



Effect on Supplementation of Garlic on Performance of Broiler

Research Project

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Introduction

In the recent years broiler production was spread on the large scale in many countries to provide the requirements of animal protein for human. The usage of antibiotics as growth promoters in broiler diet has been forbid because the anxiety of their residues in poultry tissues which lead to the inducement of new strains of microorganism resistant of antibiotic(Saleha A.A. et al 2009). Poultry meat and egg production still pain from great losses due to food contamination with harmful bacteria and their influences also on the poultry performance, such as decrease weight and increase of mortality rate (Khoobani M. et al 2019). The use of natural feed additives and growth promoters from different sources in animal feeds is an effective way to enhance nutrient utilization and to reduce the antibiotic residues. Phytogetic supplements are plant derived products used in feeding poultry to maintain performance of livestock species (Dhama K. et al 2015) among a large number of herbs like garlic has been considered as an effective plant having antioxidant and antimicrobial activities along with multiple beneficial uses. (Puvača N. et al 2021 ; Ismail I.E. et al 2021)

Litrecher review

Properties and activities of garlic

Growth performance

Because of its antimicrobial properties, garlic is a highly studied medicinal plant used as a growth promoter in broiler chickens (Lewis M.R. et al 2003). Therefore, the trials assessed garlic as an alternative growth promoter in poultry and revealed its excellent effects on growth, digestibility and carcass characteristics (Bampidis VA, Christodoulou V. et al. 2005). Garlic is usually used as seasonings to intensify the taste and, thus, the palatability of

the feed may be increased, thereby increasing the voluntary consumption of feed. Brzoska F. et al (2015) reported that garlic extract (2.25 mL/kg of feed) stimulated chicken's appetite, resulting in considerably higher feed consumption and thereby higher body weight gains. The garlic can increase the rate of salivary flow and gastric juice secretion in the broiler diet, contributing to improved digestibility and higher body weight (Singh et al. 2020).

Hematology

The supplementation of garlic in poultry has a beneficial effect on the hematological profiles of poultry birds. Hematological analysis reported by (Kung-chi C. et al 2006) found that white blood cell and red blood cell levels, hemoglobin, hematocrit and mean corpuscular hemoglobin values in rats were substantially improved by the consumption of garlic oil. In comparison, it has been stated that garlic in broilers does not affect the number of leukocytes (Singh et al. 2020) .

Product Quality

(Ao X. et al. 2010) observed a stronger fatty acid profile in egg yolks with higher polyunsaturated fatty acid content and lower saturated fatty acid content in dietary garlic (30 g/kg of feed). The administration of dietary onion extract to hens resulted in heavier eggs, higher egg yolk content and higher albumen consistency (Singh et al. 2020)

Antimicrobial properties

Use of garlic and ginger as a medicine and condiment goes back to written history. It is thought that these are originated in traditions of both India and China. Egyptian medical papyrus, Codex Ebers, interpreted in 1937; has more than 800 medical formulations, of which 22 contains garlic (Singh et al. 2020).

Antibacterial affect

Garlic can be used to treat Colibacillosis, Salmonellosis and Cholera in poultry. Garlic exerts a differential inhibition between beneficial intestinal microflora and potentially harmful enterobacteria (Rees L.P. et al.1993). For the same garlic dose inhibition zone

observed in *E. coli* was more than 10 times than that seen in *Lactobacillus casei* (Skyrme DA.1997)

Antiviral effects

Mostly the commercially available antibiotics are not affective against viruses. That is the reason these cannot be used to control the viral diseases of poultry. Very less research is done on antiviral properties of garlic compared to antibacterial. Allicin and allicin-derived substances are active against viruses and no activity has been indicated with alliin or S-allyl cysteine. It has been proved that garlic shows in vitro activity against influenza A and B viruses, rhinovirus, HIV, herpes simplex virus 1 and 2, cytomegalovirus, viral pneumonia and rotavirus (Fenwick G.R. et al.1985)

Anti-protozoal

Affects Use of garlic in poultry feed exhibits antiprotozoal effects in poultry but the exact mechanism of action remains to be explored. Several studies have shown that it is effective against a host of protozoa including *Opalina ranarum*, *Entamoeba histolytica*, *Balantidium entozoon*, *O. dimidicita*, *Trypanosomes*, *Leishmania*, and *Leptomonas* (Reuter, 1996)

Antifungal effects

Alike other antimicrobial properties antifungal activity of garlic has also been proven to be thanksgiving. The first ever report of antifungal activity of garlic in epidermophyte cultures was reported by Schmidt and Marquardt (Schmidt and Marquardt 1936) Studies suggest that garlic can prevent the growth of *Aspergillus*, *Torulopsis*, *Trichophyton*, *Cryptococcus*, *Candida* and *Trichosporon*.

