

EFFECT OF DIETARY GARLIC SUPPLEMENTATION ON PERFORMANCE, CARCASS TRAITS, AND MEAT QUALITY IN BROILER CHICKENS

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SUMMARY

A study was conducted to assess the effect of garlic (G-NUTRA[®]) supplementation in diets of broiler as a replacement antibiotic on productive performance, dressing percentage, weight of heart, gizzard and liver, and meat quality of the broilers. Three hundred and sixty, one-day-old Cobb chicks were randomly allocated to 3 groups and each group consists of 4 replicates, with 30 chicks in each over a period of 6 weeks. The groups were assigned to receive the treatment diet as follows: Group A served as control and was fed ration without any supplementation (basal diet); whereas group B and C were fed diet 2 and diet 3, respectively. Diets 2 and 3 contained supplementary raw garlic powder at 0.5 and 1.0 Kg/ton diet respectively. The birds (in group B) using ration supplemented with 0.5kg/ton garlic gained the highest live weight (g) among the treated groups and the

best-feed conversion ratio although they consumed the same food ($p < 0.05$). There was no significant difference in mortality rate of the broilers due to treatment. There was a significant difference between the average dressing percentages, while this difference was not significant for giblet weight (heart, gizzard, and liver) of the broilers fed rations with or without supplementation of garlic. Meat cholesterol concentration in thigh and breast muscles decreased significantly ($p < 0.05$) with garlic powder supplementation. There was a slight decrease in APC and coliforms for garlic supplemented groups. It is therefore concluded that dietary inclusion of garlic in the rations may be used for economical and efficient production of broilers.

Keywords: garlic, broiler, performance, meat quality.

INTRODUCTION

The fast growing nature of broilers and their short generation interval has been associated over the years with the use of antibiotic growth promoters in animal feeds in order to improve the quality of the product. Although birds raised with these feed additives achieved good performance, their potential side effects became a real public health problem worldwide [8]. In pursuit of improved chicken healthiness and in order to fulfil consumer expectations in relation to food quality, poultry producers more and more commonly apply natural feeding supplements, mainly herbs. The positive effects of herbal supplements on broiler performance [14], carcass quality and quality traits of meat [3 and 14] have been demonstrated.

Garlic (*Allium sativum*) is well known as a spice and herbal medicine for the prevention and treatment of a variety of diseases. The major active ingredients of garlic are allicin, ajoene, S-allyl cysteine. Garlic has been found to demonstrate antimicrobial activity [1], lower serum and liver cholesterol [16] and improve productive performance of broiler chicks [19]. Some studies, however, suggested that commercial garlic oil, garlic powder and commercially available garlic extract may be hypocholesterolemic [3]. In addition to its antimicrobial activities, garlic has been shown to increase feed palatability and thus feed intake [5]. The objective of this study was to investigate the effect of garlic supplementation in diets of broiler on productive performance, carcass traits; meat cholesterol and meat quality.

MATERIALS AND METHODS

Bird and Management

This study was conducted at the Faculty of Veterinary Medicine, Cairo University, Egypt. One-day old 360 broiler (Cobb) chicks were reared in a group for one week (adaptation period). A starter diet (23 % CP and 3029.84 kcal/kg ME) were supplied from 0–21 days while finisher diet (20 % CP and 2949.69 kcal/kg ME) were fed from 22–42 days. Feed and water were provided *ad-libitum*. All the birds were provided the same management conditions (floor space, temperature, relative humidity, ventilation ,light and vaccination programme). Commercial garlic-yeast extract compound (G-NUTRA 2S DAT) as feed additive produced by AMECO-Bios & Co., ARCADIA, CA 91006, USA was used. The product composed of: inactive dry yeast (*Saccharomyces cerevisiae*); silicon dioxide and garlic aroma .

Experimental design

At day eight all the birds were weighed and were randomly supplementation of garlic. Group A served as control and divided into twelve experimental units (replicates) having 30 was fed ration without any supplementation (Diet 1). chicks each. These experimental units were further allotted Whereas group B and C were fed ration supplemented with to three treatment groups, A, B, and C. The birds were fed 0.5 kg/ ton (500 mg/kg) (Diet 2) and 1.0 kg/ton (1000 *ad-libitum* an experimental ration with or without mg/kg) garlic (Diet 3), respectively.

