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Original Article

Effect of Adding Aloe Vera Gel and Garlic Powder on Performance and Liver Functions of Broiler Chickens

Rozbeh Fallah

Department of Animal Science, Faculty of Agriculture, Lorestan University, Khorramabad, Iran

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Corresponding Author:
Rozbeh Fallah
fallah.rozbeh@yahoo.com

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ABSTRACT

The present study was designed to evaluate the effects of supplementing different levels of *Aloe Vera* gel and garlic powder on performance and liver functions of broiler chickens. For this purpose, one hundred and sixty, one-day-old, Ross chicks were used, in completely randomized design, in four treatments and each with four replicates. The treatment groups consisted of: control group fed only with non-supplemented basal diet, group 2 supplemented with 3% *Aloe Vera* gel in drinking water, group 3 supplemented with 3%garlic powder in diet and group 4 supplemented with 1.5% *Aloe Vera* gel in drinking water + 1.5% garlic powder in diet, which were reared for 42 days. The results of this study showed that broilers receiving *A. Vera* gel + garlic powder had highest final body weight, feed intake and lowest FCR compared to the control groups ($P > 0.05$). The other results of this study showed that adding *A. Vera* gel and garlic powder decreased in serum activity of SALP, SGPT and SGOT between the birds receiving *A. Vera* and garlic powder with other groups ($P > 0.05$).

Keywords: *Aloe Vera*, broiler, garlic powder, liver, performance.

INTRODUCTION

Antibiotics at curative doses have been widely used in animal feed as growth promoters to enhance animal growth performance and production. In the presence of low levels of antibiotics, resistant cells survive and grow producing an antibiotic resistant population in the final products. Therefore, the application of antibiotics as growth promoters in the animal feed has been banned in the European Union since January 2006. As a result of this ban in EU and growing pressure on livestock producers in other parts of the world, alternative substances and strategies for animal growth promotion and disease prevention are being investigated, among which phytogenic and herbal products have received increased attention since they have acquired more acceptability among consumers as natural additives. Beneficial effects of bioactive plant substances in animal nutrition may include the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune responses and antibacterial, antiviral and antioxidant actions (Toghyani *et al*., 2011).

Aloe Vera (*Aloe barbadensis* Miller), known as one of the oldest herbs with a history that dates back to traditional medicine thousands years ago (Christaki and Florou-Paneri, 2010). Aloe Vera is found in tropical and sub-tropical climates and many countries have proper geographic features required for growing Aloe Vera (Boudreau and Beland, 2006). The most important part of Aloe Vera is its leaf which is composed of two main sections: latex and gel (Boudreau and Beland, 2006). The gel contained in Aloe Vera leaves is composed of about 98.5% to 99.5% water (Femenia *et al*., 1999), and the remaining dry matter contains more than 75 biologically active ingredients (Boudreau and Beland, 2006) which have medicinal effects that are useful in treating diseases. Major ingredients of Aloe Vera include vitamins, enzymes, saccharides and low-molecular-weight compounds (Choi and Chung, 2003) which give Aloe Vera its anti-inflammatory, wound-healing, anti-viral, anti-fungal, anti-tumor, anti-diabetic, and anti-oxidant effects (Christaki and Florou-Paneri, 2010). Numerous studies suggest that many benefits of Aloe Vera are attributable to polysaccharides contained in Aloe Vera gel, which compose a large part of dry matter in this gel (Hamman, 2008). SeVeral studies have been conducted to examine the effects of Aloe Vera powder on growth performance of broilers. Mehala and Moorthy (2008) fed broilers with Aloe Vera powder (0.1% and 0.2%) and Curcuma longa powder (0.1% and 0.2%) and a mixture of these two powders, and reported no significant difference in body weight gain and FCR, except for the first week of treatment. In addition, no difference was observed in terms of feed intake. Findings on the effects of Aloe Vera on growth performance are inconsistent and these discrepancies can be attributed to the form of supplement (leaf powder, gel powder, or fresh gel), dosage, or whether Aloe Vera is added to feed or drinking water (Yang *et al.*, 2009). Garlic (*Allium sativum*) is the most important specie of the onion genus, *Allium* belonging to the family *Alliaceae* (Eric, 2010). It is readily available and widely used around the world as it can be grown year-round (Charlson and McFerren, 2007). It is the second most widely consumed spice in the world and its popularity has been boosted by the growing awareness of its health benefits (FAO, 1992). Garlic is well known for its dietary and medicinal applications (Lawson, 1998). Many studies have indicated that allicin is the most potentially active component of garlic that is reponsible for its characteristic odour, flavour as well as most of its biological properties (Heinrich *et al.*, 2004). Improvement of broilers performance and carcass merits can be achieved by supplementation of diets with GP (Demir *et al.*, 2003). It was reported that feeding GP at levels of 1.5, 3 and 4.5% had no effect on birds performance (Konjufca *et al*., 1997). Additionally, Farhad *et al*., (2011) reported that blends of medicinal plants including; garlic, cinnamon, thyme, rosemary and anise induced a significant decrease in the live body weight and daily weight gain at both 21 and 42 days as compared to control birds. Thus, the aim of this experiment is to study the effect of adding *A. Vera* gel and garlic powder on performance and liver functions of broiler chickens.

