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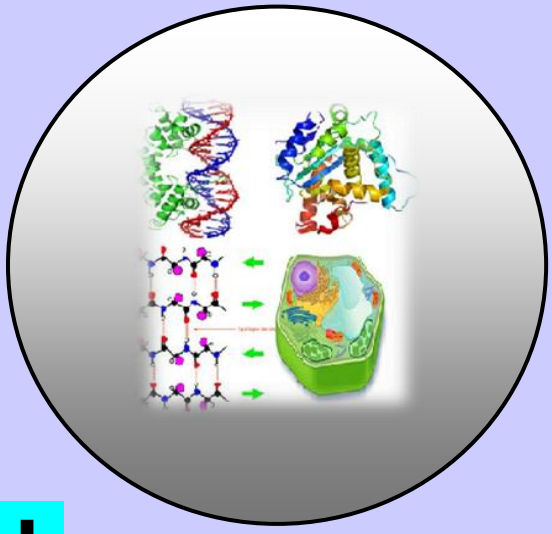

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RESEARCH PAPER

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The Effect of Garlic (*Allium sativum*) Extract on Performance, Abdominal Fat and Serum Cholesterol of Broiler

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ABSTRACT

The present study was conducted to determine the effects of garlic extract on performance, abdominal fat, and serum cholesterol of broiler up to six weeks of age. One hundried and eighty 2-wk-old broiler were colony caged in an environmentally controlled house to evaluate the effect of garlic (Allium Sativum) extract administration on performance, abdominal fat, and serum cholesterol. Garlic extract was prepared by blending pealed garlic cloves with distilled water (1:1, w/w). Birds were randomly divided into three equal groups; one served as a control and the other two groups were offered 2.5% and 5% Garlic extract of drinking water. Garlic extract increased (p<0.05) body weight ganis and feed efficiencies with no change (P>0,05) in feed consumption. Garlic extract administration recorded lower (p<0.05) abdominal fat and serum cholesterol contents. In conclution, 2.5%-5.0% garlic extract on drinking water improved performance and may decrease both abdominal fat and serum cholesterol of broiler up to six weeks of age.
Ker words: Garlic, Performance, Abdominal Fat and Cholesterol.

INTRODUCTION

Garlic (*Allium sativum*) gained the trust of many scientists and cultural remedies all over the world for the prevention and treatment of many diseases and is broadly dispersed and consumed as a spice and herbal medicine for thousands of years. Recent studies have validated many of the medicinal properties attributed to garlic and its potential to lower the

risk of diseases (Mahmoud *et al*., 2010; Bidura, 2007), has been used for medicinal purposes-shown to have antibiotic, antiviral and antifungal qualities (Silvam, 2001).

Garlic exhibits a broad antibiotic spectrum against gram-positive and gramnegative bacteria. Other therapeutic effects of garlic include lowering of cholesterol levels, blood pressure, cancer prevention, and immune system. Previous research suggested that these functions were mainly attributed to the bioactive components of garlic, including sulphur-containing compounds, such as *alliin, diallylsulphides* and *allicin* (Amagase *et al.,* 2001). Therefore, the different garlic preparations used in various studies might be one of the reasons for the inconsistent results (Ao *et al.,* 2010). The main antimicrobial constituent of garlic has been identified to be allicin, which is formed when the garlic clove is crushed (Ankri and Mirelman, 1999).

The composition of garlic include sulphur containing *allicin, diallyl disulphide* and *diallyll trisulphide*,Which are responsible for most of garlic's pharmacological properties, while the non-sulphur composition of garlic include *allixin, flavonoids, saponins*, and *fructans* (Silvam, 2001). *Allicin* is mainly responsible for the pungent odour of garlic and is produced from an inert chemical in raw garlic called *alliina* derivative of cysteine by the action of an enzyme, allinase in the presence of pyridoxal phosphate (Silvam, 2001).

Garlic produces the *allicin* to protect itself from bacteria and other diseases and antioxidant (Lee *et al.,* 2003). Garlic also contains minerals and vitamins, which are an important parts of its health benefits. Studies on garlic as an alternative of growth promoter in livestock production were conducted and its beneficial effects on growth, digestibility, and carcass traits have been reported (Nusairat, B. M. 2007; Bampids *et al*., 2005; Tatara *et al*., 2008; Amooz and Dastar, 2009).

The present study was conducted to evaluate effect of garlic extract on performance, abdominal fat, and serum cholesterol of broiler up to six weeks of age

MATERIALS AND METHODS

Animals, treatments, and experimental design: A total of one hundried and eighty 2-wk-old broiler, were obtained from a local commercial broiler farm with an average body weight of (482.62 $\pm$ 8.06 gram). The all chicks were fed of comercial feed broiler containing ME, 3,200 kcal/kg; CP, 22%; Ca, 2.0%; available phosphorus, 0.65% from 15-42 days of age. Feed and water were provided *ad libitum*. At 15 days of age, all chicks were weighed and selected on weight basis and then one hundred and eighty broiler were assigned into three treatment groups in a completely randomized design. Each group had 6 replications of 10 chicks kept in separate bamboo pens with 150 x 100 cm dimension. Groups were offered with three levels of garlic extract as a percent of drinking water; 0% as a control group and 2.5% and and 5.0% as treatment groups. The treatment groups were as follows: (1) drinking water of broiler without Garlic extract as the control; (2) drinking water of broiler with 2.5% Garlic extract; and (3) drinking water of broiler with 2.5% Garlic extract, respectively. Broiler chickens were weighed individually on a weekly basis and both feed consumption was recorded daily.

