

Research Article

Effect of *Moringa oleifera* Leaf Extract on Growth Performance and Some Biochemical Parameters of Broiler Chickens

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Abstract:

The research target of this study was to investigate the effect of *Moringa oleifera* leaf extract on growth performance, antioxidant status and some biochemical parameters of broiler chickens. Two hundred and forty unsexed day-old Evian broiler chicks were divided to control and three experimental groups. Each group had three replicates with 20 birds per replicate. The groups were received water as follows; C received 0.0 ml moringa leaf extract per 1 liter water (Cont), T1 received 90 ml moringa of leaf extract per 1 liter water (90MOLE), T2 received 135 ml moringa leaf extract per 1 liter water (135MOLE), T3 received 180 ml moringa leaf extract per 1 liter water (180 MOLE). The results showed that final weight, weight gain, feed consumption, feed conversion ratio, liver function, lipid profile and antioxidants indicators were significantly ($p < 0.05$) improved by moringa leaf extract supplementation. The data showed that T2 (135 ml moringa leaf extract / liter water) had the best values.

1. Introduction

Poultry production remains the most wide spread of all livestock enterprises; it constitutes an important pillar of food security improvement as well as socio-cultural and economic development in most countries (Dieye et al., 2010). The chicken industry in developing countries is facing some challenges, such as the high cost of feed (Abbas, 2013).

Poultry scientists are now turning their attention to safe and natural alternatives such as probiotics, prebiotics, enzymes and plant or herbal extracts. They believe it's safer, healthier, and less subject to hazards. Plant extracts have been used in the diets of poultry to reduce the high cost of conventional protein sources as well as to promote growth and have appetizing and digestion stimulating properties (Machebe et al., 2010 and Nidaullah et al., 2010).

The moringa oleifera plant possesses medicinal properties (Fahey J., 2005). Moringa oleifera leaf extract has antibacterial properties (Thilza et al., 2010), enhances immune systems (Olugbemiet et al., 2010), and exhibit antitumor, antiinflammatory and antiulcer activities (Chumark et al., 2008). Moringa oleifera is a rich source of natural antioxidants such as tocopherols, flavonoids and vitamin C and essential oils (Lewis et al., 2003). It has relatively high crude protein, low anti-nutritional factors and antimicrobial activity (Dahort, 1998). Also, Anwar and Bhangar, 2003 reported that moringa leaves are a rich source of proteins, vitamin C, β carotene, calcium and potassium and act as a good source for compounds of natural antioxidant such as carotenoids,

flavonoids and phenolics. The benefit of such practice is to maintain good health, suppress bird mortality, support optimum growth and feed utilization and increased profit (Murwani and Murtini, 2009). This study was done to investigate the effect of moringa oleifera leaf extract on growth performance, some biochemical parameters, and the antioxidant status of broiler chickens.

2. Materials and Methods

The field experiment was carried out at a private poultry farm under the supervision of the Animal Production Department, Faculty of Agriculture, Tanta University, during the period from October to December 2021, to study the effect of moringa leaf extract supplementation on broiler performance and some biochemical parameters of broiler chickens.

2.1. Birds and management

Two hundred and forty-one-day-old, unsexed Avian broiler chicks were used in this experiment. Birds were individually weighed to the nearest gram and randomly distributed into four equal experimental groups; with three replicates of 20 chicks each. The average initial body weights of the treatment's groups were nearly similar with no observed significant differences. Chicks were grown in floor pens and subjected to 23 hours of lighting during the experimental period, which extended to 5 weeks of age. The house temperature was kept at about 33°C during the first 3 days, 31°C during next 4 days and thereafter, it gradually decreased by 3°C weekly down to 24°C. Water and feed were available *ad libitum* throughout the experiment. All experimental groups were housed under similar management and hygienic

conditions. The basal diet was a commercial corn-soy-bean meal diet formulated to meet or exceed the nutritional requirements of growing chicks as recommended by the strain manual.

2.2. Experimental Design

Birds were given water as follows; control birds received 0.0 ml moringa leaf extract per 1 liter water (Cont), treatment 1 birds received 90 ml moringa leaf extract per 1 liter water (90 MOLE), treatment 2 received 135 ml moringa leaf extract per 1 liter water (135MOLE) and treatment 3 received 180 ml moringa leaf extract per 1 liter water (180 MOLE).

