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Effects of different concentrations of dietary rice bran oil on blood biochemical profile of the broiler chicken

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Abstract
This study was planned to evaluate the effects of different concentrations of dietary rice bran oil on blood biochemical profile of broiler chicken. The experiment was conducted for five weeks (35 days), with 225 unsexed day-old broiler chicks in the experimental poultry shed, College of Veterinary Science and Animal Husbandry, Rewa. The design of the experiment was completely randomized. There were three dietary treatments, T_0, T_5 and T_{10}, with diets containing 0%, 5% and 10% of total metabolizable energy from rice bran oil, respectively. Each treatment consisted of five replicates with fifteen birds in each replicate. Serum concentrations of glucose, triglyceride, total cholesterol, high density lipoprotein-cholesterol, total protein, albumin and globulin were determined along with Albumin: Globulin ratio. No significant effect of different levels of rice bran oil was observed on blood biochemical profile of boilers. All the parameters lied within their normal range.

Keywords: Dietary rice bran oil, blood biochemical profile, broiler chicken

1. Introduction
India is the fourth largest chicken producer in the world with annual production of 3.8 million tonnes of broiler meat. The broiler industry has been changed a lot in recent decades. With continuous genetic improvement and nutritional modification, the body weight gain and feed conversion ratio of broilers drastically improved. Dietary energy is the important component which increases weight gain and improves feed conversion ratio (Bell, 2007) [1]. Fat provides twice the energy than either carbohydrates or protein source. Oils increase the feed intake by its flavor and improve the absorption of fat-soluble vitamins in the gut. Rice bran oil (RBO) is obtained from rice husk, a byproduct of the rice milling industry. It contains appreciable quantities of bioactive components and has attained the status of"heart oil" due to its cardiac friendly chemical profile (Sohail *et al*., 2017) [2]. The health benefits of naturally occurring bioactive phytochemicals in the rice bran oil such as gamma-oryzanol, tocopherols, tocotrienols and phytosterols were reported for their antioxidant and cholesterol-lowering properties (Bumrungpert *et al*., 2019) [3]. Taking advantage of the micronutrients present in RBO, it was considered that the value of other edible oils could be nutritionally improved by blending with RBO.
Broiler feed is based primarily on corn or maize and soybean meal which supplies the majority of energy and protein in the diet (Araba and Dale, 1990) [4]. Rice bran oil in broiler diet is used in different concentrations depending on its availability and price mainly to supply energy during feed formulation. However, it is not known that out of total dietary energy how much energy should be from supplemental fat such as, rice bran oil in maize-soybean based diet, which would be optimum for performance of broilers. Therefore, in view of the above discussion a study was planned to evaluate the effects of different concentrations of dietary rice bran oil on blood biochemical profile of the broiler chicken.

2. Materials and Methods
2.1 Location
The experimental trial was conducted in the experimental poultry shed, College of Veterinary Science and Animal Husbandry, Rewa. Duration of the present experimental work was 35 days (5 weeks).

2.2 Experimental chicks and their management

The experimental shed was properly prepared following standard practice before the arrival of the chicks. Three days prior to the arrival of the chicks the experimental shed was fumigated with potassium permanganate ($KMnO_4$) and formaldehyde solution (40% v/v in water) at the rate of 20 g $KMnO_4$ in 40 ml formaldehyde solution per 100 square feet area and the floor of the house was disinfected with disinfectant solution. The day old 225 unsexed broiler chicks were collected from the Phoenix Hatchery, Jabalpur, and maintained at the experimental poultry shed. Chicks were housed in deep litter system and provided with both natural and artificial light source from the evening to morning. The feeders and drinkers were placed properly inside the pens. All the experimental chicks were healthy and provided with normal routine health care. Birds were vaccinated following standard protocol (table 1) during the experimental period.

Table 1: Vaccination schedule of broiler chicken

S. No.	Age	Name of vaccines	Route of application
1	0 day	Marek's disease (MD) vaccine	Drinking water
2	7 days	Ranikhet disease (RD)/New Castle disease (NCD) vaccine (B1 strain)	Drinking water
3	15 days	Infectious bursal disease (IBD)/Gumboro disease vaccine	Drinking water
4	28 days	RD/ NCD vaccine (Lasota strain)	Drinking water

2.3 Research methodology and experimental design

The design of the present experiment was completely randomized. There were three dietary treatment groups. Each treatment consisted of five replicates with fifteen birds in each replicate. Treatment groups were made based on the proportion of total dietary metabolizable energy (ME) supplied by rice bran oil (RBO) as presented in table 2.

