

Effects of feeding Aloe Vera Leaves Powder on Performance, Carcass and Immune Traits of Broiler Chickens

Seham M. Mohamed*, Wafaa. A. El-Eraky and Mahmoud. F. Al- Gamal
Nutrition and Clinical Nutrition Department, Faculty of Veterinary Medicine, Zagazig University, 44511, Egypt

Abstract

The current study was carried out to study the effect of dietary supplementation with Aloe Vera leaves powder (AVLP) as natural feed additives on growth performance, carcass characteristics and immune response of broiler chickens. Ross unsexed one day old (75 gm) broiler chicks (n=90) were randomly divided into five experimental groups; each group with three replicates (18 chicks/group; 6 chicks/replicate). Diets supplemented with AVLP at rates of 0, 1.5, 2.0 and 2.5 % and the last group supplemented with antibiotic (Oxytetracyclin 1 g/kg diet) for 42 days. Body weights and feed residues were monitored weekly. At the end of the trial, three birds/group were euthanized and then blood samples were collected, moreover carcass dressing and visceral organs were collected and weighed. Results revealed that AVLP had no significant ($P>0.05$) effects on growth performance of broiler chicken. All treated groups showed non-significant ($P>0.05$) effect on internal organ weights and carcass traits. Diets supplemented with 1.5, 2.0 and 2.5 % of AVLP stimulate the immunity by increasing the phagocytic capacity and antibody titre against Newcastle disease virus when compared with the control group. These results indicated that addition of AVLP in broiler chicken's diets has no adverse effects on growth performance beside it improves the humoral and the cellular immunity.

Keywords: Aloe Vera Leaves Powder, Broiler, Performance, Carcass, Immunity.

Introduction

Antibiotic growth promoters are helpful in improvement the growth performance and feed conversion ratio in poultry [1]. However, constant treatment of poultry by antibiotic may result in residues of these substances in poultry products and bacterial resistance against treatments in human body [2]. Many studies were carried out on using feed additives, including herbs as alternatives to antibiotics [3]. Aloe Vera is one of the most important medicinal plants that have many biologically active compounds. Many studies revealed the antibacterial, antiseptic, anti-inflammatory and immune-modulator effect of Aloe Vera [4] so it can be used as a replacement for antibiotic growth promoter.

Supplementation of Aloe Vera to substitute antibiotic growth promoter give a higher body weight gain and feed intake and better feed conversion [5]. Aloe Vera leaves in broiler chick's diet especially at level of 1% and 2% of feed, improved immunity by increase geometric means of HI titres against NDV [6]. Aqueous extract of Aloe gel had improved the dressing weight and intestinal weight, while abdominal fat deposition, breast, thigh weight, gizzard, liver and heart weight of the broilers was not affected [7]. The overall goals of the

present trial were to investigate the effect of dietary supplementation with Aloe Vera leaves powder (AVLP) as an alternative to antibiotics on growth performance, carcass characteristics and immune response of broiler chickens.

Material and Methods

Preparation of Aloe Vera leaves powder [AVLP]

The whole fresh and matured Aloe Vera leaves were collected from local market, washed under tap water, dried in hot air oven at 50°C followed by 105°C until obtained constant weight then ground using manual grinder into fine particles and consequently added to the ration.

Animals, feeding and experimental design

In this study, 90 one day old (75 gm) Ross unsexed broiler chicks were obtained from a commercial hatchery. The birds were weighed and randomly divided into 5 groups with 3 replicates per group (18 chicks/group; 6 chicks/replicate). The birds were housed in separated clean pens and kept under continuous lighting system with suitable temperature till the experimental end. The basal diet was formulated to meet the nutrient requirements

*Corresponding author email: (sehamyousef2011@yahoo.com), Nutrition and Clinical Nutrition Department, Faculty of Veterinary Medicine, Zagazig University, 44511, Egypt.

according to NRC [8] as in starter period (0-2 wks; CP 23.07% and ME 3198 kcal/kg diet); grower period (2-4 wks; CP 20.10% and ME 3201 kcal/kg diet) and finisher period (4-6 wks; CP 18.5% and ME 3204.40 kcal/kg diet). The diets were offered in mash form. Feed and water were provided *ad-libitum*. The

experimental groups supplemented with AVL P at a rate of 0, 1.5, 2.0 and 2.5 % and the last group supplemented with antibiotic (Oxytetracyclin 1 g/kg diet) for 42 days. Experimental feedstuffs and diets were analyzed for nutrients (DM, CP and EE) [9].

