVSc/P-36/2019. A total of 250 one-day old Vencobb-430 strain chicks were randomly allocated into five dietary treatment groups with 5 replicates of 10 chicks in each. The chicks were kept on five dietary treatments which includes a basal diet without any additive in negative control (NC) or that supplemented with antibiotics (Positive control-PC), aqueous extract of 1.5% *Moringa* powder (MOAQE), ether extract of 1.5% *Moringa* powder (MOEE) and alcoholic extract of 1.5% *Moringa* powder (MOALE) in basal diet. Birds were fed *ad libitum* in different phases of experimental trial. The composition of formulated experimental diets as per BIS (2007) has been given in Table 1.

The chicks were kept on deep litter system under uniform standard management conditions with availability of clean, fresh and whole some drinking water. Individual body weight (BW) at zero day and weekly interval was recorded up to 35 days of experimental trial. Replicate-wise feed intake (FI) of chicks was recorded at weekly interval and from these data body weight gain (BWG) and feed conversion ratio (FCR) were calculated accordingly. At the end of research trial, economic return was also calculated to search out the commercial viability of *Moringa oleifera* leaf extracts supplementation in broiler production. After 35 days of experiment, blood samples were collected aseptically from wing vein to assess the haemato-biochemical parameters. The haematological parameters were estimated by using the Nihon Kohden automated haematology analyser (MEK-6420P, Celltac α, Nihon Kohden India). Glucose, total protein, albumin, globulin, total cholesterol, triglyceride, SGOT and SGPT were estimated from the serum samples using Autospan commercial diagnostic kits, Arkrey Healthcare Private Limited, Surat, India.

The data were analysed by employing one way analysis of variance and means of different dietary treatments were compared with Duncan multiple range test. The P value

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less than 0.05 were considered significant.

RESULTS AND DISCUSSION

Growth Parameters

The data pertaining to the growth performance of broilers in terms of BWG, FI, FCR, EER, PER and economic return are presented in Table 2. The BWG of Moringa extracts supplemented groups was significantly (P<0.05) higher than NC group, but similar to PC group birds. The feed intake of MOAQE group was significantly (P<0.05) lower compared to NC, MOEE and MOALE groups. However, MOAQUE group showed no difference in feed intake compared to antibiotic supplement group. MOAQE group broilers showed significantly (P<0.05) lowest FCR compared to NC, PC MOEE and MOALE group birds. However, FCR of MOALE was comparable to PC group birds. The values of EER and PER were significantly (P<0.05) higher in MOAQE group as compare to other groups, while NC group recorded significantly (P<0.05) lowest value. The economic data showed that the total cost per broiler in MOAQE was significantly (P<0.05) lower than NC, MOEE and MOALE. However, no difference was observed in total cost per broiler of PC group compared with MOAQE. Profit per broiler of MOAQE was significantly (P<0.05) higher than NC, MOEE and MOALE group birds, but similar to PC group.

The present findings of higher BWG in Moringa extract supplemented group birds are in agreement with findings of Alabi *et al.* (2020) and Esiegwu, A.C. (2019) who reported significantly (P<0.05) higher final body weight, body weight gain and growth rate in Moringa aqueous extract supplemented broiler birds. Teteh *et al.* (2013) also recorded significantly (P<0.05) higher final body weight and body weight gain with alcoholic and aqueous extract of *Moringa oleifera* as compare to control group broiler chickens. The lower FCR in *Moringa* extract supplemented groups was favoured by Paul *et al.* (2018) and Allam *et al.* (2016). Higher feed efficiency was also observed by Mousa *et al.* (2017) with addition of *Moringa* leaf meal in broilers. The lower FCR values in *Moringa* supplemented groups might be due to better utilization of feed. The higher profit in *Moringa* leaf supplemented group of the present study is similar to findings of AbouSekken, (2015) who reported improvement in the net revenue and economic efficiency of broilers supplemented with *Moringa* leaf extracts.The improvement in weight gain of birds fed *Moringa* extract supplement diets could be attributed to digestion enhancing properties and stimulation of growth favouring bacteria like other herbal drugs while, decreasing harmful microorganisms and also influence the gut microflora of broiler birds. The higher body weight and lower FCR in this study might be related to the presence of different bioactive components in *Moringa* leaf extracts that may play a role in improved nutrient utilization in supplemented birds.

Table 1

Percent composition of broiler pre-starter, starter and finisher diets.

