GARLIC (*ALLIUM SATIVUM*) MODULATED SERUM CHOLESTEROL LEVEL, IMPROVED IMMUNE STATUS AND CARCASS YIELD OF BROILERS

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ABSTRACT: In present study we examined the potentials of feeding dried garlic powder to broiler chicks. One hundred and sixty, one-day old broiler chicks were randomly allocated to four replicated treatments; GE-3, GE-2 and GE-1 that received garlic @ 3, 2 and 1 g/ kg of feed, respectively, whereas GE-0 served as control. Birds were reared in floor pens (10 birds/ pen) in an open sided in optimum environmental and mangemental conditions for 42 days. Feed and water were provided ad lib and birds were vaccinated against Newcastle (ND), Infectious Bronchitis (IB) and Infectious Bursal (IBD) diseases. On day-42, three birds from each pen were randomly selected for blood collection to determine serum lipid profile using Blood Biochemical Analyzer, antibody titre using HI and ELISA kits and were killed to find out carcass yield in terms of dressing percentage. Garlic powder did not affect feed intake. However, feed efficiency, body weight gain and dressed weight were significantly improved by birds in groups GE-3 and GE-2. GE-3 had higher antibody titre against ND (4.25±0.28), IB (5.50±0.64) and IBD (5453±0.45) compared to other groups. There was a significant reduction in serum cholesterol (120.50±7.23), low-density lipoprotein (83±1.85) and triglycerides (70±1.35) and increase in high-density lipoprotein (29.12±1.73) in GE-2 compared to other groups. The difference between GE-2 and GE-3 was, however, non-significant for total cholesterol and HDL. These findings demonstrated that garlic powder can potentially be used in broiler diets to improve the immune status, growth performance and to optimize lipid profile.

Key words: Garlic powder, Immunity, Growth performance, Lipid profile, Broilers.

INTRODUCTION

Recently there has been great interest in the use of medicinal plants (phytobiotics) in poultry production due to their diverse medical uses. Phytobiotics have been reported to improve broiler growth rate, feed conversion efficiency and body weight gain (Lewis *et al.,* 2003). Several pharmacological properties including antimicrobial anti-carcinogenic, preventing cardiovascular disease and anti-parasitic activity have been reported (Singh and Singh, 2008). *Allium sativum* (garlic) belongs to lily family contains sulphur-containing compounds: allicin, diallyl disulfide, diallyl trisulfide and others. These compounds are mainly responsible for most of the pharmacological properties of garlic. Other constituents of garlic include: alliin (s-allyl-cysteine sulfoxide), S- methyl-L- cysteine sulfoxide, high concentrations of trace minerals (particularly selenium), vitamins, glucosinolates, and enzymes (alliinase, peroxidase, and myrosinase) (Amagase *et al*., 2001). Garlic possesses strong anthelmintic, antifungal, antibacterial, antiviral effect, anti inflammatory and cardiovascular protective, antioxidant and hepato protective effects (Londhe *et al.,* 2011). Present research was planned to evaluate the efficacy of dried garlic powder on the modulation of serum cholesterol level, improvement of growth performance, carcass yield and immune status of broiler birds.

MATERIALS AND METHODS

One hundred and sixty, one-day old broiler chicks (Cobb-500) were randomly assigned to replicated (n=4; 10 birds/replicate) four dietary treatments in floor pens in an open sided house. Dietary treatments were; GE-3, GE-2 and GE-1 that received dried garlic powder @ 3, 2, and 1 g per kg of feed, respectively while GE-0 served as control. At the end of experiment, cumulative feed intake, feed efficiency and body weight gain was determined. Three birds from each pen were randomly selected and were killed to measure dressed body weight. At the end of study blood was hygienically collected from birds in each pen and serum was extracted for determination of antibody titre against Newcastle (ND), Infectious bronchitis (IB) and Infectious Bursal (IBD) diseases using HI (Synder *et al.,*1984) and ELISA (Marquardt *et al.,* 1980). Serum lipid profile was determined through enzymatic colorimetric method using

Biochemical Analyzer, (Micro Lab 200 Merck). High-Density Lipoprotein (HDL-C) and Low- Density Lipoprotein (LDL-C) cholesterol fractions were determined according to Lopez-Virella *et al*. (1977). LDL=TC-[HDL+ (TG/5)]. Data was statistically analysed using general linear model (GLM) of SAS (1999) and means were compared using LSD test.