2.3. Preparation of Moringa Oleifera Leaves Extract

Fresh Moringa oleifera leaves were purchased from the Ministry of Agriculture Farm, Cairo, Egypt. Moringa leaves were air-dried for five days and ground into fine particles using a simple hammer mill. 60 g of the ground particles were then soaked in one liter of water for 24 hours, and this was done daily. The preparation was then filtered using a muslin cloth to separate the debris from the filtrate, and the extracts were placed in clean containers and diluted using clean water (volume/volume) to form 90, 135 and 180 ml/1000 ml water for Treatments 1, 2 and 3, respectively. This procedure was carried out daily and the filtration served the experimental birds in their drinking water according to Alabi et al., 2017.

2.4. Performance traits

Body weight was recorded individually, and body weight gain was calculated weekly to the nearest 0.1g throughout the experimental period from 1 week until 5 weeks of age. Feed consumption (g) was calculated by subtracting the amount of feed left from that supplied. Feed conversion ratio was calculated as the number of grams of feed consumed to produce one gram body weight as follows: feed conversion ratio = feed consumed (g) during a certain period / body weight gain (g) during the same period.

2.5. Biochemical analysis

At the end of the experiment, nine birds from each treatment (3 birds from each replicate) were slaughtered and blood samples were collected from each bird during slaughtering. Blood samples were collected into centrifuge tubes for serum separation. The collected serum was kept frozen at -20 °C until assay for determination of the biochemical parameters. Total protein was determined by using the calorimetric method according to Henry (1974). Albumin was determined by using the albumin calorimetric method according to Doumas et al. (1971). Globulin was calculated by subtracting the albumin value from the total protein value of the same sample (Coles, 1974). Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were determined according to Reitman and Frankel (1957).

2.6. Antioxidants status

Total antioxidants capacity (TAC) was determined using method of Rice-Evanc and Miller (1994). Superoxide dismutase (SOD) was determined using colorimetric method according to (Nishikimi et al., 1972). Malondialdehyde (MDA) was determined using colorimetric method according to (Ohkawa et al., 1979).

2.7. Statistical analysis

Data were statistically analyzed by one-way ANOVA, using the general linear model procedure (SAS, 1996). Tests of significance for differences among treatments were done according to Duncan (1955).

3. Results

3.1. Performance Traits

According to the data shown in Table 1, adding Moringa oleifera leaves extract to bird's water resulted in a statistically significant ($p \leq 0.05$) increase in body weight (BW), body weight gain (BWG) and amount of feed consumption (FC). Also, it significantly improved the feed conversion ratio (FCR). In general, water addition of Moringa oleifera leaves extract improved the growth performance of broiler chickens, treatment 3 (180MOLE) had the best results followed by T2 (135MOLE) then T1 (90MOLE), the differences between T3 and T2 were not significant.

3.2. Liver function

Liver enzymes activity (AST and ALT) was statistically affected by Moringa oleifera leaves extract in water. The highest values of AST and ALT levels were noticed in control birds, the lowest values were observed with treatments 2 and 3 (135 and 180 ml Moringa oleifera leaves extract in 1 liter water), while birds in treatment 1 had value between them (Table 2). Total protein as an indicator of liver activity is shown in Table (2). Concentrations of total protein, albumin and globulin were significantly ($P \leq 0.05$) affected by levels of Moringa oleifera leaves extract in water. Total protein, albumin and globulin concentrations were increased by all Moringa oleifera leaves extract in water. The birds received 135 ml or 180 ml were recorded a high value compared to the control, the differences between them were not significant, while the differences between them and T1 or control were significant.

3.3. Lipid Profile

Triglyceride, cholesterol and low-density lipoprotein (LDL) were statistically lowered by Moringa oleifera leaves extract in water. The highest value of triglyceride, cholesterol and low-density lipoprotein levels were noticed in control birds, the lowest value was observed with treatments 2 and 3 (135 and 180 ml Moringa oleifera leaves extract in 1 liter water), while birds in treatment 1 had value between them (Table 2). Concentrations of high-density lipoprotein (HDL) levels were significantly ($P \leq 0.05$) increased by levels of Moringa oleifera leaves extract in water. The birds received 135 ml or 180 ml and recorded a high value compared to the control, the differences between them were not significant, while the differences between them and T2 or the control were significant.

3.4. Antioxidant status

The activity of total antioxidant capacity (TAC), superoxide dismutase (SOD) and malondialdehyde (MDA) were statistically ($P \leq 0.05$ and $P \leq 0.01$) affected by moringa oleifera leaf extract in water. Chicks received

Table 1. Influence of Moringa oleifera leaves extract supplementation on growth performance of broiler chicks.