Serum cholesterol

Garlic, being the king of medicinal plants, imposes beneficial effects on body metabolites. Several clinical studies have supported this idea (Adler and Holub, 1997) Allicin may reduce the levels of serum cholesterol, triglyceride and LDL . Diets comprising garlic

powder has ability to lower down serum and egg cholesterol level in hens (Mottaghitalab. and Taraz. 2002)

Immune System

Although garlic kills viruses, bacteria and other microorganisms directly, it also excites the body's natural defenses against these antigens. Garlic's amazing and famous power against diseases is due to a combination of both these properties. Aged garlic extracts have an immunomodulatory effect and lessens the age-related deterioration of the immune response. Garlic supplementation in chickens increase the relative weights of the spleen, bursa of Fabricius and thymus (Hanieh H., et al. 2010)

Carcass Characteristics

One of the new insights in poultry industry is to improve the quality of meat with nutrition modelling. Alteration in the quality of intact muscle is possible by nutrition. Garlic supplementation has an antioxidant effect that is why lowers the thiobarbituric acid-reactive substance value and might protect lipid oxidation (Hanieh H., et al. 2010) . Onibi G. E., et al (2007) reported that LDL particles may have significant amount of cholesterol oxidation products.

Feed Conversion Efficiency

Garlic has been reported to have active compounds capable of substituting the role of synthetic antibiotics used in chicken production (Taufik, and Maruddin,, 2019,) . This indicates that garlic can improve the feed conversion ratio in poultry by increasing the villus height of the small intestine, which in turn activates the absorption process, thereby increasing the growth of birds.(Onu P.N., 2010) found that ginger and garlic supplementation at 0.25% in broiler finisher diets increased the feed conversion ratio of birds and the best result was obtained by feeding a diet containing 3% garlic powder with the best feed conversion efficiency(Elagib H.A., et al.2013)

Effect of garlic powder on the production efficiency of broiler

In research conducted by (Ismail et al.2021) this study was conducted to explore the usage of different levels of garlic powder on broiler's performance like body weight and daily weight gain

Body weight and daily body weight gain

As shown in Table 1. Broiler BW at 21 and 42 days of age and BW gain during 1 to 42 days of age were significantly ($p<0.05$) improved in groups fed diet supplemented with GP Feeding of 0.75 g GP/kg led to heaviest ($p<0.05$) final BW and gain compared to the other diets.

Table 1: Body weight and BW gain of broiler chicks as affected by dietary garlic powder supplementation

Treatment	Live BW (g/bird)		Daily BW gain (g/d/bird)
	21 day	42 day	1-42 day
Control	928.1 ^c	1,986.3 ^d	46.93 ^c
GP (g/kg)			
0.25	945.5 ^c	2,035.2 ^c	47.53 ^c
0.50	1,033.3 ^a	2,175.2 ^b	52.62 ^b
0.75	1,052.7 ^a	2,245.1 ^a	55.42 ^a
SEM	18.75	23.01	4.074

GP, garlic powder; SEM, standard error of the mean. (Ismail et al.2021)

a-c Means within the same column with different common superscripts differ ($p<0.05$).

Some carcass traits

Relative weight of liver was significantly increased ($p < 0.01$) when broilers fed different levels of GP compared to control (Table 2). Conversely, post slaughter weight, heart percentage, and cecum length were not affected by treatments. However, dietary additives recorded the highest values of small intestine length width compared to control . In particular, the higher liver relative weight of 2.93% was observed in broilers fed 0.75 g GP/kg diet, whereas the highest small intestine length of 183.99 mm was detected when fed 0.25 g GP/kg compared to the other groups including control diet.

Table 2: Carcass traits of broiler chicks as affected by dietary garlic powder supplementation

Treatments	Post-slaughter weight (g)	Liver (%)	Heart (%)	Cecum length (cm)	Small intestine measurements		
					Width (mm)	Length (mm)	Weight (g)
Control	1,876.6	1.61 ^c	0.456	14.67	8.67 ^b	154.67 ^c	114.34
GP (g/kg)							
0.25	1,954.1	2.36 ^{ab}	0.597	17.96	10.61 ^a	183.99 ^b	135.01
0.50	1,943.3	2.57 ^{ab}	0.603	19.21	11.21 ^a	150.34 ^c	122.35
0.75	1,871.5	2.93 ^a	0.671	21.63	10.64 ^a	180.67 ^b	115.43
SEM	48.57	0.668	0.086	1.523	4.018	5.493	8.175

GP, garlic powder; PA, phenyl acetic; SEM, standard error of the mean. (**Ismail et al.2021**)

a-c Means within the same column with different common superscripts differ ($p < 0.01$)

Blood parameters

The effect of treatments on some blood parameters is reported in Table 3. The RBC and Hb were significantly ($p<0.01$) increased in chicks fed GP, when compared to control. Further, chicks fed diet containing 0.75 g GP/kg diet had the highest value of Hb (13.46 g/dL) compared with the other groups. However, GP treatments did not elicit a significant alteration in WBCs among groups. Also, that chickens fed diets containing different levels of GP (0.25, 0.50, and 0.75 g/kg had lower ($p<0.01$) LDL than control. Conversely, HDL was increased ($p<0.01$) in all treated groups than control.