Table 2: Experimental design with dietary treatments

Treatments		T_0	T_5	T_{10}
		0% of energy (ME) from RBO	5% of energy (ME) from RBO	10% of energy (ME) from RBO
Starter (0-8 days)	ME: 2975 kcal/kg CP: 21-22%	0%	1.690%	3.380%
Grower (9-18 days)	ME: 3025 kcal/kg CP: 19-20%	0%	1.718%	3.437%
Finisher 1 (19-28 days)	ME: 3100 kcal/kg CP: 18-19%	0%	1.761%	3.522%
Finisher 2 (29-35 days)	ME: 3150 kcal/kg CP: 17-18%	0%	1.789%	3.579%

2.4 Experiment diets and feeding

The experimental diets consisted of maize and soybean meal as the major ingredients in which rice bran oil was the chief source of fat origin energy. The composition of diets is given in table 3. Each diet was offered *ad libitum* to the respective chicks for five weeks. The birds had free access to clean drinking water throughout the experiment.

Table 3: Composition of the experimental diets

Treatments	T_0				T_5				T_{10}			
Age of the birds (in days)	**0-8**	**9-18**	**19-28**	**29-35**	**0-8**	**9-18**	**19-28**	**29-35**	**0-8**	**9-18**	**19-28**	**29-35**
Ingredient composition (%)												
Maize	66.4	67.43	73.22	74.8	59.935	65.6	68.679	71.971	56.72	60.803	65.303	68.318
Soybean meal	30	29	23.4	22.12	34.735	29.07	26.3	23	36.2	31.46	27.89	24.826
Rice bran oil	0	0	0	0	1.69	1.718	1.761	1.789	3.38	3.437	3.522	3.579
Limestone powder	1.13	1	0.9	0.68	1.1	1	0.8	0.9	1.1	1.31	0.84	0.9
Dicalcium phosphate	1.03	1	1.1	0.95	1	1.042	1.05	0.9	1.1	1.32	1.05	0.96
Common salt	0.3	0.3	0.25	0.25	0.3	0.3	0.25	0.25	0.3	0.3	0.25	0.25
Sodium bicarbonate	0.2	0.2	0.2	0.19	0.18	0.2	0.2	0.2	0.2	0.3	0.21	0.21
Lysine hydrochloride	0.23	0.33	0.21	0.32	0.33	0.33	0.25	0.28	0.31	0.31	0.245	0.28
DL-Methionine	0.2	0.23	0.21	0.18	0.22	0.23	0.2	0.2	0.18	0.25	0.18	0.167
Trace minerals[a]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Vitamin premix[b]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Choline chloride	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Toxin binder	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Antioxidant	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maduramycin	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Bacitracin methyl disalicylate	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Nutrient composition (%)												
ME (kcal/kg)	2960	3010	3076	3117	2966	3000	3087	3119	2990	3054	3126	3159
Crude protein (%)	21.1	19.13	18.02	17.01	21.11	19	18.08	17	21.11	19.45	18.31	17.24
Crude fibre (%)	3.27	3.23	2.98	2.93	3.45	3.2	3.08	2.93	3.48	3.26	3.11	2.98
Lysine (%)	1.3384	1.262	1.162	1.079	1.372	1.298	1.19	1.131	1.403	1.291	1.237	1.153
Methionine (%)	0.513	0.502	0.494	0.493	0.546	0.511	0.492	0.4922	0.534	0.499	0.498	0.474
Calcium (%)	0.91	0.84	0.79	0.76	0.9	0.86	0.82	0.78	0.9	0.89	0.78	0.79
Available phosphorus (%)	0.46	0.43	0.38	0.39	0.45	0.42	0.38	0.38	0.46	0.45	0.38	0.39

[a]Supplied per kg diet (as organic minerals): Manganese- 25 mg, zinc- 20 mg, iron- 10 mg, copper- 5 mg, iodine- 1 mg, chromium- 0.05 mg, selenium- 0.05 mg

[b]Supplied per kg diet: Vitamin A- 12500 IU, vitamin D_3- 5000 IU, vitamin E- 150 mg, vitamin K_3 (menadione)- 4 mg, vitamin B_1 (thiamin)- 3 mg, vitamin B_2 (riboflavin)- 8 mg, vitamin B_3 (niacin)- 80 mg, vitamin B_5 (d-pantothenic acid)- 15 mg, vitamin B_6 (pyridoxine)- 6 mg, vitamin B_{12} (cyanocobalamin)- 0.03 mg, biotin- 0.40 mg, folic acid- 2.5 mg, choline- 600 mg, vitamin C (ascorbic acid)- 200 mg.

2.5 Collection of blood and preparation of serum samples
Collection of blood was done at the end of 5 weeks. 5 ml blood was collected from each of three birds per replicate by venipuncture of the brachial vein using vacutainer tube and needle. After collection of the blood into the test tubes, it was kept in a slanting position and left at room temperature, for 2-3 hours to separate serum from blood cells. The serum samples were then transferred to serum vials properly marked and stored at –20 °C for biochemical analysis.

2.6 Biochemical analysis
Serum concentrations of glucose, triglyceride, total cholesterol, HDL-cholesterol (high density lipoprotein-cholesterol), total protein, albumin and globulin were determined by biochemistry auto analyzer (Star 21 Plus, Aspen Diagnostics Pvt. Ltd., Delhi, India) using Erba® kits and following the analytical guidelines in kits. Albumin: globulin ratio was also calculated.