Parameters measured

The data collected were utilized to calculate the initial body (heart, liver, and gizzard). At the end of the experiment (42 weight, final live body weight and weight gain, total feed d) three birds per pen were randomly chosen and were consumption and mortality were recorded at the end of the killed , thigh (*Biceps femoris*), and breast (*Pectoralis major*) experimental period (6 weeks). At the end of experiment, muscle samples were taken, to determine the total five birds from each replicate were picked up randomly and cholesterol content of theses tissues . slaughtered for their dressing percentage and organ weight

Microbiological examination

The thigh and breast muscle samples were prepared at 45.5°C for 48±2 hours. Estimation of total mould and according to technique recommended by yeast count was done by the technique described by [4]. [10]. Determination of aerobic plate count was done Also Determination of anaerobic count by the technique according to [11]. Total Enterobacteriaceae count was described by [12] was adopted using Reinforced Clostridia applied using Violet red bile glucose agar medium Agar medium (RCM) . (OXOID). Count of Fecal Coliforms using EC broth

Statistical analysis

The data thus collected were subjected to the analysis of design. The differences in the means were compared by variance (ANOVA) technique in completely randomized the Duncan's Multiple Range following [18].

RESULTS

Table 1: Performance of broiler chickens fed diets containing supplementary garlic

Parameters	Treatments		
	A (control)	B (500 mg)	C (1000 mg)
Supplementary garlic (mg/kg diet)			
Initial live weight (g/bird)	115.92±3.17 ^a	116.13±3.77 ^a	115.12±3.28 ^a
Final live weight (g/bird)	1960.24±22.6 ^a	2093.51±16.53 ^b	1997.01±27.70 ^c
Total weight gain (g/bird)	1844.32±28.9 ^a	1977.38±22.20 ^b	1882.89±19.80 ^c
Total feed intake (g/bird)	4179.14±148.0 ^a	3912.12±220.0 ^a	4020.33±202.8 ^a
Feed conversion ratio (FCR)	2.3 ± 0.14 ^a	1.9 ± 0.15 ^b	2.1 ± 0.15 ^c
Mortality %	2.50 (3/120) ^a	4.17 (5/120) ^a	3.33 (4/120) ^a

Table 2: Carcass characteristics of broiler chickens fed diets supplemented with garlic

Parameters	Treatments		
	A (control)	B (500)	C (1000)
Supplementary garlic (mg/kg diet)			
Final live weight (g/bird)	1960.24±22.6 ^a	2093.51±16.53 ^b	1997.01±27.70 ^c
Weight after slaughtering (g/bird)	1357.37±18.2 ^a	1588.14±16.3 ^b	1408.69±21.4 ^c
Dressing %	69.24±3.66 ^a	75.86±4.83 ^b	70.54±3.76 ^a
Heart weight	13.06 ± 0.63 ^a	14.19 ± 0.93 ^a	12.88 ± 1.06 ^a
Liver weight	44.24± 1.93 ^a	46.35± 1.95 ^a	44.85± 2.65 ^a
Gizzard weight	32.35± 2.34 ^a	34.87± 1.72 ^a	33.67± 1.95 ^a

Abc = means within rows with different superscripts are significantly differ at $p \leq 0,05$.

Table 3: Influence of dietary garlic on thigh and breast muscle cholesterol

Variables	Treatments		
	A (control)	B (500)	C (1000)
Supplementary garlic(mg/kg diet)			
Thigh muscle cholesterol (mg/100 g wet tissue)	145.3±17.2 ^a	112.1±8.7 ^b	121.4±12.1 ^c
Breast muscle cholesterol (mg/100 g wet tissue)	43.24±3.4 ^a	32.15±3.7 ^b	35.11±7.3 ^c

Table 4: Effect of garlic powder on bacteriological Examination of chicken meat (Thigh and breast)

	mg	Aerobic Plate Count			Coliforms			Fecal Coliforms			Enterobacteriaceae			Anaerobic Count		
		con	500	1000	con	500	1000	con	500	1000	con	500	1000	con	500	1000
Thigh	Mean	4.2 x10 ⁴	4.2 x10 ⁴	6.8 x10 ⁴	1.56 x10 ²	3.1 x10 ²	62.4 5	<3	<3	<3	1.1 x10 ²	1.92 x10 ²	4.98 x10 ²	2.03 x10 ⁴	2.6 x10 ⁴	2.7 x10 ⁴
	SE	7.1 x10 ³	5.9 x10 ³	2.0 x10 ⁴	66.5	60.4 2	14.2 7	<3	<3	<3	23.4	60	1.1 x10 ²	1.8 x10 ⁴	2.4 x10 ³	2.9 x10 ³
Breast	Mean	3.7 x10 ⁴	2.3 x10 ⁴	3.8 x10 ⁴	51.4	7.3 x10 ²	9.72 x10 ²	<3	<3	<3	5.3 x10 ²	2.06 x10 ²	1.4 x10 ²	1.93 x10 ⁴	2.1 x10 ⁴	1.5 x10 ⁴
	SE	6.4 x10 ³	6.3 x10 ³	5.7 x10 ⁴	9.75	1.5 x10 ²	85.3 3	<3	<3	<3	26.1 2	3.28 x10 ²	3.05 x10 ²	9.78 x10 ²	1.6 x10 ³	9.4 x10 ²