Table 1: Composition and chemical analysis of the experimental diets

Ingredients	Starter diet		Grower diet		Finisher diet
Yellow corn (kg)	58.6		65.5		69.6
Soybean meal 48% (kg)	22.5		21.3		18.4
Corn gluten 60% (kg)	13.2		7.8		7.2
Soybean oil (kg)	2		2		1.6
Calcium carbonate (kg)	1		0.9		0.9
Calcium dibasic (kg) Phosphate (kg)	1.8		1.5		1.4
Common salt (kg)	0.3		0.3		0.3
Premix ¹ (kg)	0.25		0.3		0.3
DL- Methionine 98% (kg)	0.1		0.1		0.1
L-Lysine Hcl, 78% (kg)	0.15		0.2		0.1
Anti-mycotoxin (kg)	0.1		0.1		0.1
Calculated composition					
ME (Kcal/Kg)	3198.1		3201		3204.4
CP %	23.07		20.1		18.5
EE %	4.6		4.7		4.4
CF %	2.4		2.4		2.4
Ca %	1		0.9		0.86
Available phosphorus %	0.45		0.39		0.36
Lysine %	1.1		1		0.89
Methionine %	0.58		0.49		0.47
Feed Additive	Moisture%	C.P%	E.E %	C.F %	Ash %
Aloe Vera	94.9	5.1	3.2	69.6	19.4
1.5 %	-	0.07	0.04	1.04	0.29
2 %	-	0.1	0.06	1.39	0.38
2.5 %	-	0.12	0.08	1.74	0.48

¹Muvco premix: Each 2.5 kg contain Vit. A (10,000,000 IU), Vit. D3(2,000,000 IU), Vit. E (10g), Vit. k3 (1000mg), Vit. B1 (1000mg), Vit. B2 (5g), Vit. B6 (1.5g), pantothenic acid (10g), Vit. B12 (10mg), choline chloride (1000mg), niacin (30g), folic acid (1000mg), biotin (30g), Fe (80g), Mn (60g), Cu (4g), I (300mg), Co (100mg), Se (100mg) and Zn (50g).

Growth performance and carcass traits

Individual chicks were weighed weekly to determine the body weight (BW), also amount of feed intake (FI). Body weight gain (BWG) and feed conversion ratio (FCR) were calculated [10]. At the end of the experiment (42 days), 3 birds from each group were selected, fasted overnight, weighed then slaughtered by sharp knife. After complete bleeding, plucking the feather, evisceration and finally weighed the carcass to estimate the dressing percentage in which the head, neck, feet and lower wing were removed. The intestine, liver, gizzard, heart, spleen and

abdominal fat were weighed and expressed as % of live body weight.

Immunological parameters

Assay procedure for humoral immunity

The humoral immunity was measured using the haemagglutination (HA) and haemagglutination inhibition tests (HI) carried out according to Anon [11]. HI test carried out using the micro technique beta procedure (constant virus plus diluted serum) [12].

Assay procedure for cellular immunity (phagocytic assay)

