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Effect of feeding neem, ginger and garlic powder on serum lipid profile and meat cholesterol in Giriraja birds

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Abstract
An experiment was conducted to study the effect of feeding neem, ginger and garlic powder serum lipid profile and meat cholestrol in Giriraja birds. A total of 150 day old Giriraja birds were procured and allocated to five experimental groups each consisting of three replicates with ten chicks each. Experimental diets for broiler starter and finisher rations were formulated as per the ICAR (2013) standards using commonly available feed ingredients and basal diet (control) T_1 was prepared using corn and soya-bean meal (as per requirement) without supplementation of garlic, neem and ginger for day 1 to 56 days of experimental period and the experimental diets were prepared by incorporating treatment group T_2, T_3, T_4 and T_5 will be included with basal diet+ 0.5% garlic powder, basal diet + 0.5% neem powder, basal diet + 1% ginger and basal diet + 0.5% garlic powder + 0.5% neem powder + 1% ginger powder, respectively. The results revealed that feeding neem, ginger and garlic powder individually and also in combination resulted in significant ($P \leq 0.05$) reduction in serum cholesterol, triglycerides, low density lipoprotein and meat cholesterol was observed compared to control group.

Keywords: Giriraja birds, serum cholesterol, triglycerides, low density lipoprotein and meat cholesterol

Introduction
Poultry farming has emerged as one of the fastest growing agribusiness industries in the world. It has triggered the discovery and widespread use of a number of 'feed additives'. The main objective of adding feed additives is to boost animal performance by increasing their growth rate, better-feed conversion efficiency, greater livability and lowered mortality in poultry birds. These feed additives are termed as "growth promoters" and often called as non-nutrient feed additives. Antibiotic growth promoters (AGP) have been used as a feed additive to enhance gut health and control sub-clinical diseases. Sub-therapeutic levels of antibiotics given to poultry as growth enhancer may result to the development of antibiotic-resistant of bacteria, which are hazardous to animal and human health (Sarica *et al*., 2005) [10].

The poultry industry is currently moving towards a reduction in use of synthetic antibiotics because of the growing concern over the transmission and proliferation of resistant bacteria via the food chain. Alternative feed additives for farm animals are referred to as Natural Growth Promoters (NGP) or non-antibiotic growth promoters which include acidifiers, probiotics, prebiotics, phytobiotics, feed enzymes, immune stimulants and antioxidants are gaining the attention.

There are some important bioactive components such as alkaloids, bitters, flavonoids, glycosides, mucilage, saponins, tannins (Vandergrift, 1998) [13]; phenols, phenolic acids, guinones, coumarins, terpenoids, in the structures of nearly all the plants. Generally plant extracts have no problem of resistance and broilers fed on herbal feed additives were accepted well by the consumers (Tipu *et al*., 2006) [12].

Neem (*Azadirachta indica*) is one of the most common wild growing trees in India. Extract of dried leaves (5 to 10 gram per kg of feed) resulted in reduction of blood cholesterol and triglycerides in broilers (Ahsan-ul-haq *et al.*, 1999) [1]. Neem and tulsi have attracted worldwide prominence due to its vast range of medicinal properties like antibacterial, antiviral, antifungal, antiprotozoal, hepatoprotective and various other properties (Kale *et al.*, 2003) [5]. Low dose of neem leaves extract have an inhibitory action on wide spectrum of microorganisms (Talwar *et al*., 1997) [11] and immunomodulatory actions that induce cellular immune reaction.

Garlic (*Allum sativum*) is widely distributed all over the world. In past two decades attention

has been focused on its cholesterol lowering activity (Reddy *et al*., 1991) [9]. Garlic contains active principles like allum, allylic sulphide which lowers the low density lipo protein levels and act as anti carcinogenic. It possess antibacterial, antiparasitic, antiviral, antioxidant, anticholesteremic, anticancerous and vasodilator characteristics (Hanieh *et al.*, 2010) [3]. The active ingredient in garlic is the plant chemical allicin, which rapidly decompose to several volatile organosulphur compounds with bioactivity (Cheong *et al.*, 2008) [2].

