



Effect of Garlic and Neem Leaf Powder Supplementation on Cholesterol Levels in Serum, Breast and Thigh Muscles in Broilers

KEYWORDS

garlic, neem leaf powder, serum cholesterol, breast muscle, thigh muscle

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ABSTRACT *Effect of supplementation of garlic and neem leaf powder on cholesterol levels in serum, breast and thigh muscles in broilers was studied. 210 day-old male broiler chicks were distributed in to 7 groups, each group had six replicates with five chicks per each replicate. Group 1 was served as control. Groups 2 & 3 were supplemented with garlic powder @ 0.5, 1 g/kg respectively. Groups 4 & 5 were supplemented with neem leaf powder @ 1, 2 g/kg respectively. Group 6 was supplemented with 0.5 g/kg garlic powder and 1.0 g/kg neem leaf powder, Group 7 was supplemented with 1.0 g/kg garlic powder and 2.0 g/kg neem leaf powder. At 42nd day blood samples, breast and thigh muscles were collected from each replicate. Results showed that supplementation of garlic powder and neem leaf powder alone and their combination significantly ($P < 0.05$) reduced the serum, breast and thigh meat cholesterol levels in broilers.*

INTRODUCTION

In the recent past there is growing concern or fright about the cholesterol content of meat. It is an established fact that cholesterol at certain risk levels predisposes man to coronary heart diseases, high blood pressure, stroke and obesity.

Non pharmacological dietary agents like garlic, onion, neem and ginger with varying degrees of efficacy can act as hypocholesterolemic agents (Lata et al., 1991). Garlic is recommended primarily for its ability to lower cholesterol and blood pressure in the attempts to reduce the risk of suffering from cardiovascular diseases. Neem leaves and its constituents have been demonstrated to exhibit immunomodulatory, anti-inflammatory, antihyperglycemic, antifungal, antiviral, antioxidant, antimutagenic properties (Subapriya and Nagini, 2005).

In the present study, the effect of supplementation of neem leaf powder alone and in combination with garlic on serum, thigh and breast muscle cholesterol levels were evaluated in birds

MATERIALS AND METHODS

Animals

210 day-old male broiler chicks were procured and distributed in to seven groups, each group had six replicates with five chicks per each replicate. The experiment was conducted at Poultry Experimental Station, College of Veterinary Science, Rajendranagar, Hyderabad

Housing and Management

Battery brooders, feed hoppers, waterer, nipple system pipes, nipples were cleaned thoroughly, disinfected and sterilized with blow lamp prior to stocking chicks. Chicks were housed in battery brooder providing floor space of 1.0 sft/bird upto six weeks of age. During the experiment, light was provided continuously (24 hours). Feed and water were offered ad libitum throughout the experimental period. The experimental design is shown in Table 1. At the time of sacrifice (42nd day) blood samples, breast and thigh muscles were collected from each replicate.

Serum total cholesterol

The serum total cholesterol was estimated colorimetrically by Ferric chloride method

Meat total cholesterol

At time of sacrifice breast and thigh muscles were collected from each replicate and preserved at -18° C under deep freeze. The lipid from breast and thigh muscles was extracted by the method suggested by Folch et al. (1957). The total cholesterol was estimated from extracted lipid by one step method of Wybenga et al. (1970).

Statistical analysis

The data were analyzed using General Linear Model procedure of statistical package for social sciences (SPSS) 15th version and comparison of means tested using Duncan's multiple range test (1955) and significance was considered at $P < 0.05$.

RESULTS AND DISCUSSION

Serum cholesterol

The mean serum total cholesterol (mg/dl) levels revealed significant ($P < 0.05$) differences among the groups. Among the garlic supplemented groups, the serum cholesterol values were low in 1.0g/kg GP (G3). Among the neem supplemented groups, the mean serum cholesterol values were also low in 2.0g/kg NLP (G5). Whereas, treatment group supplemented with 1.0g/kg GP+2.0g/kg NLP (G7) showed lowest mean serum cholesterol values which indicate that supplementing combination of garlic powder and neem leaf powder at higher concentrations has synergistic effect on lowering the serum cholesterol levels (Table 2).