Composition	Pre-starter	Starter	Finisher
Ingredient composition (%)			
Maize	54.3	55.20	59.1
Soybean meal	34.2	31.60	26.8
Rice polish	2.00	2.20	3.0
Vegetable fat	2.7	3.9	4.6
Sodium bicarbonate	0.55	0.42	0.44
Limestone powder	0.80	0.8	0.8
Common salt	0.25	0.25	0.25
Mustard deoiled cake	1.6	1.7	1.0
DDGS*	3.0	3.4	3.5
DL-Methionine	0.25	0.18	0.16
Lysine	0.2	0.2	0.2
Vitamin premix1	0.05	0.05	0.05
Mineral premix1	0.10	0.10	0.10
Chemical composition (% DM basis)			
Dry Matter (%)	86.95	86.77	88.02
Crude protein (%)	23.00	22.01	20.06
Crude fiber (%)	3.86	3.77	3.50
Ether extract (%)	5.74	7.01	7.84
Total ash (%)	3.29	3.19	2.98
Metabolizable energy (Kcal/kg)**	3000.30	3100.15	3202.50

*Dried distillers grain soluble; **Calculated values; 1Supplies (per kg diet): Vitamin A, 12, 500IU; Vitamin D3, 2200IU; Vitamin E, 22 mg; Vitamin K, 3 mg; Vitamin B2, 8 mg; Vitamin B6, 2.4 mg; Vitamin B12,11µg; Niacin, 28 mg; Pantothenic acid, 12 mg; Folic acid, 1.5 mg; Mn, 85 mg; Zn, 70 mg; Fe, 50 mg; Cu, 10 mg; I, 1.2 mg; Se, 0.2 mg; Co, 0.25 mg.

Haematological traits

The result showed significantly (P<0.05) higher values of RBC count in MOEE group than MOALE, PC and NC group birds, but there was no difference compared with MOAQE group. MOALE group recorded significantly (P<0.05) higher value of MCV as compare to NC, PC, MOAQE and MOEE group birds. MCH and MCHC value of *Moringa* extracts and antibiotic supplement groups were significantly (P<0.05) lower as compare to the group with no supplement. Platelets, WBC and granulocyte count of *Moringa* extracts supplemented groups were significantly (P<0.05) lower than NC and PC groups, except MOALE group which showed no significant (P<0.05) difference compared with NC and PC group birds.The lymphocyte percentage of MOAQE and MOEE group broilers was significantly (P<0.05) higher than PC

Table 2

Effect of different dietary levels of *Moringa* leaf extracts on growth performance of broiler chickens

Attributes	NC	PC	MOAQE	MOEE	MOALE	P-value
Initial BW (g)	55.10±0.55	55.49±0.49	55.20±0.51	55.95±0.52	55.88	0.700
Final BW (g)	1798.28±17.26^{a}	1854.82±30.52^{ab}	1881.62±21.19^{b}	1890.70±28.22^{b}	1897.52±21.34^{b}	0.027
BW gain/broiler (g)	1743.18±16.83^{a}	1799.33±30.12^{ab}	1826.42±20.91^{b}	1834.75±27.78^{b}	1841.64±20.91^{b}	0.027
Feedintake/broiler (g)	3206.95±35.83^{b}	3044.05±29.92^{a}	3025.91±30.34^{a}	3181.56±29.60^{b}	3157.40±35.42^{b}	<0.001
FCR	1.78±0.023^{d}	1.65±0.011^{b}	1.61±0.008^{a}	1.69±0.012^{c}	1.67±0.009^{bc}	<0.001
EER*	17.79±0.09^{a}	19.25±0.14^{c}	19.71±10^{d}	18.79±0.13^{b}	19.06±0.10^{bc}	<0.001
PER**	2.70±0.01^{a}	2.91±0.02^{c}	2.98±0.02^{d}	2.84±0.02^{b}	2.88±0.02^{bc}	<0.001
Total cost/broiler (Rs.)	146.71±1.07^{b}	142.49±0.90^{a}	142.56±0.92^{a}	155.52±0.97^{c}	153.14±1.15^{c}	<0.001
Saleprice/broiler (Rs.)	161.85±1.55^{a}	166.93±2.75^{ab}	169.35±1.91^{b}	170.16±2.54^{b}	170.78±1.90^{b}	0.027
Profit/broiler (Rs.)	15.14±0.79^{a}	24.45±1.87^{b}	26.79±1.15^{b}	14.65±1.65^{a}	17.64±1.03^{a}	<0.001
Profit index	0.09±0.004^{ab}	0.14±0.01^{c}	0.16±0.01^{c}	0.08±0.01^{a}	0.10±0.01^{b}	<0.001

abcd Means with different superscripts in a row between groups differ significantly (P<0.05).
* Energy efficiency ratio; ** Protein efficiency ratio

Table 3

Effect of different dietary levels of *Moringa* leaf extracts on haematological profile of broiler chickens

