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Effect of Garlic (*Allium sativum*) Supplementation in Diets of Broilers on Productive Performance, Meat Cholesterol and Sensory Quality.

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Abstract

The objective of this study was to investigate the effect of garlic (*Allium sativum*) supplementation in diets of broiler as a replacement antibiotic on productive performance and meat acceptability test. Three hundred and twenty, one-day-old chicks were randomly allocated to 4 groups consisting of 4 replications with 20 chicks. The groups were assigned to receive the treatment diet as follows: balanced diet with 0.01% antibiotic (T1), balanced diet supplemented with 0.7% garlic powder (T2), balanced diet supplemented with 1% garlic powder (T3) and balanced diet supplemented with 1.3% garlic powder (T4). The balanced diet was formulated according to the growing period; 0-3 weeks, 3-6 weeks. There were no significant differences ($P>0.05$) in feed intake and weight gain and FCR across treatment was observed in this study. The garlic supplementation treatment tended to have higher weight gain compared to the treatment supplementation with 0.01% antibiotic. A slightly better FCR was also observed in all garlic supplementation treatment compared to the treatment supplementation with 0.01% antibiotic. The mortality rate of the broilers in treatment 1, 2, 3 and 4 was 0, 3.5, 5 and 3.5%; respectively. In term of carcass quality, there were no significant difference ($P>0.05$) in abdominal fat, meat cholesterol among treatment. To evaluate the sensory quality, the 9- point Hedonic Scale was used. The result showed no significant ($P>0.05$) differences in an overall liking of meat among treatment. It was suggested that replacing of garlic powder for antibiotic growth promoter could maintain productive performance of broiler and have no effect on sensory quality.

Keywords: garlic, broiler, productive performance, sensory quality.

Introduction

Garlic (*Allium sativum*)) is well known as a spice and herbal medicine for the prevention and treatment of a variety of diseases (Adibmoradi *et al*. 2006). The major active ingredients of garlic are allicin, ajoene, S-allyl cysteine. Garlic has been found to demonstrate antimicrobial activity

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(Carvallito and Bailey, 1944 cited by Adimoradi *et al*, 2006), lower serum and liver cholesterol (Qureshi *et al*., 1983) and improve productive performance of broiler chicks (Demir *et al*., 2003; Tollaba and Hassan, 2003). Antibiotics are widely used in animal feed as a growth promoter to enhance animal growth performance. There is a growing concern about the negative effect on human health due to antibiotic-resistant human pathogens. Therefore, there is an urgent need to investigate other alternative growth enhancer which gives similar results in improving animal performance as well as prevents or controls infectious diseases. The objective of this study was to investigate the effect of garlic supplementation in diets of broiler as a replacement antibiotic on productive performance, meat cholesterol and sensory quality.

Materials and Methods

Three hundred and twenty, one-day-old chicks were randomly allocated to 4 groups. Each group consisting 4 replications with 20 chicks. The groups were assigned to receive the treatment diet as follows: balanced diet supplemented with 0.01% antibiotic (T1), balanced diet supplemented with 0.7% garlic powder (T2), balanced diet supplemented with 1% garlic powder (T3) and balanced diet supplemented with 1.3% garlic powder (T4). The balanced diet was formulated to contain 23% CP and 3170 Kcal/kg during 0-3 weeks and 20% CP and 3180 Kcal/kg in 3-6 weeks old chicks. Chicks were fed *ad libitum* and water was available all the time. The chicks' weight and feed intake were recorded every week. At the end of the experimental period, 8 birds of each treatment were killed and dissected to evaluate the abdominal fat. The cholesterol content of breast meat and thigh was analyzed according to AOAC (1990) and Zlatkis *et al*. (1952).

Color, odor, flavor and overall liking are the sensory parameters for this study. Breast meat was used for sensory quality test according to the 9-point Hedonic Scale (Peryam and Pilgrim, 1957). The scale is verbally anchored with nine categories, as follows: like extremely, like very much, like moderately, like slightly, neither like or dislike, dislike slightly, dislike moderately, dislike very much, dislike extremely. The statistical analysis of the experimental data was conducted using ANOVA and treatment means were compared using Duncan's Multiple range test (Stell and Torrie, 1980).

Results and Discussion.

Table 1. Productive performance of broiler chicks fed diets containing antibiotic 0.01% and garlic powder 0.7%, 1% and 1.3%.