The hypocholesterolemic and hypolipidemic action of garlic might be due to Allicin which depresses the hepatic activities of lipogenic and cholesterogenic enzymes such as malic enzyme, fatty acid synthase, glucose-6-phosphatase dehydrogenase and HMG-CoA reductase was suggested by Ashayerizadeh et al. (2009). Similarly, Onyimonyi et al. (2012) reported that garlic contains high level of bioactive saponins which form insoluble complexes with cholesterol and inhibit intestinal absorption of endogenous and exogenous cholesterol. These

key saponins in garlic also possess the ability to inhibit key enzymes in the cholesterol and lipid biosynthetic pathways. The organo-sulphur compound present in neem leaf powder might have exerted indirect inhibitory effects at the levels of HMG-CoA reductase (a key enzyme in cholesterol biosynthesis) resulting in lowering the cholesterol level was suggested by Biswas et al. (2002) and Sathyan (2004).

This hypocholesterolemic properties of garlic and neem might have attributed in the reduction of serum cholesterol level when supplemented in combination. Supplementation at higher dose showed significant reduction in mean serum cholesterol level as suggested by Lonkar et al. (2009).

Similar findings of Ologhobo et al. (2008), Choi et al. (2010), Daneshmand et al. (2012) and Onyimonyi et al. (2012) reported reduction in serum cholesterol with supplementation of garlic. Dietary supplementation of neem leaf meal in broiler diets reduced the serum cholesterol was suggested by Jahanzeb Ansari et al. (2012), Obikaonu et al. (2012) and Nnenna et al. (2013). In contrary to our findings, Dono et al. (2010) and Figen Kirkpinar et al. (2010) reported that supplementation of garlic had no effect on blood cholesterol in broilers.

Breast and thigh meat total cholesterol

The mean breast and thigh meat cholesterol (mg/dl) levels revealed significant ($P < 0.05$) differences among the groups. The neem leaf powder supplemented groups showed no difference in the values of breast and thigh meat cholesterol. G3 (1.0g/kg GP) showed reduction in breast and thigh meat cholesterol among the garlic supplemented groups. G7 (1.0g/kg GP+2.0g/kg NLP) showed highest reduction in the level of breast and thigh meat cholesterol compared to lower concentration group G6 (0.5g/kg GP+1.0g/kg NLP) indicating that supplementing combination of garlic powder and neem leaf powder at higher concentration is beneficial in reducing the breast and thigh meat cholesterol (Table 2).

The principle behind the pharmacological action of garlic is that the sulphur containing compounds oxidize NADPH which is necessary for cholesterol synthesis. The reduction in breast and thigh meat cholesterol might be attributed to the reduced cholesterol biosynthesis mediated through the changes in the enzyme (HMG-CoA reductase) responsible for regulating cholesterol metabolism (Konjufca et al., 1997).

The present study indicated that the supplementation of high-

er level combination of GP and NLP reduced breast and thigh meat cholesterol more significantly than the lower level combination of the same and same suggestion was made by Lonkar et al. (2009). Similar findings were reported by You SunJong et al. (2009) and Fayed et al. (2011) who observed that meat cholesterol concentration in thigh and breast muscles was significantly ($P < 0.05$) decreased with garlic powder supplementation.

Conclusion

The supplementation of GP and NLP alone and their combination significantly ($P < 0.05$) reduced the serum, breast and thigh meat cholesterol in broilers.

Table 1: Experimental Design

GROUPS	DIET
G1(control)	Basal diet
G2	Basal diet + 0.5g/kg GP
G3	Basal diet + 1.0g/kg GP
G4	Basal diet + 1.0g/kg NLP
G5	Basal diet + 2.0g/kg NLP
G6	Basal diet + 0.5g/kg GP+ 1.0g/kg NLP
G7	Basal diet + 1.0g/kg GP+ 2.0g/kg NLP

GP – Garlic Powder, NLP – Neem Leaf Powder

Table 2: Effect of supplementing garlic and neem leaf powders and their combinations to access cholesterol level in serum, breast meat and thigh meat of broiler chicken

Groups	Cholesterol levels(mg/dl)			
	Serum	Breast muscle	Thigh muscle	
G1	181.38 ^f	54.51 ^e	111.66 ^e	
G2	174.36 ^{cd}	51.38 ^d	103.73 ^c	
G3	170.25 ^c	46.15 ^b	99.71 ^b	
G4	178.05 ^c	47.86 ^c	106.73 ^d	
G5	173.83 ^d	47.06 ^{bc}	106.30 ^d	
G6	164.76 ^b	45.59 ^b	99.22 ^b	
G7	156.08 ^a	43.27 ^a	97.45 ^a	
SEM	1.27	0.57	0.74	
ANALYSIS OF VARIANCE				
Source of Variance	Df	MSS values of respective age groups		
Between Treatments	6	438.37	86.311	154.25
Error	41	146.49	48.99	29.26
P- value		0.00	0.00	0.00

Values bearing different superscripts within a column are significantly ($P < 0.05$) different.

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