Attributes	NC	PC	MOAQE	MOEE	MOALE	P-value
R.B.C. (103/µL)	2.34± 0.07^{a}	2.35± 0.04^{a}	2.47±0.05^{ab}	2.61± 0.05^{b}	2.41± 0.05^{a}	0.036
Haemoglobin (g/dl)	11.03±0.22	10.76±0.33	11.33±0.21	11.52±0.25	11.16±0.18	0.099
PCV (%)	32.42± 0.92	32.03± 0.90	32.94±0.59	34.92± 0.47	33.16±0.72	0.101
MCV (fL)	133.60±0.68^{a}	132.40±1.53^{a}	133.20±0.37^{a}	133.40±0.93^{a}	137.60±0.24^{b}	0.004
MCH (pg)	48.03± 0.54^{c}	44.11± 0.65^{a}	45.83± 0.38^{b}	44.00± 0.21^{a}	45.76± 0.59^{b}	<0.001
MCHC (g/dl)	35.93± 0.33^{c}	33.62±0.15^{ab}	34.43± 0.20^{b}	32.93± 0.34^{a}	33.28± 0.40^{a}	<0.001
Platelets (103/µL)	60.2± 5.70^{c}	57.8± 2.41^{c}	35.00± 1.64^{b}	19.00± 0.54^{a}	13.80± 1.35^{a}	<0.001
W.B.C. (103/µl)	14.86± 0.60^{b}	15.70± 0.73^{b}	11.79± 0.88^{a}	12.56± 0.62^{a}	12.51± 0.46^{a}	0.002
Lymphocyte (%)	49.01± 3.15^{a}	50.16± 3.17^{a}	55.62± 2.53^{b}	56.52± 3.13^{b}	53.84±2.76^{ab}	0.002
Granulocyte (%)	47.95± 3.01^{b}	48.10± 3.49^{b}	41.28±2.56^{a}	40.58±2.92^{a}	43.62±2.57^{ab}	<0.001
Monocyte (%)	2.27± 0.21	1.71± 0.43	3.08± 0.44	2.85± 0.50	2.23± 0.36	0.099

abcd Means with different superscripts in a row between groups differ significantly (p<0.05).

and NC group birds and similar to MOALE group.

The present findings are in agreements with Esiegwu, A.C. (2019) and Faluyiand Agbede (2018) who observed no significant (P>0.05) effect of aqueous leaf extract of *Moringa oleifera* on Hb and PCV values of broiler birds. Paul *et al.* (2018) also found no significant differences across the treatments in all the haematological indices (RBC, haemoglobin and PCV) measured due to addition of 1% *Moringa* leaf extract in diet of birds. Similarly, Redekar *et al.* (2019) observed insignificant difference in values of Hb and PCV% in groups supplemented with concentrate mixture containing 10 and 20 percent *Moringa oleifera* leaf meal in growing sheep. Hussein and Jassim (2019) also reported significantly (P<0.05) lower values of WBC in broilers fed diets supplemented with aqueous and alcoholic leaf extract. Whereas, Hussein and Jassim (2019) observed significantly higher (P<0.05) values of RBC, PCV% and Hb in aqueous and alcoholic *Moringa* leaf extract supplemented broilers birds. In contrary to these findings, Mahmood *et al.* (2015) and Allam *et al.* (2016) recorded no significant difference in WBC values of broilers supplemented with *Moringa* leaf extract. The decrease number of WBC of *Moringa* extract treated groups suggests good health of broiler birds. The numerically higher values of RBC and Hb in present study might be attributed to the influence of *Moringa oleifera* leaf content which is rich in nutrients such as protein and minerals. Red blood cells are

Table 4

Effectof different dietary levels of *Moringa* leaf powder on biochemical profile of broiler chickens

Attributes	NC	PC	MOAQE	MOEE	MOALE	P-value
SGPT (U/L)	12.42± 0.97^{b}	11.81±0.82^{ab}	9.35±0.86^{a}	10.02± 0.99^{a}	8.18± 1.27^{a}	0.05
SGOT (U/L)	214.46± 4.03	212.47±3.64	210.59± 3.88	211.20± 2.12	206.08±3.37	0.294
Total protein (g/dl)	3.32± 0.05	3.32± 0.07	3.31± 0.10	3.44± 0.07	3.20± 0.12	0.432
Albumin (g/dl)	1.25± 0.03	1.25± 0.04	1.24± 0.03	1.25± 0.04	1.24± 0.02	0.999
Globulin (g/dl)	2.07± 0.03	2.07±0.08	2.06± 0.07	2.19± 0.05	1.96± 0.11	0.279
A/G ratio	0.60± 0.01	0.61± 0.03	0.60± 0.01	0.57± 0.02	0.64± 0.013	0.765
Cholesterol (mg/dl)	150.72±3.83^{c}	151.60±5.31^{c}	141.07±3.06^{bc}	132.19±4.22^{ab}	120.03±7.16^{a}	0.001
Triglyceride(mg/dl)	141.93±2.40^{c}	143.69±3.51^{c}	115.30± 5.92^{b}	132.83± 9.44^{c}	100.89±10.16^{a}	<0.001
Blood glucose (mg/dl)	260.71±4.00^{a}	261.69±6.23^{a}	271.85±4.95^{b}	274.70± 2.55^{b}	278.24± 5.14^{c}	0.014

abcd Means with different superscripts in a row between groups differ significantly (p<0.05).