Table 3: Some blood parameters of broiler chicks as affected by dietary garlic powder

Treatments	RBC ($\times 10^6/\text{mL}$)	Hb (g/dL)	WBC ($\times 10^3/\text{mL}$)	HDL (mg/dL)	LDL (mg/dL)
Control	2.84 ^{ab}	9.27 ^c	22.27	17.84 ^c	42.41 ^a
Gp(g/kg)					
0.25	2.96 ^{ab}	11.93 ^{ab}	23.89	26.67 ^{bc}	26.71 ^b
0.50	3.28 ^a	12.71 ^{ab}	24.18	28.79 ^{ab}	24.23 ^b
0.75	3.16 ^a	13.46 ^a	26.21	38.24 ^a	21.97 ^b
SEM	1.328	1.881	3.075	5.589	13.954

RBC, red blood cells; Hb, hemoglobin; WBC, white blood cells; HDL, high-density lipoprotein; LDL, low-density lipoprotein ; GP, garlic powder; SEM, standard error of the mean. a-d Means within the same column with different common superscripts differ ($p<0.01$). (**Ismail et al.2021**)

Effect of garlic oil on the production
Performance and carcass characteristics of broiler

In research conducted by (Bamigboye Samson O. et al. 2020) this study was conducted to explore the usage of different levels of garlic oil on broiler's performance and carcass characteristics. As shown in (Table 4) there was significant ($P < 0.05$) difference in the final body weight, weight gain, feed intake and feed to gain ratio across dietary treatment. The result of the study showed that birds fed 0.3% garlic oil had the highest weight gain of 2005.8g, while birds on 0.0% garlic oil had the least weight gain of 1600.2g.

Table 4: Effect of graded oil levels of garlic on the performance of broiler chickens

Parameters	T1	T2	T3	T4	SEM
Initial body weight (g/bird)	45.04	45.00	45.03	45.01	-
Final body weight (g/bird)	1600.2 ^c	1804.5 ^b	1944.8 ^a	2005.8 ^a	8.75
Weight gain (g/bird)	1555.2 ^c	1759.5 ^b	1899.8 ^a	1960.8 ^a	8.06
Total feed intake (g/bird)	3803.1	3801.9	3800.8	3800.2	9.03
Feed conversion ratio	2.45 ^c	2.16 ^b	2.00 ^b	1.94 ^a	0.02

^{a,b,c} means with same superscript are significantly different ($p < 0.05$), T1: Control (without Garlic oil), T2: 0.1% Garlic oil, T3: 0.2% Garlic oil, T4: 0.3% Garlic oil, SEM = standard error of mean (**Bamigboye Samson O. et al. 2020**)

Effect of Garlic oil on carcass characteristics of Broiler Chickens.

The results on (Table 5) reveal the Carcass characteristics of broilers. There were significant ($P<0.05$) differences in the carcass weight, dressed percentages, percentages of wings, back, breast, thigh and heart but for liver the significant difference just in T3.

Table:5 Effect of Garlic oil on carcass characteristics of broiler chickens.

Parameters %	T1	T2	T3	T4	SEM
carcass weight (g)	1284.3 ^c	1440.2 ^b	1549.0 ^b	2101.8 ^a	12.31
Dressed percentages	75.40 ^c	76.00 ^c	78.63 ^b	81.4 ^a	19.35
Thigh	9.55 ^c	10.22 ^b	10.34 ^b	11.22 ^a	0.17
Breast cut	17.22 ^c	19.22 ^b	22.08 ^a	23.17 ^a	1.22
Back cut	19.22 ^b	18.45 ^b	19.21 ^b	22.17 ^a	02.04
Wing	11.22 ^a	10.88 ^a	8.77 ^b	9.92 ^b	0.05
Heart	0.94 ^b	0.91 ^b	0.87 ^c	1.16 ^a	0.02
Liver	2.39 ^a	2.41 ^a	1.88 ^b	2.08 ^a	0.01

^{a,b,c} means with same superscript are significantly different ($p<0.05$), T1: Control (without Garlic oil), T2: 0.1% Garlic oil, T3:0.2% Garlic oil, T4: 0.3% Garlic oil, SEM = standard error of mean (**Bamigboye Samson O. et al. 2020**)

Conclusion

Garlic is king of medicinal plants and it has wondrous effects in poultry. The garlic supplementation of poultry feed has shown better performance of birds, ultimately enhancing the production potential. Additionally, garlic reduces the number of pathogenic bacteria like Campylobacter, E. coli and Salmonella, clostridium, etc. It has beneficial effects on consumer's immunity. So, it can be effectively used to replace the antibiotic growth promoter in poultry feed. Although, there is huge pile of research literature in this area, but still there is a need to establish standards of garlic use in poultry feed. To fulfil this purpose more research is needed in this economics friendly supplement.

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