Experimental Layout

Dietary treatments	Garlic powder (g/Kg feed)	Replicates and birds per replicate			
		R1	R2	R3	R4
GE-0	0	10	10	10	10
GE-3	3	10	10	10	10
GE-2	2	10	10	10	10
GE-1	1	10	10	10	10

RESULTS AND DISCUSSION

Garlic powder did not alter feed intake significantly but significantly improved body weight gain in group GE-3 (1296 g) and GE-2 (1302 g) and FCR by 12.5 and 11.9%, respectively in these two groups as compared to control. Carcass yield expressed in term of dressing percentage was similarly greater in group GE-2 and GE-3. Chowdhury *et al*. (2002) observed similar finding that garlic powder had no effect on feed intake in layers supporting the findings of present study. However, Ademola (2004) reported that garlic and ginger extract had significant ($P < 0.05$) effect on broilers feed intake that could probably be due to the impact of ginger extract in addition to garlic. The active constituents of garlic powder might have positive influence to enhance efficiency of feed utilization, improve balanced gut microbiota which had improved general body health and weight gain of broilers (Lovkova *et al*., 2001). Cross *et al*. (2007) reported similar findings of improved body weight gain in birds fed garlic. This positive effect could be due to the better digestibility of feed by birds in these two groups. It has been previously reported by Demir *et al*. (2003) that active constituents of medicinal plants can positively balance microflora thus improve nutrient digestibility and absorption by the birds as has been observed in present study. Hernandez *et al*. (2004) observed that broilers fed a diet treated with plant extract had improved apparent whole tract digestibility of the nutrients that ultimately improved feed conversion ratio. Medicinal plants contain certain essential oil that can potentially improve growth performance by increasing efficiency of feed utilization (Demir *et al*., 2003). Similar findings of higher dressed weight in broiler fed garlic and other medicinal herbs have been previously reported (Cross *et al*., 2007). It was interesting that birds fed different level of garlic powder had significantly greater antibody titer against ND, IB and IBD compared to control group (Table 2). Antibody titer against ND, IB and IBD were significantly higher in GE-3 followed by GE-2 and GE-1. It has been reported that animals injected with garlic powder had a significant increase of delayed type hypersensitivity response (Ghazanfari *et al*., 2002). Hamza *et al*. (2010) worked on modulatory effect of dietary garlic on immune response in leghorn chicks and investigated that dietary garlic has a potential to enhance the immune functions in White Leghorn chickens due to thymus activities enhanced by garlic. A significantly ($P<0.05$) positive impact of garlic powder on reducing serum cholesterol, LDL and TG was noticed in birds of group GE2 and GE3 (Table 3). However, birds in these two groups (GE2 and GE3) had higher ($P<0.05$) serum high density lipoprotein. A number of studies have reported that garlic possess hypolipidemic effects that is mainly dependent on method of preparation of garlic extract, the duration of the study and the bioactive components of the garlic cloves (Amagase *et al*., 2001). Several clinical reports have shown that garlic has cholesterol-lowering effect in animals due to the presence of sulphur containing bioactive compounds in its homogenates (Chowdhury *et al*., 2002). Tropentag (2008) observed that feeding of raw or sun-dried garlic to broiler at 2% significantly reduced the serum lipid that supports the findings of present study.

Table.1: Showing effect of Garlic powder on feed intake, body weight gain, feed efficiency, dressing percentage and mortality of broiler chicks.

Groups	*Mean ± SE*			
	Feed Intake (g)	Weight Gain (g)	FCR	Dressing Percentage
GE-3	2534±0.94	1296^{a} ±1.36	1.95^{a} ±0.23	60.02^{a} ±1.26
GE-2	2556±1.84	1302^{a} ±2.54	1.96^{a} ±1.98	60.39^{a} ±0.13
GE-1	2646±0.34	1140^{b} ±0.32	2.32^{b} ±1.35	56.81^{b} ±1.03
GE-0	2565±1.94	1150^{b} ±1.45	2.23^{b} ±0.32	56.88^{b}±1.03

Means in column with different superscripts are significantly different at $\alpha = 0.05$

Table.2: Showing effect of Garlic powder on Antibody titer of broiler chicks.

Groups	*Mean ± SE*		
	ND	**IB**	**IBD**
GE-3	4.25^{a} ±0.28	5.50^{a} ±0.64	5453^{a} ±0.45
GE-2	3.00^{b} ±0.61	3.75^{b} ±0.27	4552^{b} ±0.61
GE-1	2.50^{b} ±0.57	3.75^{b} ±0.45	4248^{b} ±1.43
GE-0	1.00^{c} ±0.36	3.00^{c} ±0.38	3696^{c} ±1.74

Means in column with different superscripts are significantly different at α =0.05

Table.3: Showing effect of Garlic powder on Serum Lipid Profile of broiler chicks.

Groups	*Mean ± SE*			
	Cholesterol Level	**HDL Level**	**LDL Level**	**TG Level**
GE-3	$129.75±4.65^{a}$	$28.71±2.73^{a}$	$92.00±0.26^{ab}$	$83.00 ±1.58^{b}$
GE-2	$120.50±7.23^{a}$	$29.12±1.73^{a}$	$83.00±1.85^{b}$	$70.00 ±1.35^{a}$
GE-1	$143.00±2.85^{b}$	$27.67±2.23^{b}$	$96.00±2.74^{b}$	$86.00 ±1.43^{bc}$
GE-0	$148.25±3.59^{b}$	$26.45±1.84^{b}$	$102.00±1.83^{b}$	$95.00 ±1.49^{c}$

Means in column with different superscripts are significantly different at α =0.05

Conclusion: It can be deduced from these findings that garlic powder can strategically be supplemented in the diet of birds to enhance their production performance, immune status and possess cholesterol lowering potential.

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