responsible for the transportation of oxygen and carbon dioxide in the blood as well as manufacture of Haemoglobin. Hence higher value indicates a greater potential for this function and better health of broiler birds (Olugbemi *et al.*, 2010).

Biochemical traits

The data pertaining to biochemical traits has been depicted in table 4. The results revealed that SGPT level of *Moringa* leaf extract supplemented groups was significantly (P<0.05) lower than NC group birds. However, no significant (P>0.05) difference was observed in SGPT level of Moringa leaf extract supplement groups compared with PC group birds. No significant (P>0.05) difference was noticed in values of SGOT, total protein, albumin, globulin and A/G ratio among the different treatment groups under the study. The serum cholesterol concentrations of MOEE and MOALE group were found significantly (P<0.05) lower as compared to PC and NC group birds, whereas there was no significant (P>0.05) difference in cholesterol values among PC, NC and MOAQE group broiler chickens. Triglyceride concentration was significantly (P<0.05) lower in MOAQE and MOALE group birds as compare to NC, PC and MOEE group birds. The glucose concentration of MOALE group followed by MOEE and MOAQE was significantly (P<0.05) higher than NC and PC group birds.

The results of the present study were compatible with those observations which were observed by Esiegwu, A.C. (2019) and Ibrahim *et al.* (2018) who reported no significant (P>0.05) effect of *moringa* leaf extract on SGOT level of *Moringa* supplement group birds. Allam *et al.* (2016) also reported statistically similar values of SGOT in the groups treated with aqueous and alcoholic *Moringa* leaf extract. Decrease in the SGPT level of broilers supplemented with *Moringa* was in accordance to the findings of Hafsa *et al.* (2020). The results of increase in glucose concentration of broilers fed aqueous and ethanolic extract of *Moringa* leaf was in agreement to the reports of Hussein and Jassim (2019). Whereas, Mahmood *et al.* (2015) observed significant (P<0.05) decrease in blood glucose of broilers fed with *Moringa* leaf extract compare to without supplement group birds. Present findings of decrease inserum cholesterol of broilers were supported by Hussein and Jassim (2019) who recorded significantly (P<0.05) lower cholesterol level in the groups supplemented with aqueous and ethanolic *Moringa* leaf extracts. Mahmood *et al.* (2015) also reported significant (P<0.05) reduction in serum cholesterol in broilers supplemented with leaf extract of *Moringa* oleifera. Contrary to present findings, Ibrahim *et al.* (2018) observed that total cholesterol, HDL, LDL, Triglyceride levels of broilers were statistically similar for all groups including *moringa* leaf extract supplement group. Finding of Allam *et al.* (2016) agreed with present result, who reported no significant effect of aqueous and alcoholic *moringa* leaf extract on total protein, albumin, globulin and A/G ratio values of broiler birds. Faluyiand Agbede (2018), also reported no significant (P<0.05) effect of aqueous *Moringa* leaf extract on protein indices of supplemented broiler birds. Whereas, dissimilar finding was observed by Esiegwu, (2019) who reported significant (P<0.05) reduction in concentration of total protein and globulin as the inclusion level of the *Moringa* oleifera leaf increased.

Lower values of SGPT in *Moringa* extract supplemented group might be due to the high concentrations of antioxidants present in MO leaves. The values of total serum protein (3.20-3.44 g/dl) obtained in current study lies within the normal range (2.5 and 4.5 g/dl) for healthy broiler birds as reported by Campbell (2004), an indication

of nutritional sufficiency of the dietary proteins in present experiment. The reduction in the levels of cholesterol and triglyceride among birds supplemented with *Moringa oleifera* may reflect its beneficial effectsin the diets, as *M. oleifera* has a high content of Phenolic compounds and flavonoids that involved in the inhibition of pancreatic cholesterol esterase activity, thereby reducing and delaying cholesterol absorption and binding bile acids thus reducing plasma cholesterol concentrations (Adisakwattana, S. and Chanathong, B., 2011). *Moringa oleifera* (MO) leaves also contain the bioactive β-sitosterol, with documented cholesterol lowering effect, which might have been responsible for the cholesterol lowering action in plasma of *Moringa* extract supplemented group birds.

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