MATERIALS AND METHODS

Birds and Diets

In this investigation, 161-day old Ross 308 broiler chickens were reared in 16 pens with 4 treatments and 4 replications in a poultry farm in Amol city for 42 days of age. Treatments in this experiment consist of control (no additives), treatment supplemented with 3% *A. Vera* to drinking water, treatment supplemented with 3% garlic powder in diet, treatment supplemented with 1.5% *A. Vera* to drinking water + 1.5% garlic powder in diet. Garlic powder and *A. Vera* were purchased from local markets and M/s. Barij Essence Pharmaceutical Co. The birds were exposed to 23 h light: 1 h darkness during each 24h period throughout the 42 days of trial. Starter and grower diets were offered from 1 to 21 and 22 to 42 days of age, respectively. Feed and water were provided ad libitum throughout the experiment. The composition and nutrients content of the basal diets is shown in Table 1. The diets were formulated to meet or exceed the National Research Council (NRC, 1994) requirements.

Experimental Procedure and Sampling

Broilers and feed intake were weighed weekly from day 1 to 42 of the experiment. Feed conversion ratio was calculated as feed intake per unit body weight.

Table 1: composition of experimental chicken diets and calculated major components (% as fed)

Ingredient (%)	1-21 days	22-42 days
Corn grain	54.17	63.49
Soybean meal	39.84	30.72
Soybean oil	2.12	1.84
CaCO3	1.18	1.07
Dicalcium phosphate	1.56	1.73
Common salt	0.34	0.33
Vitamin premix 1	0.25	0.25
Vitamin premix 2	0.25	0.25
DL methionine	0.20	0.27
L-Lysine HCL	0.10	0.06
Nutrient composition		
Metabolizable energy (kcal/kg)	2900	3005
Crude protein	22.50	20.70
Crude fiber	4 .10	2.59
Calcium	0.92	0.90
Available phosphorus	0.45	0.40
Lysine	1.38	1.12
Methionine + cystine	0.92	0.95

1Each kilogram of vitamin supplement contains: Vitamin A, 3600000 IU, vitamin D3, 800000 IU, vitamin E, 7200 IU, vitamin K3, 800 mg, vitamin B1, 720 mg, vitamin B2, 2640 mg, vitamin B3, 4000 mg; vitamin B5, 12000 mg, vitamin B6, 1200 mg, vitamin B9, 400 mg, vitamin B12 , 6 mg, biotin, 40 mg, choline chloride, 100000 mg, antioxidant, 40000 mg, 2Each kilogram of mineral supplement contains: Mn, 40000 mg, Zn, 33880 mg, Fe, 20000 mg, Cu, 4000 mg, I, 400 mg, Se, 80 mg, choline chloride,100000 mg.

Table 2: Growth performance characteristics of broiler chickens at 42 days of age

Parameters	Control	Group2	Group 3	Group 4
Final body weight (g)	2206±116.21^{a}	2260±113.20^{a}	2285±115.78^{a}	2342±118.25^{b}
Feed Intake (g)	4282±318.29	4365±302.73	4388±315.53	4486±325.16
Feed Conversion Ratio (FCR)	1.94±0.01	1.93±0.02	1.92±0.02	1.91±0.01

Group 2: addition of *A. Vera* 3% in drinking water; Group 3: addition of garlic powder 3% in diet; Group 4 addition of *A. Vera* 1.5% in drinking water + addition of garlic powder 1.5% in diet; a, b, c: means within the same row with no common superscript differ significantly ($p<0.05$).