Table 5. Effect of garlic-yeast extract compound on meat quality of broiler meat

Samples		Mould count			Yeast count		
		Cont.	0.5kg/ton	1.0 kg/ton	Cont.	0.5kg/ton	1.0 kg/ton
Thigh	Mean	-	1.09 x10 ²	72.73	2.5x10 ²	2.64x10 ²	9.2x10 ²
	±SE	-	24.94	29.05	90.73	74.24	1.72x10 ²
Breast	Mean	2.7x10 ²	5.8x10 ²	10 ²	4x10 ³	2.4x10 ³	2.08x10 ³
	±SE	39.58	2.17x10 ²	29.81	1.2x10 ³	5.29x10 ²	2.73x10 ²

DISCUSSION

Performance

The use of garlic 500mg/kg showed more increase in live weight of the birds as compared to non-supplemented and 1000 mg/kg level in this study, which is also in agreement with the findings of [14], who concluded that powdered garlic at 0.5% level may be incorporated as a growth promoter in the ration of Japanese quails. Addition of garlic improved the weight gain of the broilers in this study. These results are in line with those reported by [2] who reported higher weight gain in broilers fed rations supplemented with garlic. 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 [13]. Resultantly, when the load of these bacteria in the intestine is low, birds may absorb more nutrients, thus leading to the improvement in weight gain of the birds using rations supplemented with *alum sativum*. This study clarified that, the birds fed rations supplemented with garlic utilized their feed more efficiently than those feed ration without addition of garlic. These findings were in agreement with [9]. 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 .

Carcass and organ characteristics

All organ weights and carcass characteristics were not affected by the treatments, except for a slight increase in dressing percentage of birds fed on low level of garlic (500 mg/kg diet) compared with other treated groups. These findings concide with those of [7 and 2], who reported a non-significant effect on broiler dressing percentage values due to the inclusion of garlic in the diet of broilers.

Meat quality

Tissue cholesterol concentration

Results in table-3 showed that, garlic supplementation lowered thigh muscle cholesterol by 23 and 17% and lowered breast muscle cholesterol by 26 and 19%, in group B (500mg/kg) and C(1000 mg/kg), respectively than control non supplemented group. Reduction in cholesterol with garlic has also been reported previously [13;15 and 16]. This reduction may be attributed to that organic tellurium compounds are found in high concentration in garlic buds, which may inhibiting squalene epoxidase, the penultimate enzyme in the synthetic pathway of cholesterol [16]. Cholesterol concentrations were found to be much higher in the thigh than in breast muscle (Tables 3). A possible explanation is that cholesterol is usually associated with adipose tissue, which is more abundant in thigh than in breast muscle.

Bacteriological examination

From the results in tables 4 and 5, it can be concluded that, there are only observable decreases for APC and coliforms counts in breast muscles and also for yeast in both groups B and C (fed 500mg and 1000mg/kg diet, respectively), in breast and thigh muscles. While no valuable changes were noticed for other bacteriological examination (Enterobacteriaceae, and anaerobic counts); so addition of garlic powder in meat products is more useful than its dietary supplementation and this agree with [20] who stated that, exogenous addition of garlic-derived organosulfur compounds significantly delayed both oxymyoglobin and lipid oxidations ($P < 0.05$). and presence of diallyl sulfide (DAS), diallyl disulfide (DAD) in ground beef significantly reduced total aerobes and inhibited the growth of five inoculated pathogenic bacteria, these results suggested the application of these organosulfur compounds in meat or other food systems could enhance color, lipid and microbial safety.

CONCLUSION

Garlic supplementation of broiler chicken diets improved weight gain and it was better at low level of supplementation (500 mg/kg diet) which may be useful for economical and efficient production of broilers

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