



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(8): 870-874
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www.thepharmajournal.com
Received: 10-06-2021
Accepted: 12-07-2021

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Effect of dietary incorporation of lemon grass (*Cymbopogon flexuosus*) oil and turmeric (*Curcuma longa*) rhizome powder on haemato-biochemical parameters in commercial broiler chickens

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Abstract

A feeding trial was conducted to discern the effect of dietary incorporation of lemon grass oil (*Cymbopogon flexuosus*) and turmeric rhizome powder (*Curcuma longa*) on haemato-biochemical parameters in commercial broiler chickens. 120, (one day-old) broiler chicks were divided randomly into 4 treatment groups with 3 replicate each i.e. 10 broiler chicks per replicate. Chicks of treatment T₁ (control) were fed basal diet (starter and finisher diet), whereas in treatment groups T₂, T₃ and T₄, basal diet was incorporated with basal diet with 1ml/kg feed lemon grass oil + 0.25% turmeric rhizome powder, basal diet with 2ml/kg feed lemon grass oil + 0.25% turmeric rhizome powder, basal diet with 3ml/ kg feed lemon grass oil +0.25% turmeric rhizome powder respectively. No significant difference was observed in haematological parameters among different treatment groups and all the values were in normal range. However it can be observed that incorporation of lemon grass oil and turmeric rhizome powder reduced serum cholesterol values compared to the control values with no added oil and turmeric rhizome powder. Maximum value of triglycerides was noted in T₂ treatment however the values did not differ significantly among the various treatment groups. The mean values of serum triglycerides for different treatment was 67.99, 75.15, 76.63 and 66.06 (mg/dl) for T₁, T₂, T₃ and T₄ treatment groups respectively. There was no significant difference in serum total protein, albumin, globulin and glucose concentrations as well as serum ALP, ALT and AST activities among the different treatment groups. Therefore, it could be concluded that incorporation of lemon grass oil (*Cymbopogon flexuosus*) and turmeric rhizome powder (*Curcuma longa*) in the diets of commercial broiler chickens had lower level of serum cholesterol and triglycerides.

Keywords: lemon grass oil, turmeric rhizome powder, triglycerides, cholesterol, total protein, albumin, globulin, commercial broiler chickens

1. Introduction

In India, poultry sector has experienced an exemplary switch in structure and action of functioning from basic backyard rearing to major commercial agricultural based industry. Broiler industry is thought out be among the rapidly growing agro based industry in India. Number of poultry in India is 851.81 Million in 2019 (Livestock census, 2020) [9]. The contribution of poultry production in our country is about 0.66% its GDP and 7.72% GDP of the livestock sector. (Prabakaran, 2014; Rajenderan *et al.*, 2014) [22, 24]. Due to rapid growth in poultry production the per capita availability for a year has also raised considerably and reached to 60 eggs and 2.5 Kg of meat.

Essential oils are mixtures of oily compounds aromatic in nature and which are abstracted from different part of the plants such as leaves, flowers, buds, seeds, fruits, twigs, bark, wood, and also their roots (Gopi *et al.*, 2014) [12]. Essential oil from lemon grass (*Cymbopogon flexuosus*) is taken from the leaves of the plant by a process known as hydro distillation. Citral is the vital component in oil of lemon grass it is accountable for the peculiar lemon like aroma. Because of various well-known medicinal properties in many popular culture especially antimicrobial activity these oils has been in use since eternal (Adukwu *et al.*, 2012; Dasai and Parekh, 2012) [1, 10]. The oil from lemon grass is as remedy for treating intestinal worms, anemia, bacterial and viral infections and also used for the manufacturing of different pesticides, perfumes, cosmetics and pharmaceuticals (Russo, 1992) [27]. Turmeric is a considered to be perennial plant of Zingiberaceae family. Turmeric Rhizome is a considerably used as spice, colouring agent and food preservative which has many biological

actions and medicinal applications. Powdered turmeric rhizome has antioxidant, anti-inflammatory, antibacterial, antihypertensive and hypocholesterolemic properties (Chattopadhyaya *et al.*, 2004) [7]. These properties are due to presence of phytochemicals such as curcmins, demethoxycurcumin, tetrahydro-curcumin, curcuminoids, arturmerone, zingiberene, turmirone and curlone (Burt, 2004) [6]. Powdered Turmeric rhizome also has the potential to increase the secrete of various enzymes of the alimentary system alike amylase, pancreatic lipase, trypsin, and chymotrypsin (Patel and Srinevasan, 2000).