Table 3: Effect of adding Aloe Vera gel and garlic powder on liver enzymes in broiler chickens at 28 days of age

Parameters	Control	Group2	Group 3	Group 4
SALP (IU. dl^{-1})	81.83±4.65	75.26±4.18	78.23±4.12	72.53±4.08
SGPT (IU. dl^{-1})	4.16±0.38	3.85±0.34	3.78±0.32	3.73±0.32
SGOT (IU. dl^{-1})	253.35±5.16	248.87±5.32	245.68±5.18	243.26±5.06
ALT (U/L)	19.85±1.56	18.36±1.53	18.43±1.75	18.12±1.68
AST (U/L)	128.64±4.83^{a}	124.89±4.67^{b}	124.58±4.53^{b}	123.17±4.42^{b}

Group 2: addition of *A. Vera* 3% in drinking water; Group 3: addition of garlic powder 3% in diet; Group 4 addition of *A. Vera* 1.5% in drinking water + addition of garlic powder 1.5% in diet; a, b, c: means within the same row with no common superscript differ significantly ($p<0.05$); Serum Alkaline Phosphatase (SALP), Serum Glutamate Pyruvate Transaminase (SGPT) and Serum Glutamate Oxaloacetate Transaminase (SGOT).

On day 28, two birds per pen were selected and Blood samples (4 ml) were collected from birds for determination of serum enzymes, including serum glutamate pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), and serum alkaline phosphatase (SALP). The concentrations of SGPT and SGOT were assessed based on the IFCC method without pyridoxal phosphate as described by Bergmeyer *et al.* (1986). SALP was measured based on the DGKC method (Anonymous, 1972) with slight modifications as adopted by SCE (Anonymous, 1974). The serum enzymes activities such as aspartate amino transferase (AST) and alanine amino transferase (ALT) were determined by using (IFCC, 1986 a, b) methods.

Statistical Analysis

All the data were subjected to ANOVA using the General Linear Models procedure of SAS

software (SAS Institute, 2003). The mean differences among different treatments were separated by Duncan's multiple range tests. Consequently, a level of ($P < 0.05$) was used as the criterion for statistical significance (Duncan, 1955).

RESULTS and DISCUSION

The results of feed additives on broiler growth performance are presented in Table 2. The results of this experiment showed no significant differences ($p>0.05$) in final body weight, feed intake and FCR among control and other treatments. Broilers receiving *A. Vera* gel and garlic powder had higher final body weight and feed intake compared to the control group. The highest final body weight (g) was shown in group feeding with *A. Vera* gel 1.5% in drinking water + garlic powder 1.5% in diet (2342) and the lowest of this was shown in control group (2206).

The lowest FCR was shown in group feeding with *A. Vera* gel 1.5% in drinking water + garlic powder 1.5% in diet (1.91) and the highest of this was shown in control group (1.94). The highest feed take (g) was consumed in groups feeding with *A. Vera* gel 1.5% in drinking water + garlic powder 1.5% in diet (4486) and the lowest feed intake was shown in control group (4282). The results of feed additives on liver enzymes in broiler chickens are presented in Table 3. No significant differences were observed in serum activity of SALP, SGPT and SGOT between the birds receiving *A. Vera* and garlic powder with other groups ($P > 0.05$). The lowest serum activity of SALP was shown in group feeding with *A. Vera* gel 1.5% in drinking water + garlic powder 1.5% in diet (72.53) and the highest amount of this was shown in control group (81.83).