Preparation of Garlic (*Allium sativum*): Fresh garlic cloves (*Allium sativum*) were obtained from the Lokal Market for use in the study. Garlic extract was prepared by blending pealed garlic cloves with distilled water (1:1, w/w) and kept overnight (Obochi *et al*., 2009).

Garlic extract was then filtered using a cheese cloth to further mixed into the drinking water were given a dosed of 2.5 cc/100 cc drinking water (treatment B) and 5 cc/100 cc drinking water (treatment C), repectively.

Sampling and laboratorium analysis: At the end of experiment (42 days of age), 18 broiler chickens in each treatment groups were selected and slaughtered. In order to avoid variations in the cutting procedures, the same operator was employed (Zhang *et al*., 2013). The parts of the body fat are: pad-fat (separated from the organs of the abdominal viscera to the skin), mecenteric-fat (linkage separated from the intestine), vernticulus-fat, and abdominal-fat (a combination of fat-pad, ventriculus-fat, and mecenteric-fat). The blood samples were allowed to clot in a sample bottle and serum harvested was used to determine the total serum cholesterol content with the aid of a commercial kit.

Statistical analysis: All data were subjected to analysis of variance and if it was significantly different it was further tested by Duncan's Multiple Range Test.

RESULTS

Results of the current study are presented in Table 1. It can be noted that addition of Garlic extract on drinking water of various level of the Garlic extract ranging from 2.5% to 5.0% resulted in a significant ($P<0.05$) increase in final body weight and body weight gains. Moreover, the supplementation of 2.5% to 5.0% of Garlic extract on drinking water significantly ($P<0.05$) increased in feed efficiency. However, no significant different ($P>0.05$) in feed consumption was noted among the treatments (Table 1).

Table 1. The influence of Garlic extract on drinking water administrations on performance, abdominal fat, and serum cholesterol of broilers (2-6 weeks of age).

Variables	Treatments[1)]			SEM[2)]
	Group A	Group B	Group C	
Feed Consumption (g/head/4 weeks)	3022.81a[1)]	3123.58b	3113.80	40.802
Live weight gains (g/head/4 weeks)	1574.38a	1784.90b	1810.35b	38.097
FCR (feed consumption: weight gain)	1.92a	1.75b	1.72b	0.037
Abdominal fat (g/100 g body weight)	2.15a	1.82b	1.85b	0.069
Serum cholesterol (mg/dl)	175.37a	142.64b	144.85b	8.082

Notes:

1. A: drinking water without Garlic extract as control; (B): drinking water with 2.5 cc/100 cc Garlic extract; and (C): drinking water with 5 cc/100 cc Garlic extract, respectively.
2. SEM :"Standard Error of Treatment Means"
3. Means with different superscripts within raws are significantly different ($P<0.05$)

The average value of FCR (feed consumption: weight gain) during the four weeks of observation birds were given the control treatment was 1.92/head (Table 1), and did not show any significant differences (P>0.05) with duck treatment B. the average of the value of FCR in ducks treatment B and C, respectively 8.85% and 10.42% (P<0.05) lower than the control.

Furthermore, the present results also found that addition of the Garlic extract at levels 2.5%-5.0% has resulted in a significant (P<0.05) decrease in levels of cholesterol in the serum of birds. In regard to the percentage of abdominal fat, it was recorded that the lowest value was for broiler subjected to treatment C, 5.0% Garlic extract supplementation.

DISCUSSION

In the present study, the effects of oral administration of garlic extract on broiler performance and serum cholesterols levels in broiler were investigated. Although the garlic administered groups had numerically higher broiler performance values. Chowdhury *et al*. (2002) researched the effect of mixing layer diets with 2-10% sun-dried garlic paste. Neither of these studies detailed significant alterations in performance of layers.

In more recent studies, Yalcin *et al.* (2006) showed that supplementing garlic powder at level of 5 or 10 g/kg showed numerical increase in performance or layers production. Also, Khan *et al.* (2007) reported that laying hens fed on dried garlic (2-8%) showed higher egg-production intensity. The diversity of garlic preparation and administration methods makes it harder to contrast our results with those in literature. Garlic powder had no significant effects on broilers weight gain, feed intake (FI), feed conversion (Issa and Omar, 2012). This result is in disagreement with previous research where supplementation of 1% garlic powder caused higher thigh yield while the poorest thigh yield belonged to 3% garlic powder group. Groups received 1% garlic powder significantly had higher breast yield than others (Raeesi *et al*., 2010). In broilers, it was reported that garlic, as a natural feed additive, improved broiler growth and feed conversion ratio (FCR), and decreased mortality rate (Tollbav and Hassan, 2003).