Presently there is very less information available about feeding of lemon grass oil and turmeric rhizome powder as feed additives in commercial broiler chickens. Though both of these feed additives have been fed separately in various experiments, but information about combined feeding of these feed additives and /or feed ingredients is not available. Therefore the objective of the present study was to investigate the effect of powder of turmeric rhizome and lemon grass oil on haemato-biochemical parameters in commercial broiler chickens.

2. Materials and Methods

A total of 120, day-old commercial broiler chicks were procured and randomly divided into four treatment groups with 3 replication having 10 chicks in each in a completely randomized design. First group was given basal diet, second group was given basal diet with 1ml/kg feed lemon grass oil + 0.25% turmeric rhizome powder while third group was given basal diet with 2ml/kg feed lemon grass oil + 0.25% turmeric rhizome powder and fourth group was given basal diet with 3ml/ kg feed lemon grass oil + 0.25% turmeric rhizome powder respectively. The feeding trial lasted for 42 days viz., 0-21 days (starter phase) and 21-42 days (finisher phase). The ingredient compositions of diets are presented in Table 1. The birds were vaccinated for RD vaccine (F- strain) on 7th day, IBD vaccine on 14th day and ND vaccine (*Lasota* strain) booster on 28th day. The feed offered daily to birds in different treatment groups was weighed and recorded.

2.1 Procurement of lemon grass oil and turmeric rhizome powder

Turmeric rhizome bought from Pantnagar shopping complex and stored under ambient temperature. After this the required amount of the turmeric rhizome was weighed with weighing machine and grounded in mixer to convert it into powder of smaller particle size. Lemongrass oil bought from CSIR-CIMAP Research Center Pantnagar Uttarakhand.

2.2 Blood collection and analysis

Blood samples were collected at the end of feeding trial (42nd day). Blood sample (about 3.0 ml) was collected aseptically from the wing vein with sterile needle into well labeled blood collecting vials containing EDTA which act as anticoagulant for hematological analysis.

2.3 Hematological parameters

Haemoglobin concentration (g/dl) was estimated following the method described by Sharma and Singh (2000) [29] using Sahli's haemoglobinometer with acid haematin method. Micro haematocrit method was used to estimate PCV as described by Sharma and Singh (2000) [29]. Total erythrocyte counts (TEC) and total leucocytes count (TLC) was performed with Neubauer's counting chamber as described by

Jain (1986) [13]. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) was calculated.

2.4 Serum biochemical parameters

Cholesterol concentration in serum was estimated spectrophotometrically using Erba diagnostic kit with Enzymatic CHOD-PAP (cholesterol oxidase - phenol + amino phenazone) method at 505 nm wavelength (Tietz, 1998). Serum triglycerides were estimated using Autospan diagnostic kit based on the method of Wako and the modifications by McGowan *et al.* (1983) [17] at 505 nm wavelengths. Estimation of serum glucose was conducted by enzymatic GOD-POD (glucose oxidase- peroxidase) method with using Autospan diagnostic kit at 505 nm wavelength against blank reagent (Sacks, 1998) [28]. Total protein concentration in serum was estimated by biuret method using Erba diagnostic kit at 540 nm wavelength (Johnson *et al.*, 1999) [14]. Albumin concentration in the serum was estimated by bromocresol green end point assay method with the aid of AUTOSPAN diagnostic kit at 630 nm wavelength (Johnson *et al.*, 1999) [14]. The serum albumin content was subtracted from serum total protein content to arrive at serum globulin content. For the estimation of serum glutamate pyruvate transaminase (SGPT), 4 - DNPH method (2, 4-Dinitrophenylhydrazin) of Reitman and Frankel (1957) [26] was followed using AUTOSPAN diagnostic kit. The activity of serum glutamate oxaloacetate transaminase (SGOT) or aspartate aminotransferase (AST) was measured following 2, 4 - DNPH method of Reitman and Frankel (1957) [26] using a AUTOSPAN diagnostic kit. The alkaline phosphatase activity in serum was assayed using Autospan diagnostic kit.

2.5 Statistical analysis

The experimental data obtained in the present study were analyzed statistically (Snedecor and Cochran, 1994) [31] by using general linear model procedure. Difference between treatments means were compared using Duncan's multiple range test (Kramer, 1957) [16].