Ginger (*Zincifer officinale*) is one of the potential rhizome with a wide range of medicinal effects (Khan *et al.*, 2012) [6]. The supplementation of the ginger to the diets lowered the serum cholesterol, triglycerides and glucose significantly in broilers (Mohamed *et al*., 2012) [8]. Zhang *et al.* (2009) [14] supplemented ginger root processed to different particle sizes to the broilers to study the effect on serum metabolites. They observed no significantly (P>0.05) lowered serum cholesterol in the birds in all groups fed with ginger root powder compared to the control. Garlic contains active principles like allin, allylic sulphide which lowers the low density lipoprotein levels and act as anti carcinogenic. Garlic has been used as a spice and native medicine for many years. It possess antibacterial, antiparasitic, antiviral, antioxidant, anticholesteremic, anticancerous and vasodilator characteristics.

Materials and Method

The experiment was conducted at the Department of Poultry Science, Veterinary College, Hebbal, Bengaluru. A total of 150 one day old Giriraja birds were distributed into five treatment groups with three replicates in each group and ten birds in each replicate. Chicks were reared under deep litter system with supply of *ad libitum* feed and water. The trial duration was for 8 weeks (56 days). A standard broiler starter and finisher rations were formulated as per ICAR (2013) recommendation. Basal diet (T_1) and the experimental diets were prepared by incorporating garlic powder at 0.50 per cent (T_2), neem powder at 0.50 per cent (T_3), ginger powder at 1.0 per cent (T_4) and garlic powder 0.5 per cent + neem powder 0.5 per cent + ginger powder 1 per cent (T_5). Blood samples were collected from two birds from each replicate at the end of the trial in respected treatment groups. Serum was separated individually and pooled treatment wise and subjected to estimation of serum cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL) and triglycerides by enzymatic method using auto analyzer kits. Two birds from each replicate will be slaughtered in each treatment at the end of the experiment for estimation of meat cholesterol. The muscle samples will be collected, chopped, minced and frozen at -200 C and meat cholesterol level estimated by using auto analyser kits.

Results and Discussion

The results of the influence of feeding neem, ginger and garlic powder on biochemical parameters and meat cholesterol at 56th day in Giriraja birds are presented in Table 1 and 2.

Serum Cholesterol

At the end of 56th day, the serum cholesterol values were 137.13 (T_1), 119.75 (T_2), 112.31 (T_3), 135.83 (T_4) and 128.34 (T_5) (mg/dl). The serum cholesterol content was significantly different (P≤0.05) among the dietary treatment groups. The serum cholesterol content was significantly lower in the treatment group T_2, T_5 compared to control (T_1), T_3, T_4 and also significant lower level was observed in T_4 compared to T_1 and T_3. There was no significant difference (P > 0.05) in the serum cholesterol content was noticed between group T_2, T_5 and also among treatment group T_1 and T_3.

Serum low density lipoprotein (LDL)

The LDL (low density lipoprotein) values at the end of the experiment in treatment groups T_1, T_2, T_3, T_4 and T_5 were 89.20, 63.92, 87.93, 67.39 and 64.43 (mg/dl), respectively. Serum LDL content was significantly lower (P≤0.05) in T_2, T_4 and T_5 compared to T_1 and T_3. There was no significant difference (P > 0.05) in the serum LDL content among T_1 and T_3 and also among T_2, T_4 and T_5.

Serum high density lipoprotein (HDL)

At the end of 56th day, serum HDL values were 56.41 (T_1), 53.47 (T_2), 56.41 (T_3), 56.75 (T_4) and 54.75 (T_5) (mg/dl). Statistical non-significant difference (P > 0.05) was observed in the serum HDL among all the treatment groups and also compared to control.

Serum triglycerides (TGS)

At the end of 56th day, the serum triglycerides values were 74.61 (T_1), 49.83 (T_2), 73.33 (T_3), 61.41 (T_4) and 48.31 (T_5) (mg/dl). The serum triglycerides content was significantly different (P≤0.05) among the dietary treatment groups. The serum triglycerides content was significantly lower in the treatment group T_2, T_5 compared to control, T_3, T_4 and also significant lower level was observed in T_4 compared to T_1 and T_3. There was no significant difference (P>0.05) in the serum triglycerides content was noticed between group T_2, T_5 and also among treatment group T_1 and T_3.