Blood was collected from chickens [3-5 mL blood] into heparinized tubes. The tubes opened in the laminar flow hood and pipette blood from each glass tube into a 15mL falcon tube. An amount of 10 mL PBS was placed into each tube [1:2 Blood to PBS]. Overlaying in 2 mL Ficoll in falcon tube then the diluted blood was added gently on the side of the tube to avoid the distraction of WBCs cells. Centrifugation at 1750 rpm/10 min till have a gradient i.e. cells are in layers. Resultant layers were approximately from top to bottom: Plasma – platelets – PBMC (peripheral blood mononuclear cells)– Ficoll –red blood cells. The supernatant plasma was discarded. Then Careful aspiration of buffy coat with PBMC's and transferring it to new tube were done. Enough PBS was added to the PBMC and Spin at 1500 rpm for 10 minutes. The supernatant was decanted and the cells washed once again with PBS. The solution discarded using diagonal position and RPMI 1640 media with antibiotics to the remained cell suspension. From the mixture of cell suspension and RPMI 1640, 1mL was taken and put in each well. Microbial suspension of candida was prepared by taking 1 colony from candida mixed with 1 mL PBS in sterile test tube, mixed thoroughly and 10 uL from the candida suspension was added to each well, the plate was mixed well using 8 figure position. The cultured plates kept in Co2 incubator for about 30 min, then were examined microscopically [13].

Statistical analysis

All the data analyzed using one way analysis of variance ANOVA using SAS [14]. The significant mean differences were done

with Duncan's multiple range tests. The significance based on $P < 0.05$ level of probability.

Results and Discussion

Growth performance and carcass quality

Growth performance of birds fed the experimental diets was presented in Table (2). The dietary treatments with AVL P had no significant ($P > 0.05$) difference in final body weight, body weight gain and total feed intake when compared with the control group. Group fed diet supplemented with antibiotic (Oxytetracyclin) 1 g/kg diet showed significant ($P < 0.05$) higher FCR than other groups. The growth performance of birds fed diets contained AVL P performance results were alike those of Mehala and Moorthy [15], who reported that there was no difference in body weight, body weight gain and feed consumption between broiler groups fed diets supplemented with Aloe Vera and Curcuma longa and their combinations. In the same line Amaechi and Iheanetu [5], investigated the dietary supplementation of Aloe Vera at rate of 0.5, 1.0 and 1.5% and antibiotic (Enramycin). They reported significant ($P < 0.05$) higher FCR and lower feed efficiency, while no significant changes of body weight gain and feed intake when compared with the control group. The obtained results disagreed with Khan *et al.* [6], who studied the effect of using Aloe Vera leaves in broiler chicks' ration by 1 and 2%. They detected an improvement in weight gain with better feed intake and feed efficiency than those fed diets without Aloe Vera leaves.

Table 2: Effect of dietary supplementation with Aloe Vera leaves powder (AVLP) on the growth performance of broiler chicks

Parameters	Experimental diets				
	Control	1.5% AVLP	2% AVLP	2.5% AVLP	Oxytetracyclin 1gm/kg diet
Initial body weight(g)	75	75	75	75	75
Final body weight (g)	2991.66± 65.84	2751.66±158.91	2991.66±186.28	2741.66±79.49	2935.00± 184.54
Absolute weight gain (g)	2916.66±65.84	2676.66±158.91	2916.66±186.28	2666.66±79.49	2860±184.54
Total feed consumption, g	4409.22±146.98 ^{ab}	3721.52±254.26 ^b	4352.91±281.57 ^{ab}	4038.11±81.66 ^b	4914.72±343.13 _a
Feed conversion ratio	1.51±0.08 ^b	1.38±0.01 ^b	1.49±0.03 ^b	1.51±0.03 ^b	1.71±0.05 ^a

^{ab}Means within the same row carrying different superscripts were significantly different (P<0.05).

The results of carcass yield were presented in Table (3). There was non-significant (P>0.05) differences in the carcass dressing, intestine, liver, gizzard, heart, spleen and abdominal fat percentages among the experimental groups. The obtained results agreed with Mehala and Moorthy findings [15], who evaluated the inclusion of Aloe Vera and Curcuma longa and its combinations and

found no significant difference in carcass yields. However, our results differed with those of Iheanetu [5], who investigated the dietary supplementation of Aloe Vera at rate of 0.5, 1.0 and 1.5% and group of antibiotic Enramycin0 and reported that the antibiotic group showed better dressing weight than the Aloe Vera powder and the control groups.

