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Effect of some herbal extracts on growth performance and liver enzymes in broilers

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Abstract

Objective: After the ban in 2006 of the use of antibiotic growth promoters, the search for an alternative led to the utilization of plants like Moringa oleifera Lam. The present study was carried out to determine the effect of Moringa and Echinacea supplementation on drinking water on growth performance and liver function.

Methods: One hundred and fifty one-day-old chicks (Cobb strain) were randomly allotted to three experimental groups G1 (basic diet, control group), G2 (basic diet + watering of Echinacea herbal extract), and G3 (basic diet + watering of Moringa herbal extract). The liver function test was performed through the detection of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels in plasma.

Results: The herbal mixture groups (G2 and G3) significantly ($P<0.05$) improved the growth performance while no significant difference in serum levels of liver function enzymes AST and ALT as compared to the control group.

Conclusion: With these results, we could conclude that replacing antibiotic growth promoters with herbal supplements is safe and improve the growth performance of broilers.

Keywords: Moringa oleifera, Echinacea purpurea, Growth performance, Broiler.

1. Introduction

Antibiotic growth promoters (AGP) have been used as a feed additive in the poultry industry to enhance gut health and control sub-clinical diseases. With increasing public concerns about bacterial resistance to antibiotics, the use of antibiotics in therapeutic or sub-therapeutic doses in poultry feed has been limited or eliminated in many countries. European Union has banned the use of antibiotics as growth promoters since 1st January 2006 (Catala-Gregori et al., 2008). Therefore, livestock producers look for alternatives to AGP in order to maintain animal health, productivity, and carcass quality.

Herbal plants are widely utilized in the treatment of several diseases and as a growth promoter (Elgazar et al., 2018; Elieba et al., 2018). Along the same line, of medicinal plant components mechanism may include improving the physical conditions of the gut ecosystem and enhancing the function of the immune system of chickens (Guo, 2003). Echinacea purpurea, as a herbal plant, contains many useful ingredients including flavonoids, caffeic acid derivatives, essential oils, polyacetylenes, and alkyl amides (Manayi et al., 2015).

Moringa is the sole genus in the flowering plant family Moringaceae. This genus comprises 13 species, all of which are trees that grow in tropical and sub-tropical climates. Every part of the *Moringa oleifera* tree, from the roots to the leaves has beneficial properties. It is a multipurpose tree, various parts of which are used as fodder, herbal medicine, spices, food, natural coagulants, and nectar for bees, fuel, and fertilizer. *Moringa* contains very high antioxidants and anti-inflammatory compounds (Yang, *et al*., 2006).

Little is known regarding the effect of Moringa and Echinacea on the growth performance of broilers. Therefore, the present study aimed to investigate the effect of these two herbal plants on growth performance in broilers.

2. Materials and methods

This study was conducted after under the ethical approval from the Experimental Animals Care Committee in compliance with guidelines of the University of Sadat City.

2.1. Plant preparation and extraction

Both *Moringa oleifera* and *Echinacea purpurea* were brought from medicinal plant farms in Sadat city in a green form which were dried under shade and ground into powder. The powder (500 g) was macerated in 70% ethanol at room temperature for 24 hours then filtered using filter paper (Whitman size no.1) and the filtrate evaporated in a water bath at 60C. The brownish residue (30.5 g) was obtained and kept in an airtight bottle in the refrigerator until used. This volume of the extract was freshly prepared before giving it to birds.

2.2. Experimental design

One hundred and fifty-one-day old chicks (Cobb strain) obtained from El-Arabia Poultry Company were equally divided into 3 groups from the 1st day of the experiment as follows: Group 1 (Control group), chicks fed

only basic diet plus clear water; G2 (basic diet + watering of Echinacea herbal extract), birds received basic ration with watering of Echinacea herbal extract 1ml/l at the morning for 12 hours daily and clear water the rest of the day; and G3 (basic diet + watering of Moringa herbal extract), birds received basic ration plus Moringa herbal extract in water 1ml/l daily at the morning for 12 hours. The treatment was given daily up to the end of the experimental period (45 days).

2.3. Growth performance parameters

Feed intake (FI), body weight (BW), body weight gain (BWG), feed conversion ratio (FCR, g feed/ g gain) were recorded weekly for each group as previously described (Abdel Gawad et al., 2019; Saleh et al., 2014). On the 45th day of the experiment, 10 birds per group were randomly sampled. The birds were weighed to obtain live body weight and then slaughtered for complete bleeding. The birds were reweighted after the removal of blood, skin, head, and shanks. After that, viscera were removed, then reweight to obtain all viscera weight.