Productive performance	Dietary treatment				
	0.01% antibiotic (colistin)	% garlic powder in diet			SEM
		0.7 %	1.0%	1.3%	
Feed intake (g per bird)					
0-3 weeks	1,058	1,061	1,057	1,046	30.92
3-6 weeks	2,924	2,948	2,917	2,893	45.72
0-6 weeks	3,981	4,009	3,975	3,939	32.89
Body weight gain (g per bird)					
0-3 weeks	817	801	805	803	22.68
3-6 weeks	1,374	1,454	1,405	1,434	30.70
0-6 weeks	2,190	2,254	2,210	2,237	44.21
FCR					
0-3 weeks	1.29	1.33	1.32	1.31	0.034
3-6 weeks	2.13	2.03	2.08	2.02	0.047
0-6 weeks	1.82	1.78	1.80	1.76	0.027
Mortality rate (%)	-	3.75	5.00	3.75	

The result of productive performance of broiler chicks is shown in Table 1. There were no significant differences (P>0.05) in feed intake and weight gain among treatments observed in this study. There is a tendency of lower body weight gain of chicks receiving diet supplemented with garlic during 0-3 weeks. However during 3-6 weeks as well as 0-6 weeks, the better body weight gain of chick receiving diet supplemented with garlic was obtained. A higher survival rate (100%) was obtained from the chicks receiving diet supplemented with 0.01% antibiotic compared to T2 (96.5%) T3 (95%) T4 (96.75%). It was, however, not significantly different. The comparable effect of garlic supplementation in diet compared to antibiotic supplementation on growth performance of broiler chicks can be explained by its effect on the histological structure of the small intestine in broiler chicks. The taller and narrower villi as well as thinner epithelium thickness in the ileum of antibiotic or garlic treated chicks (Solomon and Tullett,1988; Krinke and Jamroz, 1996; Adibmoradi *et al*., 2006) has been proposed to provided greater surface area for nutrient absorption (Visek, 1978). In addition, the inhibitory effect of garlic on bacterial growth may result in the thinner intestinal epithelium thickness as well as minimize the competition for nutrients in gastrointestinal tract between animal and bacteria (Ferket, 1991).
No significant difference (P>0.05) in abdominal fat, meat cholesterol was obtained between treatments (Table 2). Cholesterol content in breast and thigh muscle ranged from 40.24-46.83 mg/100 g and 52.16-54.29 mg/100 g; respectively. The values of cholesterol in breast meat obtained in this study are similar to those reported by Gardzielewska *et al.* (2003). These authors also reported that garlic did not reduce cholesterol content in breast muscle.

Table 2. Abdominal fat and cholesterol content of meat from chicks fed diets containing antibiotic 0.01% and garlic powder 0.7%, 1% and 1.3%.

Meat quality	Dietary treatment				
	0.01% antibiotic	% garlic powder in diet			SEM
		0.7 %	1.0%	1.3%	
Cholesterol (mg/100 g)					
Breast	42.44	46.83	44.54	40.24	4.81
Thigh	54.29	52.37	52.16	52.97	5.22
Abdominal fat (% of carcass weight)	4.75	4.70	5.42	4.19	2.09

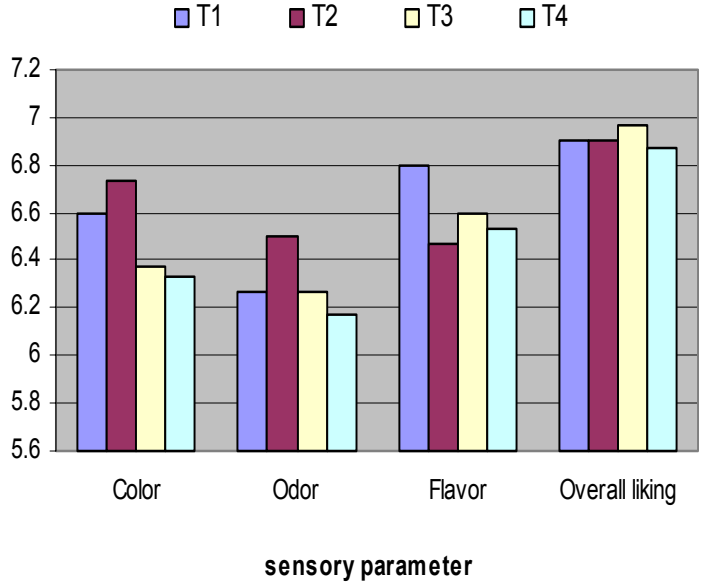

Figure 1. Sensory evaluation of meat from chicks fed diets containing antibiotic 0.01% and garlic powder 0.7%, 1% and 1.3%.

The result of sensory evaluation of meat is shown in Figure 1. The results of the acceptance scale were 6.17-6.90. There was no significance difference (P>0.05) in color, odor, flavor and overall liking of breast meat between treatments. The result of sensory quality from this study is in agreement with the results of the study by Saenkhunthow (2004 (which reported that there were no significant different of panelist score on flavor and consumer's acceptance of meat obtained from chicks receiving diets with garlic or antibiotic.

Conclusion

1. Replacing antibiotic growth promoter with garlic powder could maintain productive performance of broiler as well as abdominal fat and meat cholesterol.
2. Supplementation of garlic up to the level of 1.3% have no effect on sensory quality.

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