Meat cholesterol

At the end of 56th day, the Meat cholesterol values were 0.80 (T_1), 0.64 (T_2), 0.79 (T_3), 0.63 (T_4) and 0.61 (T_5) (mg/g). ANOVA revealed significant difference (i≤0.05) meat cholesterol content among different treatment group compared to control. Meat cholesterol content was significantly lower (P≤0.05) in T_2, T_4 and T_5 compared to T_1 and T_3. There was no significant difference (P>0.05) in the Meat cholesterol content among T_1 and T_3 and also among T_2, T_4 and T_5. The present study is in agreement with Konjufca *et al.* (1997) [7] reported that serum and liver cholesterol decreased significantly when broiler diets were supplemented garlic powder. This effect may be because garlic contains active principles like allin, allylic sulphide which lowers the low density lipoprotein levels and act as anti carcinogenic. Garlic has been used as a spice and native medicine for many years. It possess antibacterial, antiparasitic, antiviral, antioxidant, anticholesteremic, anticancerous and vasodilator characteristics. Because ginger root contains a number of compounds that exert varying biological activities, including antioxidant, antimicrobial and various pharmacological effects (Jagetia *et al*., 2003) [4]. The supplementation of the ginger to the diets lowered the serum cholesterol, triglycerides and glucose significantly in broilers (Mohamed *et al*., 2012) [8]. The present study is in disagreement with Zhang *et al*. (2009) [14] supplemented ginger root processed to different particle sizes to the broiler chickens to study the effect on serum metabolites. They observed no significantly (P>0.05) lowered serum cholesterol in the birds in all groups fed with ginger root powder compared to the control.

Table 1: Effect of supplementation of neem, ginger and garlic powder on serum cholesterol, LDL, HDL and Serum triglycerides values (Mean ± SE) at the 56th day in Giriraja birds

Experimental group	Description of the treatment	Serum Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)	Serum Triglycerides (mg/dl)
T_1	Basal diet	147.21 ± 4.26[a]	89.20 ± 4.32[a]	56.41 ± 1.03	74.61 ± 3.73[a]
T_2	Basal diet + 0.5% Garlic powder	109.67 ± 3.93[c]	63.92 ± 7.13[b]	53.47 ± 0.48	49.83 ± 2.21[c]
T_3	Basal diet + 0.5% Neem powder	149.43 ± 2.48[a]	87.93 ± 3.19[a]	56.41 ± 0.93	73.33 ± 2.27[a]
T_4	Basal diet + 1% Ginger powder	126.41 ± 2.75[b]	67.39 ± 2.51[b]	56.75 ± 1.13	61.41 ± 2.75[b]
T_5	Basal diet + 0.5% Garlic powder + 0.5% Neem powder + 1% Ginger powder	101.75 ± 2.67[c]	64.43 ± 3.01[b]	54.75 ± 0.81	48.31 ± 4.11[c]

[abc] Means in the same column with no common superscript differ significantly ($P \leq 0.05$)

Table 2: Effect of supplementation of neem, ginger and garlic powder on meat cholesterol (Mean ± SE) at the 56th day in Giriraja birds

Experimental group	Description of the treatment	Meat Cholesterol (mg/g wet tissue)
T_1	Basal diet	0.80 ± 0.002[a]
T_2	Basal diet + 0.5% Garlic powder	0.64 ± 0.003[b]
T_3	Basal diet + 0.5% Neem powder	0.79 ± 0.008[a]
T_4	Basal diet + 1% Ginger powder	0.63 ± 0.001[b]
T_5	Basal diet + 0.5% Garlic powder + 0.5% Neem powder + 1% Ginger powder	0.61 ± 0.003[b]

[abc] Means in the same column with no common superscript differ significantly ($P \leq 0.05$)

Conclusion

Inclusion of garlic and ginger powder at 0.5 per cent and 1 per cent powder, respectively and combination of 0.5% garlic, 0.5 % neem, 1% ginger powder, respectively revealed significant ($P \leq 0.05$) reduction in serum cholesterol, triglycerides, low density lipoprotein, and meat cholesterol compared to control group and 0.5% neem at the end of the experiment (56th day). Based on the above result it was concluded that inclusion of garlic, neem and ginger powder at 0.5 per cent, 0.5 per cent, 1 per cent powder and combination of 0.5% garlic, 0.5% neem, 1% ginger powder, respectively was beneficial in lowering serum cholesterol in Giriraja birds, but inclusion of 1 per cent ginger and combination of 0.5% garlic, 0.5% neem and 1% ginger powder was more beneficial in lowering serum cholesterol in Giriraja birds.

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