Table 3: Effect of dietary supplementation with Aloe Vera leaves powder (AVLP) on carcass traits of broiler chicks (Means±SE)

Parameters	Experimental diets				
	Control	1.5% AVLP	2% AVLP	2.5% AVLP	Oxytetracycline 1 gm/kg diet
Dressing, %	80.94±6.69	73.41± 0.49	72.6± 1.22	72.01± 0.88	73.59± 0.74
Intestine, %*	4.89±0.34	5.91± 0.2	5.73± 0.47	5.52± 0.79	5.28± 0.39
Liver, %	2.30±0.20	2.07 ± 0.1	2.39 ± 0.17	2.12 ± 0.08	2.36 ± 0.18
Gizzard, %	2.09±0.16	2.38 ± 0.21	2.15 ± 0.18	2.17 ± 0.34	2.26 ± 0.16
Heart, %	0.49±0.02 ^{ab}	0.55 ± 0.02 ^a	0.43 ± 0.02 ^b	0.53 ± 0.04 ^{ab}	0.48 ± 0.05 ^{ab}
Spleen, %	0.15±0.01	0.12 ± 0.02	0.19 ± 0.01	0.18 ± 0.03	0.13 ± 0.03
Abdominal fat, %	0.35±0.08	0.36 ± 0.12	0.44 ± 0.13	0.36 ± 0.13	0.42 ± 0.16

*Intestine %: the weight from the beginning of duodenum tells the end of rectum that expressed as a percentage of live body weight.

Immunological parameters

Phagocytic capacity of broiler chicks

Data of phagocytic percent of broiler chicken were presented in Table (4). The results revealed that no significant (P>0.05) difference in phagocytic percent among all experimental groups and the control group, while groups fed diet supplemented with 1.5

and 2.5% ALP showed significant (P< 0.05) higher phagocytic index when compared with the experimental groups. This improvement in immunity due to polysaccharide contained in aloe vera called acemannan which can stimulate both humoral and cellular immunity by increase cytokines and antibodies that enhance the performance of natural killers, B- and T-lymphocyte.

Table 4: Effect of dietary supplementation with Aloe Vera leaves powder (AVLP) on phagocytic capacity of broiler chicks (Means \pm SE)

Parameters	Experimental diets				
	Control	1.5% AVLP	2% AVLP	2.5% AVLP	Oxytetracycline 1 gm/kg diet
Phagocytic, %	62.0 \pm 1.15	68.0 \pm 4.05	62.0 \pm 1.15	73.0 \pm 6.02	64.0 \pm 3.05
Phagocytic index	4.36 \pm 0.14 ^b	5.76 \pm 0.3 ^a	4.46 \pm 0.08 ^b	5.43 \pm 0.41 ^a	4.43 \pm 0.18 ^b

^{ab}Means in the same row carrying different superscripts were significantly different (P<0.05).

log antibody of broiler chicks

In current study, there was no significant (P>0.05) difference in log antibody GMT between all experimental groups in 1st, 2nd, 4th and 5th week, while in 3rd week, groups fed diet supplemented with 2.5% ALP showed

significant (P<0.05) higher antibody titre against Newcastle disease virus. But, we recorded no significant (P>0.05) difference in group fed diet supplemented with 2% ALP when compared with the other experimental groups.

Table 5: Effect of dietary supplementation with Aloe Vera leaves powder (AVLP) on log antibody GMT of broiler chicks (means \pm SE).

Antibody titer/week	Experimental diets				
	Control	1.5% AVLP	2% AVLP	2.5% AVLP	Oxytetracycline 1 gm/kg diet
1 st week	18.66 \pm 7.05	18.66 \pm 7.05	21.33 \pm 5.33	18.66 \pm 7.05	18.66 \pm 7.05
2 nd week	8.00 \pm 4.61	5.33 \pm 2.66	16.66 \pm 8.66	17.33 \pm 8.11	9.33 \pm 3.52
3 rd week	1.33 \pm 1.33 ^b	2.66 \pm 1.33 ^b	12.66 \pm 9.68 ^{ab}	34.66 \pm 16.22 ^a	4.66 \pm 1.76 ^b
4 th week	26.66 \pm 5.33	133.33 \pm 69.33	512.66 \pm 295.02	533.33 \pm 277.33	69.33 \pm 32.44
5 th week	25.33 \pm 19.36	53.33 \pm 10.66	133.33 \pm 69.33	202.66 \pm 154.94	174.66 \pm 68.67
6 th week	174 \pm 169 ^b	341.33 \pm 85.33 ^{ab}	768 \pm 256 ^{ab}	1376 \pm 672 ^a	213.33 \pm 42.66 ^b

^{ab}Means in the same row carrying different superscripts were significantly different (P<0.05).