Improvement of broilers performance and carcass weight can be achieved by supplementation of diets with garlic powder (Demi *et al*., 2003; Lewis *et al*., 2003; Sivam, 2001). Increased weight gain was due to the chicken Garlic can increase protein digestibility and dry matter ration as reported by Issa and Omar (2012) that dry matter (DM), crude protein (CP) and ether extract (EE) digestibility were improved by feeding Garlic powder. Hernandes *et al*. (2004) who showed that plant extract supplementation improved apparent whole tract digestibility of the nutrients. Adibmoradi *et al*. (2006) reported that garlic administration enhanced villus height and crypt depth and decreased epithelial thickness and goblet cell numbers in duodenum, jejunum and ileum of birds; similar results were reported by Nusairate (2007). Ramakrishna *et al.* (2003) reported that garlic supplementation probably enhanced the activities of the pancreatic enzymes and provided micro-environment for better nutrient utilization in rats.

Feeding garlic powder at levels of 1.5%, 3%, and 4.5% had no effect on birds performance (Konjufca *et al*.,1997). The absence of garlic on feed intake and then general performance was probably due to the intense smell of garlic, which required a period of adaptation of chickens to this kind of feed (Horton *et al*., 1991).

The isoprene derivatives, flavonoids, glucosinolates and other plant metabolites may affect the physiological and chemical function of the digestive tract. The stabilizing effect on intestinal microflora may be associated with intermediate nutrient metabolism (Jamroz *et al*., 2003).

The Garlic extract at levels 2.5%-5.0% on drinking water has resulted in a significant decrease in levels both of cholesterol in the breast meat and abdominal fat of birds. The levels of garlic juice were insufficient to influence egg yolk cholesterol and *E. coli* bacteria in eggs (Mahmoud *et al*., 2010). Garlic powder supplementation reduced significantly the plasma cholesterol concentration when laying hens were fed 0.5 and 1.0% garlic powder (Sakine and Onbasilar, 2006). The decrease of plasma cholesterol concentration by garlic powder supplementation might be due to the reduction of synthetic enzymes. Significant decreases in hepatic 3-hydroxy-3-methylglutaryl-CoA reductase, cholesterol 7α-hydroxylase, fatty acid synthetase, and in representative pentosephosphate pathway activities accompanied the feeding of petroleum ether-, methanol- and water-soluble fractions of garlic (Qureshi *et al*., 1983). Eidi *et al*. (2006) reported that garlic extract significantly decreased total cholesterol, triglycerides in diabetic rats.

Ao *et al*. (2010) reported that plasma total cholesterol decreased with increasing levels of dietary garlic powder. Chowdhury *et al*. (2002) reported that plasma cholesterol concentration was decreased on average by 15%, 28%, 33%, and 43% with increasing levels of dietary garlic paste of 2%, 4%, 6%, or 8%, respectively. Prasad *et al*. (2009) reported similar findings were total cholesterol and triglycerides, were significantly decreased by garlic supplementation in chicken up to 8 weeks of age in comparison to control group. Khan *et al*. (2007), reported that dried garlic powder in the diets of commercial laying hens reduced serum and yolk cholesterol concentrations and skewed the layer performance upwards significantly.

Issa and Omar (2012) reported that Garlic powder significantly decreased the levels of trigliserida. Both levels of garlic powder decreased trigliserida levels compared to trigliserida levels in birds of the control group. This effect can be explained by the possible inhibition of the Acetyl CoA synthetase enzyme that is necessary for the biosynthesis of fatty acids (Qureshi *et al*., 1983). This may probably be due to the possible mechanism of hypocholesterolaemic and hypolipidemic action of garlic products which depresses the hepatic activities of lipogenic and cholesterogenic enzymes such as malic enzyme, fatty acid synthase, glucose-6-phosphatase dehydrogenase (Cavallito *et al*.,1994) and 3-hydroxyl-3-methyl-glutaryl-CoA (HMG-CoA) reductase (Qureshi *et al*., 1983). These results are consistent with the beneficial effects of garlic on cholesterol metabolism in human health. Birrenkott *et al*. (2000) showed that diet supplementation with 3% of powdered garlic was not effective in lowering yolk cholesterol (mg/g) or other lipid components of the serum of laying hens, even when fed for up to 8 months and on broiler chickens (Amooz and Dastar, 2009). More recently, Yalcin *et al*. (2006) reported that total yolk cholesterol was not affected by garlic supplementation. Similar findings were reported in rats where garlic powder failed to influence the lipid profiles in rats (Islam and Choi, 2008). Raeesi *et al*. (2010) reported garlic at levels of 1% and 3% had no significant effects on relative weights of carcass, fat pad, or digestive organs among different treatments except for the small intestine. It has been suggested that different commercial garlic products may explain the contradictory results in the literatures (Chowdhury *et al*., 2002).

CONCLUSION

In conclution, 2.5%-5.0% garlic extract on drinking water improved performance and may decrease both abdominal fat and serum cholesterol of broiler up to six weeks of age.

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