2.4. Liver function test

During slaughtering, the blood samples (5 ml) were collected in heparinized tubes and centrifuged at 3000 rpm for 20 minutes. The obtained plasma was used to measure the levels of aspartate aminotransferase *(*AST) and alanine aminotransferase (ALT) using commercial kits (Diamond Diagnostics, Egypt).

2.5. Statistical analysis

Results are expressed as mean ± standard error (SE). Differences between means in different groups were tested for significance using a one-way analysis of variance (ANOVA) followed by Duncan's test (using the statistical analysis system, SPSS) and a *P*-value of 0.05 or less was considered significant.

3. Results and Discussion

3.1. Live body weight

The live body weight was significant ($P < 0.05$) higher in herbal extracts-treated groups (G2 and G3), with higher weight in G3, than the control group (G1) (Table 1). This improved growth performance could be due to the ability of *Moringa oleifera* extract to stimulate secretion of digestive enzymes (lipase and amylase) and intestinal mucous in broilers, which in turn enhance feed digestion, impair adhesion of pathogens, and stabilize microbial balance in the gut (Lee et al. 2003). Shankar et al. (2007) also reported that niaziridin and niazarin, two main ingredients of *M. oleifera*, enhanced the bioactivity of some antibiotics and also facilitated the gastrointestinal absorption of vitamins and other nutrients. Moreover, Yang, *et al.* (2006) reported that supplementation of dehydrated leaves of *M. oleifera* in broiler diet significantly enhanced immune responses, reduced *E. coli*, and increased *Lactobacillus* counts in the ileum. It could improve feed ingredient digestibility due to their higher contents of vitamins, minerals, amino acids, and fatty acids (Moyo et al., 2011; Teixeira et al., 2014; Razis et al., 2014). Hence, Moringa has great potential in improving intestinal health. It may lead to more protein deposition in body tissues and induce an immune response of broilers. On the other hand, Echinacea also improves the performance of birds by stimulating the secretion of digestive enzymes leading to enhancement of nutrient digestion and absorption (Geier and Oster, 2001; Recoquillay, 2006).

3.2. Body weight gain

Both G2 and G3 had significantly ($p < 0.05$) higher BWG, with higher value in G3, than G1 (Table 2). This finding revealed that a growth promoter effect was exerted by the herbal feed additives similar to the antibiotic growth promoter. This result was in line with the finding of Kakengi et al., (2003); Olugbemi and Banjo (2012) who found that the inclusion of *M. oleifera* meal in the diet of the broilers significantly enhanced their weight gain at 1% level which was significantly higher than the control. Several research findings reported that herbal extracts could increase broiler performance by improving live weight gain (Al-Kassie and Jameel, 2009; Badawy et al., 2019; Jamroz *et al.*, 2003).

3.3. Feed conversion ratio and feed intake

The feed conversion ratio (FCR) was significantly ($p < 0.05$) lower in G2 and G3 as compared to G1 (Table 3). This result matched with Abdulla *et al*. (2010) who stated that the broilers fed on diets containing commercial herbal products showed the lowest FCR. In contrast, El-Gendi et al., 1994 and Jamroz and Kamel, 2002 found an improvement in FCR in birds fed on a diet supplemented with herbal products. They contributed this effect to improving the digestibility of dietary protein in the small intestine. No significant difference was noticed in feed intake (FI) between the three groups

3.4. Liver function

There were no significant differences in ALT or AST in herbal extract treated groups compared with the control group (Table 5). Das et al., 2013 observed a reduction of ALT, AST, and ALP and lower liver damage in rats fed with high-fat diet and mixed with *Moringa oleifera* leaves, suggesting a potential role of the leaves in the prevention of nonalcoholic fatty liver disease. Moringa oleifera leaves decrease liver toxicity induced by acetaminophen (paracetamol) through decreasing AST, ALT, ALP, and hepatic lipid peroxidation and increasing hepatic glutathione, superoxide dismutase and catalase (Fakurazi et al. 2012). In contrast to our result Ajibade T. O, et al., (2012) noted a significant increase in the levels of (ALT and AST) following administration of *Moringa oleifera.*

Table 1. Effect of herbal extract (Moringa & Echinacea) supplementation to drinking water on body weight (g).