Treatments	Parameters				
	Initial body weight, g	Final body weight, g	Body weight gain, g/35 days	Feed consumption, g/35 days	Feed conversion Ratio
Cont.	42.15	1878.32 ^c	1835.37 ^c	3322.02 ^b	1.81 ^a
(T1) 90MOLE	42.27	1990.55 ^b	1947.78 ^b	3311.23 ^b	1.70 ^b
(T2) 135MOLE	41.95	2143.41 ^a	2101.05 ^a	3382.69 ^a	1.61 ^c
(T3) 180MOLE	41.71	2152.00 ^a	2110.29 ^a	3376.46 ^a	1.60 ^c
SEM	±0.32	±22.01	±22.01	±22.01	±0.02
Significance	N. S	*	*	*	*

a,b,c Means within a column with no common superscript differ significantly. N. S= not significant. * = significant at P < 0.05, Cont = 0.0 ml moringa leaf extract per 1 liter water, (T1) 90MOLE = 90 ml moringa leaf extract per 1 liter water, (T2) 135MOLE = 135 ml moringa leaf extract per 1 liter water, (T3) 180MOLE = 180 ml moringa leaf extract per 1 liter water

Table 2. Effect of Moringa oleifera leaves extract supplementation on plasma protein and liver enzymes of broiler chicks

	Parameters				
	Total Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	AST (U/L)	ALT (U/L)
Cont.	4.92 ^c	3.19 ^c	1.73 ^c	39.58 ^a	30.00 ^a
(T1) 90MOLE	5.67 ^b	3.69 ^b	1.98 ^b	34.87 ^b	24.09 ^b
(T2) 135MOLE	6.15 ^a	3.94 ^a	2.21 ^a	30.16 ^c	19.12 ^c
(T3) 180MOLE	6.21 ^a	4.01 ^a	2.22 ^a	29.91 ^c	18.94 ^c
SEM	±0.15	±0.09	±0.11	±1.02	±0.68
Significance	*	*	*	*	*

a,b,c Means within a column with no common superscript differ significantly. * = significant at P < 0.05, Cont = 0.0 ml moringa leaf extract per 1 liter water, (T1) 90MOLE = 90 ml moringa leaf extract per 1 liter water, (T2) 135MOLE = 135 ml moringa leaf extract per 1 liter water, (T3) 180MOLE = 180 ml moringa leaf extract per 1 liter water

Table 3. Effect of Moringa oleifera leaves extract supplementation on plasma protein and liver function enzymes of broiler chicks.

Treatments	Parameters			
	Triglycerides (mg/dl)	Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Cont.	141.33 ^a	66.81 ^a	23.11 ^c	35.32 ^a
(T1) 90MOLE	112.66 ^b	57.76 ^b	28.24 ^b	27.04 ^b
(T2) 135MOLE	87.23 ^c	50.19 ^c	32.17 ^a	17.17 ^c
(T3) 180MOLE	86.91 ^c	49.94 ^c	32.33 ^a	17.08 ^c
SEM	±5.81	±2.44	±1.05	±1.33
Significance	*	*	*	*

a,b,c Means within a column with no common superscript differ significantly. * = significant at P < 0.05, Cont = 0.0 ml moringa leaf extract per 1 liter water, (T1) 90MOLE = 90 ml moringa leaf extract per 1 liter water, (T2) 135MOLE = 135 ml moringa leaf extract per 1 liter water, (T3) 180MOLE = 180 ml moringa leaf extract per 1 liter water, HDL= high-density lipoprotein, LDL= low-density lipoprotein

Table 4. Effect of Moringa oleifera leaves extract supplementation on antioxidant indicators of broilers at 5 weeks of age.

Treatments	Parameters		
	TAC (mm/l)	MDA (m mol/l)	SOD (m mol/l)
Cont.	1.83 ^c	1.96 ^a	17.28 ^c
(T1) 90MOLE	2.09 ^b	1.75 ^b	26.45 ^b
(T2) 135MOLE	2.58 ^a	1.51 ^c	39.62 ^a
(T3) 180MOLE	2.65 ^a	1.52 ^c	40.00 ^a
SEM	±0.06	±0.05	±1.33
Significance	*	*	**

a,b,c Means within a column with no common superscript differ significantly. N. S= not significant. * = significant at P < 0.05, Cont = 0.0 ml moringa leaf extract per 1 liter water, (T1) 90MOLE = 90 ml moringa leaf extract per 1 liter water, (T2) 135MOLE = 135 ml moringa leaf extract per 1 liter water, (T3) 180MOLE = 180 ml moringa leaf extract per 1 liter water

135 and 180 ml moringa oleifera leaves extract in 1 liter water (T2 and T3) had the highest values of total antioxidant capacity and superoxide dismutase, followed by birds in treatment 2 then control ones. (Table 4). Concentrations of malondialdehyde (MDA) was significantly ($P \leq 0.05$) decreased by levels of moringa oleifera leaf extract in water. The birds received 135 ml or 180 ml were recorded low value compared to the control, the differences between them were not significant, while the differences between them and T2 or the control were significant.