The highest serum activity of SGPT and SGOT were shown in control groups and the lowest amount of this was shown in group feeding with *A. Vera* gel 1.5% in drinking water + garlic powder 1.5% in diet. No significant differences were observed in serum activity of ALT between the birds receiving *A. Vera* gel and garlic powder with other groups ($P > 0.05$) however, there was a significant difference in serum activity of AST between the birds receiving *A. Vera* gel and garlic powder with control groups. The lowest serum activity of ALT and AST were shown in groups feeding with *A. Vera* gel 1.5% in drinking water + garlic powder 1.5% in diet and the highest amount of these were shown in control groups. Olupona *et al*., (2010) supplemented broiler drinking water with Aloe Vera and reported an increase in final body weight, weekly body weight gain, and average feed intake in the groups that received Aloe Vera. In addition, improvement in FCR was observed for broilers treated with Aloe Vera compared to the control group, but the difference was not significant. Sinurat *et al*., (2002) examined Aloe Vera gel and whole leaf added to broiler feed in both dry and fresh forms and found that adding fresh gel (0.25 g/kg) and dry gel (0.25 and 0.1 g/kg) improves FCR. The other researchers have examined potential effects of Aloe Vera on improving growth performance in broilers and found that Aloe Vera powder (0.1%, 0.3%, and 0.5%) added to the Feed of these broilers does not lead to significant difference in terms of body weight gain (Yim *et al.,* 2011). However, particular attention must be paid to anti-bacterial activities and improvement in immune response as these two factors may contribute to better growth performance in broilers (Yang *et al.,* 2009), and previous studies confirm these two properties (anti-bacterial effect and improvement in immune response) for *Aloe Vera*. In fact, anti-bacterial properties of *Aloe Vera* improve intestinal micro flora and reduce pathogens, thereby changing intestinal morphology and improving growth performance. On the other hand, by improving immune response in broilers and increasing body resistance, *Aloe Vera* indirectly affects growth performance. The improvement in weight gain of the birds using garlic in their rations may probably be due to the fact that allicin (an antibiotic substance found in garlic), inhibits growth of intestinal bacteria such as S. aureus and E. coli and inhibit aflatoxins producing fungi (Fadlalla *et al*., 2010). Better feed conversion ratio of the broilers may be attributed to the antibacterial properties of this supplement, which resulted in better absorption of the nutrients present in the gut and finely leading to improvement in feed conversion ratio (Meraj, 1998). These findings were in agreement with the findings of (Yang *et al.,* 2009; Sinurat *et al*., 2002; Yim *et al.,* 2011 ; Olupona *et al*., 2010). The liver is the primary site for fatty acid synthesis in poultry. Activities

of ALT and AST in serum are usually considered as an important index for understanding the liver health. When liver works healthy, the activity of these enzymes in serum will reduce. As showed in Table 3, *A. Vera* and garlic supplementation reduced the serum levels of AST and ALT indicating that the supplement has no toxic effects on the liver. Similar hepatoprotective effects of garlic have been reported in a study where post lead exposure was treated with garlic and vitamin C (Ajayi *et al.*, 2009). Celyk *et al*., (2003) showed that the estimation of serum marker enzymes is a useful quantitative marker of the extent and type of hepatocellular damage in chicken, as well as many other species exposed to toxic substances through feed. The other experiment showed that the activity of blood enzymes including ALT and AST were suppressed by the supplementation of turmeric rhizome powder to heat stressed broiler diets (Hosseini-Vashan *et al.*, 2012). Khosravinia *et al*., (2013) showed that adding savory (*Satureja khuzistanica*) essential oils in drinking water of broiler chickens caused significant increases in serum glutamate pyruvate transaminase (SGPT) activity. Fernandez *et al.*, (1994) induced liver damage by aflatoxin in broilers and an increase in serum ALT activity was observed. Emadi and Kermanshahi (2007) indicated that dietary inclusion of turmeric rhizome powder significantly increased the activity of AST, whereas significantly decreased ALT activity. The results of this experiment were in accordance with the findings of Akbarian *et al*., (2012) who collected data in broiler chickens, showed no significant differences in the activity of ALT enzyme on supplementation of herbs.

CONCLUSION

The findings of this study showed that supplementation of *A. Vera* gel and garlic powder improved final body weight, feed intake and the feed conversion ratio (FCR) in broiler chicks at 42 days of age. The effect of adding *A. Vera* gel and garlic powder reduced liver enzymes in broiler chickens at 28 days of age. The results of this study showed that addition of *A. Vera* gel 1.5% in drinking water + garlic powder 1.5% in diet had best effect on broiler performance at 42 days of age.

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