3. Result and Discussion

3.1 Haematological parameters

Dietary of incorporation of lemon grass oil and turmeric rhizome powder on haemoglobin, packed cell volume, total erythrocyte count, mean corpuscular volume and mean corpuscular haemoglobin showed significant changes ($P \leq 0.05$) as shown in Table 2. There was no significant difference in the packed cell volume of the commercial broiler chickens incorporated with lemon grass oil and turmeric rhizome powder. Total leukocyte counts, mean corpuscular volumes and mean corpuscular haemoglobin concentration were not significantly changed. This is in agreement with Tariq *et al.* (2014) who reported that incorporation of clove essential oil in the diets has no significant difference in the values of hemoglobin and PCV in broiler chickens. Similarly no significant changes noted by Emadi *et al.* (2007) [11] and Raghdad *et al.* (2012) [23] in the hemoglobin value and PCV value by feeding of the turmeric rhizome powder to the broiler chickens. Whereas contrary to this, Amera *et al.* (2013) [4] reported that incorporation of rosemary and garlic oil in the feed of broiler chickens significantly increase the hemoglobin, PCV and leucocytes values. Al-Noori *et al.* (2011) [3] also noted that by incorporation of turmeric rhizome powder in the diet of the

broilers had a significant increase in the value hemoglobin, PCV, total protein and globulin.

3.2 Serum biochemical parameters

There was significant ($P \leq 0.05$) change in the serum cholesterol, triglycerides, glucose, serum glutamate pyruvate transaminase (SGPT), serum glutamate, oxaloacetate transaminase (SGOT), total protein and globulin content on incorporated with lemon grass oil and turmeric rhizome powder in the broiler chickens as shown in Table 3.

The mean serum cholesterol values of the different groups incorporated with lemon grass oil and turmeric rhizome powder did not differ significantly among the groups. The mean values for the T1, T2, T3 and T4 was 100.4, 90.85, 87.74 and 82.79 (mg/dl) respectively. However it can be observed that incorporation of lemon grass oil and turmeric rhizome powder reduced serum cholesterol values compared to the control values with no added oil and turmeric rhizome powder. Minimum value of the cholesterol was reported in T4 group with maximum concentration of lemon grass oil followed by T3, T2 and T1.

This is in agreement with Takeli *et al.* (2011) [33] who observed no effect on the cholesterol level due to incorporation of lemon grass oil. Najafi and Toriki. (2010) [20] observed similar results when broiler chicken diets incorporated with essential oil blend. No effect on the serum cholesterol value was noticed when the broiler birds were fed diet incorporated with turmeric rhizome powder @0.5g/kg diet (Akbarian *et al.*, 2012) [2].

The mean values of serum triglycerides for different treatment was 67.99, 75.15, 76.63 and 66.06 (mg/dl) for T1, T2, T3 and T4 treatment groups respectively. Maximum value of triglycerides was noted in T2 treatment however the values did not differ significantly among the various treatment groups. Results of the current study were relevant to Mehr *et al.* (2014) [18] and Shirzadegan (2014) [30] who found no significant effect on the level of triglycerides by the incorporation of clove essential oil.

The mean values for the serum glucose was found to be non-significant among different treatment groups. This is in agreement with Tekce and Gül. (2017) [32] who observed that essential oil in the diet of broiler chickens had no effect on the glucose level.

Serum total protein, serum albumin, serum globulin were no significant difference noted among the groups of different treatments. The results of present study are comparable to Khattak *et al.* (2014) [15] who observed no changes in the level of total protein, albumin and globulin when fed diet

incorporated with essential oil blend of caraway, laurel, lemon, oregano, sage, tea and thyme. However Chaudhary *et al.* (2014) [8] noted that incorporation of turmeric rhizome powder in the diet of broiler chickens significantly enhance the serum total protein value.

The values of alkaline phosphate (ALP), serum glutamate pyruvate transaminase (SGPT) and serum oxaloacetate transaminase (SGOT) did not show any significant difference in different dietary treatments incorporated with lemon grass oil and turmeric rhizome powder. The values for SGPT observed to be 26.52, 26.22, 26.52 and 26.81 U/L for T1, T2, T3 and T4 treatments respectively. The value of SGOT noted to be 172.80, 172.38, 173.56 and 172.09 U/L for T1, T2, T3 and T4 treatments respectively.

The value for ALP was recorded as 84.82, 83.92, 81.20 and 80.30 U/L for T1, T2, T3 and T4 treatments respectively. The ALP values for different treatment were found to decrease from T1 to T4 but the difference was non-significant. This is in agreement with incorporation of lemon grass oil and turmeric rhizome powder did not induce any significant effect on the activities of these enzymes which are corroborated to the study by Michalina (2018) [19], Najafi and Toriki (2010) [20]. Hamed Moomivand *et al.* (2015) also observed no effects by the incorporation of essential oil in the diet of broiler chickens on the enzymes activity. Supplementation of garlic and turmeric rhizome powder in the diet of poultry ration does not show significant difference in the SGOT, SGPT and ALP values (Ratika *et al.*, 2018) [25].