4. Discussion

Our data indicate a clear improvement in the productive performance of broiler chickens as a result of adding moringa oleifera leaves extract to drinking water. These results are in harmony with Akhouri et al., (2013), who found that supplementation of moringa oleifera leaves significantly increased body weight and body weight gain and improved feed conversion ratio in broilers. Also, Hussein et al., (2019) observed the same result, they reported that the presence of limiting amino acids as well as other essential amino acids in moringa leaves may contribute to improved growth performance. The results also agree with findings of Okafor et al. (2014) who found that broiler chicks fed a diet containing moringa oleifera leaves had a higher mean final body weight compared with the group fed the control diet. In another study, results of feed conversion ratio indicated that birds on moringa leaves extract groups performed better than the control ones (Alabi et al., 2017). Moreover, Faluyi and Agbede (2018) noted that *Moringa oleifera* leaves extract exhibited significant ($p \leq 0.05$) improvement on final body weight of the experimental broiler chickens. Also, Zanu et al. (2012) observed that the body weight and body weight gain increased with increase in level of moringa oleifera leaves and then significantly declined with an increase in the level. On the other hand, Faluyi and Agbede (2018) reported that feed consumption and feed conversion ratio were not significantly ($p \geq 0.05$) influenced by *Moringa oleifera* leaves extract addition. Also, John and Kenaleone (2014) noted that birds on the moringa oleifera leaves extract treatments had significantly ($p \leq 0.05$) lower body weight than the control birds.

Adding moringa oleifera leaves extract to the drinking water of broiler chickens improved the values of total proteins, albumin, and globulin, as well as the values of liver enzymes. On this line, Hussein et al., (2019) observed that the values of total protein and albumin in serum were increased in all *Moringa oleifera* treatments. The increase in total protein may be due to dehydration and an increase in the globulin levels (Melesse et al., 2013). Also, Zanu et al. (2012) observed that body weight and body weight gain increased with an increase in the level of moringa oleifera leaves and then significantly declined with increasing the level. On the other hand, Faluyi and Agbede (2018) reported that moringa leaves extracts did not have any significant ($p \geq 0.05$) influence on serum indices of protein indices (Total protein, albumin and globulin).

Moringa oleifera leaves extract added to the drinking water of broiler chickens improved the values of

triglycerides and cholesterol in the blood. On the same line, Hussein et al. (2019) showed an increased in the values of HDL for all moringa oleifera treatments, while the values of LDL and total cholesterol were decreased. Also, Alnidawi et al. (2016) found that the total cholesterol and LDL decreased with increasing level of moringa oleifera, while HDL was increased.

Our data showed that moringa oleifera leaf extract added to the drinking water of broiler chickens improved the values of antioxidants in the blood. These results are agreed with Karthivashan, et al. (2015) who revealed that the broilers fed moringa oleifera leaves exhibited enhanced antioxidant status ($P < 0.05$). Also, aqueous moringa oleifera leaves exhibit high antioxidant activity that may be attributed to phytoconstituents, such as polyphenols, tannins, anthocyanin, glycosides, and thiocarbamates that scavenge free radicals, activate antioxidant enzymes, and inhibit oxidases (Liu et al., 2009, Eloff 2008 and Luqman et al., 2012). Moreover, Ojo and Adetoyi (2017) found that the total antioxidant capacity (TAC) value of rabbits increased consistently with increased moringa oleifera leaf extract concentration, while MDA values were not significantly influenced across the treatments.

Conclusions

As can be seen from the data shown above, adding moringa oleifera leaf extract to broiler drinking water at a rate of 135ml/liter has the potential to improve performance traits (body weight, body weight gain, feed consumption and feed conversion ratio), blood proteins (total protein, albumin, globulin) liver functions (AST and ALT), lipid profile (triglycerides, total cholesterol, HDL and LDL) and antioxidant indicators (TAC, SOD and MDA).

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