At 6th week, groups fed diet supplemented with 2.5% ALP showed significant (P<0.05) higher antibody titre against Newcastle disease virus when compared with the control and antibiotic groups and showed non significant (P>0.05) with other groups. Enhanced humoral immunity can be attributed to polysaccharide contained in Aloe Vera (acemannan). It can increase cytokines and antibodies production. The obtained results were clearly confirmed by Durrani *et al.* [7], who investigated the effect of aqueous extract of aloe gel and found significantly (P< 0.05) higher serum antibody titer for IBD in group received 15 mL of aqueous extract of aloe gel/liter of water when compared with the others in broilers. In the same line, Khan *et al.* [6] determined the effect of using 1% and 2% of Aloe Vera leaves and showed that geometric means of HI titres of birds fed on diets containing Aloe Vera leaves

were higher than those fed on control in broiler chicks.

Conclusion

In accordance with the obtained results, dietary supplementation of broiler chickens with Aloe Vera leaves powder, hadn't adverse effects on growth performance, carcass quality and simulated both humoral and cellular body immunity. Thus, the use of these natural feed additives at level of 1.5, 2.0 and 2.5% in broiler diets is recommended as an immune-stimulant.

Conflict of interest

The authors have no any conflict of interest.

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الملخص العربي

تأثير تغذية أوراق نبات الصبار المجففة على الأداء في بداري التسمين

سهام محمد محمد ابراهيم* ؛ وفاء عبد الحميد العراقي ؛ محمود فتحي أحمد الجمل
قسم التغذية والتغذية الإكلينيكية- كلية الطب البيطري – جامعة الزقازيق

تم اجراء هذه التجربة لدراسة أثر إضافة مستويات مختلفة من أوراق نبات الصبار المجففة كإضافات طبيعية للأعلاف على أداء النمو، وخصائص الذبيحة والاستجابة المناعية لبداري التسمين. استخدم في هذه الدراسة عدد ٩٠ كتكوت تسمين من فصيلة روس قسمت عشوائيا إلى خمس مجموعات تجريبية مع ثلاث مكررات لكل مجموعة (١٨ طائر/ مجموعة؛ ٦ كتكايت / تكرار) وتم استخدام عليقة تحتوي على أوراق نبات الصبار المجففة بمعدل [٠، ١.٥، ٢.٠، و ٢.٥٪] وأخر مجموعة تحتوي على المضاد الحيوي [أوكسيتيتراسيكلين ١ جم / كيلو عليقة] لمدة ٤٢ يوما . تم رصد أوزان الجسم وبقايا العلف أسبوعيا. في نهاية التجربة تم ذبح ثلاثة طيور من كل مجموعة لتجميع عينات الدم وتقييم مواصفات الذبيحة والأعضاء الداخلية. أظهرت النتائج أن استخدام أوراق نبات الصبار المجففة لم يكن له تأثير معنوي على الاداء في بداري التسمين. أظهرت جميع المجموعات التجريبية تأثيرا غير معنوي على أوزان الأعضاء الداخلية وصفات الذبيحة. استخدام ١.٥، ٢.٠ و ٢.٥٪ من أوراق نبات الصبار المجففة أدى إلى تحفيز المناعة من خلال زيادة السعة البلعمية لخلية الدم المسئولة عن إلتهام الجراثيم المرضية وزيادة في المعيار الكمي للأجسام المناعية ضد لقاح فيروس مرض النيوكاسل بالمقارنة مع المجموعة الضابطة. وتشير هذه النتائج إلى أن إضافة أوراق نبات الصبار المجففة للعلائق الغذائية لبداري التسمين عمل على تحسين المناعة ولم يكن له أي آثار سلبية على أداء النمو.