Table 1: Ingredient composition (%) of broiler chicks (starter and finisher) basal diets (kg/100kg)

Ingredients (%)	Broiler starter (0 -3 weeks)	Broiler finisher (3 - 6 weeks)
Maize	53.0	56.0
Rice polish	04.0	06.0
Deoiled soyabean meal	30.0	25.0
Groundnut cake	10.0	08.0
Vegetable oil	0.725	2.325
Lysine	0.20	0.20
DL-methionine	0.30	0.30
Dicalcium phosphate	01.00	1.40
Trace mineral mixture	0.25	0.25
Common salt	0.30	0.30
Vitamin premix	0.025	0.025
Coccidiostat	0.05	0.05
Hepatocare	0.10	0.10
Choline chloride	0.05	0.05
Total	100.00	100.00

Table 2: Haematological values of commercial broiler chickens fed diets supplemented with lemon grass oil and turmeric rhizome powder (42nd days)

Parameters	Treatments*				SEm	P-value
	T ₁	T ₂	T ₃	T ₄		
Haemoglobin (%)	8.83±0.19	8.98±0.11	9.11±0.14	8.94±0.11	0.143	0.579
Packed cell volume (%)	29.43±0.29	28.53±0.55	29.23±1.21	28.95±0.43	0.050	0.745
Total erythrocyte counts (10 ⁶ /µl)	2.47±0.05	2.40±0.03	2.46±0.04	2.43±0.05	0.515	0.511
Total leukocyte counts (10 ³ /µl)	23.33±0.65	24.26±0.59	23.56±0.29	23.26±0.44	0.714	0.828
Mean corpuscular volume (fl)	119.41±3.59	118.74±3.52	119.44±3.95	119.06±3.11	3.185	0.997
Mean corpuscular haemoglobin (pg)	35.79±1.07	37.45±0.90	37.06±0.52	36.89±0.97	0.897	0.610
Mean corpuscular haemoglobin concentration (g/dl)	30.03±0.80	31.56±0.88	31.48±1.54	30.89±0.39	0.996	0.685

T1: Basal diet; T2: basal diet incorporated with lemon grass oil @ 1ml/kg feed + 0.25% turmeric rhizome powder; T3: basal diet incorporated with lemon grass oil @ 2ml/kg feed +0.25% turmeric rhizome powder and T4: basal diet incorporated with lemon grass oil @3ml/kg of feed + 0.25% turmeric rhizome powder.

Table 3: Average values of serum biochemical constituents of commercial broilers fed diets incorporated with lemon grass oil and turmeric rhizome powder (42nd days)

Parameters	Treatments*				SEm	P-value
	T ₁	T ₂	T ₃	T ₄		
Cholesterol (mg/dl)	100.46±7.8	90.85±13.21	87.74±8.92	82.79±11.84	10.680	0.698
Triglyceride(mg/dl)	67.99±3.96	75.15±4.65	76.63±5.36	66.06±2.85	4.309	0.030
Glucose (mg/dl)	169.35±16.93	169.71±11.44	168.95±6.05	168.09±5.36	10.989	1.000
Total protein (g/dl)	2.80±0.22	2.90±0.21	2.89±0.16	2.99±0.25	0.261	0.938
Albumin (g/dl)	1.41±0.07	1.53±0.16	1.41±0.06	1.52±0.05	0.097	0.704
Globulin (g/dl)	1.38±0.18	1.36±0.16	1.48±0.19	1.46±0.21	0.189	0.962
Serum glutamate pyruvate transaminase (U/L)	26.52±1.11	26.22±0.95	26.52±1.02	26.81±1.24	1.090	0.985
Serum glutamate oxaloacetate transaminase (U/L)	172.80±4.54	172.38±3.12	173.56±3.45	172.09±5.87	5.396	0.996
Serum Alkaline Phosphatase (U/L)	84.82±2.06	83.92±5.44	81.20±5.65	80.32±7.11	5.443	0.255

T1: Basal diet; T2: basal diet incorporated with lemon grass oil @ 1ml/kg feed + 0.25% turmeric rhizome powder; T3: basal diet incorporated with lemon grass oil @ 2ml/kg feed +0.25% turmeric rhizome powder and T4: basal diet incorporated with lemon grass oil @3ml/kg of feed + 0.25% turmeric rhizome powder.

4. Conclusion

It could be concluded that incorporation of lemon grass oil (*Cymbopogon flexuosus*) and turmeric rhizome powder (*Curcuma longa*) in the diets of commercial broiler chickens had lower level of serum cholesterol and triglycerides and no significant difference noted in the serum biological enzymes.

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