Groups	G1	G2	G3
At day zero	43.50 ± 0.72^{a}	42.90 ± 0.62^{a}	44.10 ± 0.60^{a}
After 1 week	129.00 ± 4.05^{b}	129.15 ± 5.68^{b}	150.40 ± 5.13^{a}
After 2 weeks	252.40 ± 8.16^{b}	264.45 ± 15.49^{b}	319.55 ± 13.17^{a}
After 3 weeks	404.15 ± 11.21^{c}	431.35 ± 10.13^{bc}	578.00 ± 17.78^{a}
After 4 weeks	617.45 ± 22.82^{cd}	714.75 ± 24.47^{b}	789.25 ± 22.06^{a}
After 5 weeks	954.85 ± 28.50^{b}	952.28 ± 20.84^{b}	1095.60 ± 37.92^{a}
After 6 weeks	1344.40 ± 39.00^{b}	1332.20 ± 30.10^{b}	1693.60 ± 29.30^{a}

Means ± SE. Means (in the same raw) having different superscripts are significantly different at $P < 0.05$.

Table 2. Effect of herbal extract (Moringa & Echinacea) supplementation to drinking water on weight gain (%).

Groups	**G1**	**G2**	**G3**
After 1 week	85.50 ± 3.35^{b}	86.25 ± 5.10^{b}	106.30 ± 4.56^{a}
After 2 weeks	123.40 ± 4.29^{c}	135.30 ± 10.67^{bc}	169.15 ± 8.22^{a}
After 3 weeks	151.75 ± 4.44^{c}	166.90 ± 8.04^{bc}	258.45 ± 6.92^{a}
After 4 weeks	213.30 ± 14.41^{b}	283.40 ± 14.59^{a}	211.25 ± 5.51^{b}
After 5 weeks	337.40 ± 13.33^{a}	238.05 ± 9.89^{c}	306.35 ± 18.52^{ab}
After 6 weeks	389.60 ± 12.74^{c}	379.40 ± 12.15^{c}	598.05 ± 11.49^{a}
Total	1301.10 ± 38.32^{b}	1289.3 ± 29.52^{b}	1649.6 ± 28.72^{a}

Means ± SE. Means (in the same raw) having different superscripts are significantly different at $P < 0.05$.

Table 3. Effect of herbal extract (Moringa & Echinacea) supplementation to drinking water on feed conversion ratio.

Groups	G1	G2	G3
After 1 week	1.30 ± 0.06^{ab}	1.32 ± 0.10^{ab}	1.12 ± 0.06^{b}
After 2 weeks	3.06 ± 0.10^{a}	2.85 ± 0.18^{a}	2.31 ± 0.11^{b}
After 3 weeks	3.67 ± 0.11^{a}	3.35 ± 0.22^{a}	2.40 ± 0.07^{b}
After 4 weeks	3.31 ± 0.18^{a}	2.36 ± 0.16^{b}	3.42 ± 0.10^{a}
After 5 weeks	2.59 ± 0.11^{b}	3.06 ± 0.12^{a}	2.84 ± 0.16^{ab}
After 6 weeks	2.91 ± 0.14^{a}	2.47 ± 0.09^{b}	1.73 ± 0.04^{c}
Mean FCR	2.32 ± 0.05^{a}	1.83 ± 0.02^{b}	1.98 ± 0.03^{c}

Means ± SE. Means (in the same raw) having different superscripts are significantly different at $P < 0.05$.

Table 4. Effect of herbal extract (Moringa & Echinacea) supplementation to drinking water on feed intake (g).

Groups	G1	G2	G3
After 1 week	108 ± 12.32	105 ± 11.05	115 ± 12.80
After 2 weeks	369 ± 34.19	350 ± 29.60	375 ± 41.24
After 3 weeks	547 ± 49.90	527 ± 50.77	611 ± 53.92
After 4 weeks	665 ± 60.03	627 ± 56.03	711 ± 67.38
After 5 weeks	846 ± 81.17	705 ± 71.29	816 ± 71.50
After 6 weeks	1100 ± 93.38	915 ± 83.57	1028 ± 96.00
Total	3635 ± 270.46	3229 ± 260.00	3656 ± 278.10

Table 5. Effect of herbal extract (Moringa & Echinacea) supplementation to drinking water on liver enzymes

Groups	G1	G2	G3
AST (IU/l)	161.67 ± 7.80	168.00 ± 8.98	163.33 ± 7.80
ALT (IU/l)	92.67 ± 2.76	93.33 ± 2.92	95.67 ± 2.21

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