2.7 Statistical analysis
The data collected from the experiment were analyzed by one way ANOVA using the procedure of IBM SPSS Statistics V22.0 (IBM, New York, USA). Means were compared by using Tukey's test and considered significantly different when $p<0.05$.

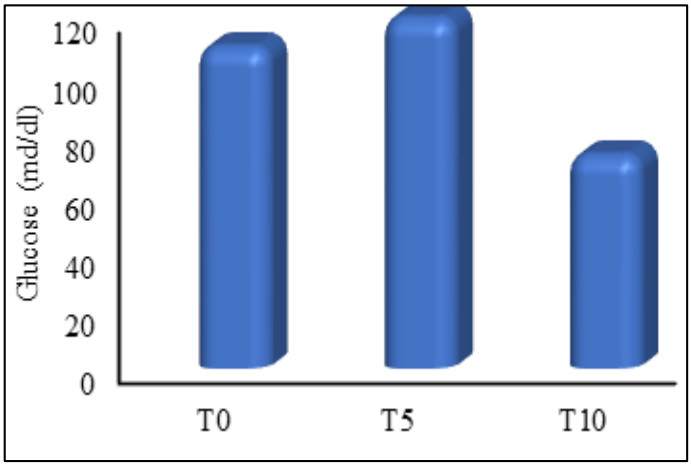
3. Results and Discussion
Results on serum biochemical profile of broiler chickens are shown in table 4 and figure1. There were no significant differences among the treatments in serum concentration of glucose, triglyceride, total cholesterol, high density lipoprotein-cholesterol (HDL-cholesterol), total protein, albumin and globulin, and albumin: globulin ratio.

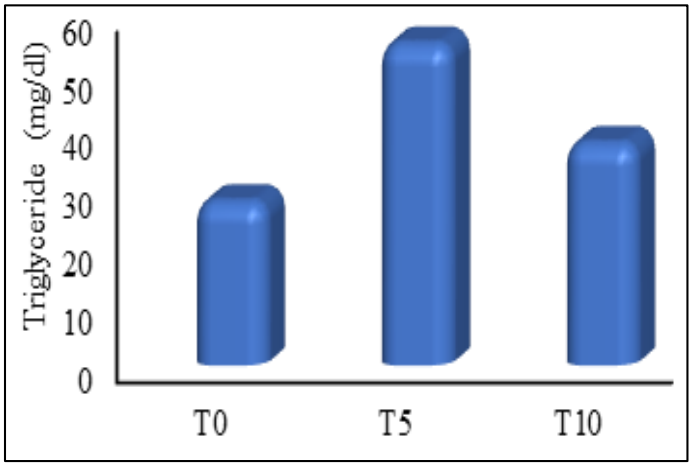
The results corroborate with the reports of Anitha *et al.* (2006) [5] who concluded that serum total cholesterol, HDL-cholesterol and triglyceride levels did not differ significantly among treatment groups containing rice bran oil (1 to 5%). Our findings are similar with those of Srinivasan *et al.* (2020) [6] who reported that dietary inclusion of rice bran oil (3.5 to 5.5%) caused no significant differences among treatments in serum glucose, triglyceride, total cholesterol, HDL-cholesterol, total protein, albumin and globulin.

On the other hand, our findings partially match with those of Kang and Kim (2016) [7] and Selim *et al*. (2021) [8]. Kang and Kim (2016) [7] observed that feeding the diets containing increasing amount of rice bran oil from 5 to 20 gm/kg feed to broiler chicken had no significant effects on serum glucose and albumin levels, but decreased (linear, $P<0.01$) the concentrations of total cholesterol. Selim *et al*. (2021) [8] also reported that rice bran oil (1 to 2%) inclusion in diets caused no differences in the serum levels of albumin and albumin: lobulin ratio, but reduced total cholesterol and triglyceride, and increased HDL-cholesterol, total protein and globulin concentrations in serum of broilers.

Table 4: Biochemical profile of broiler chicken supplemented with rice bran oil as the key source of fat-origin energy in maize-soybean diets

Dietary treatments	T_0 0% of energy (ME) from oil	T_5 5% of energy (ME) from oil	T_{10} 10% of energy (ME) from oil	SEM	*P*-value
Glucose (mg/dl)	110	120	73	13.70	0.07
Triglyceride (mg/dl)	28	55	38	10.24	0.21
Total cholesterol (mg/dl)	142	151	124	28.74	0.79
HDL-cholesterol (mg/dl)	8	22	16	4.47	0.15
Total protein(g/dl)	1.27	1.65	1.42	0.14	0.56
Albumin (g/dl)	1.27	1.65	1.42	0.15	0.23
Globulin (g/dl)	1.50	0.99	1.44	0.20	0.18
Albumin: globulin ratio	1.88	2.65	1.12	0.74	0.22





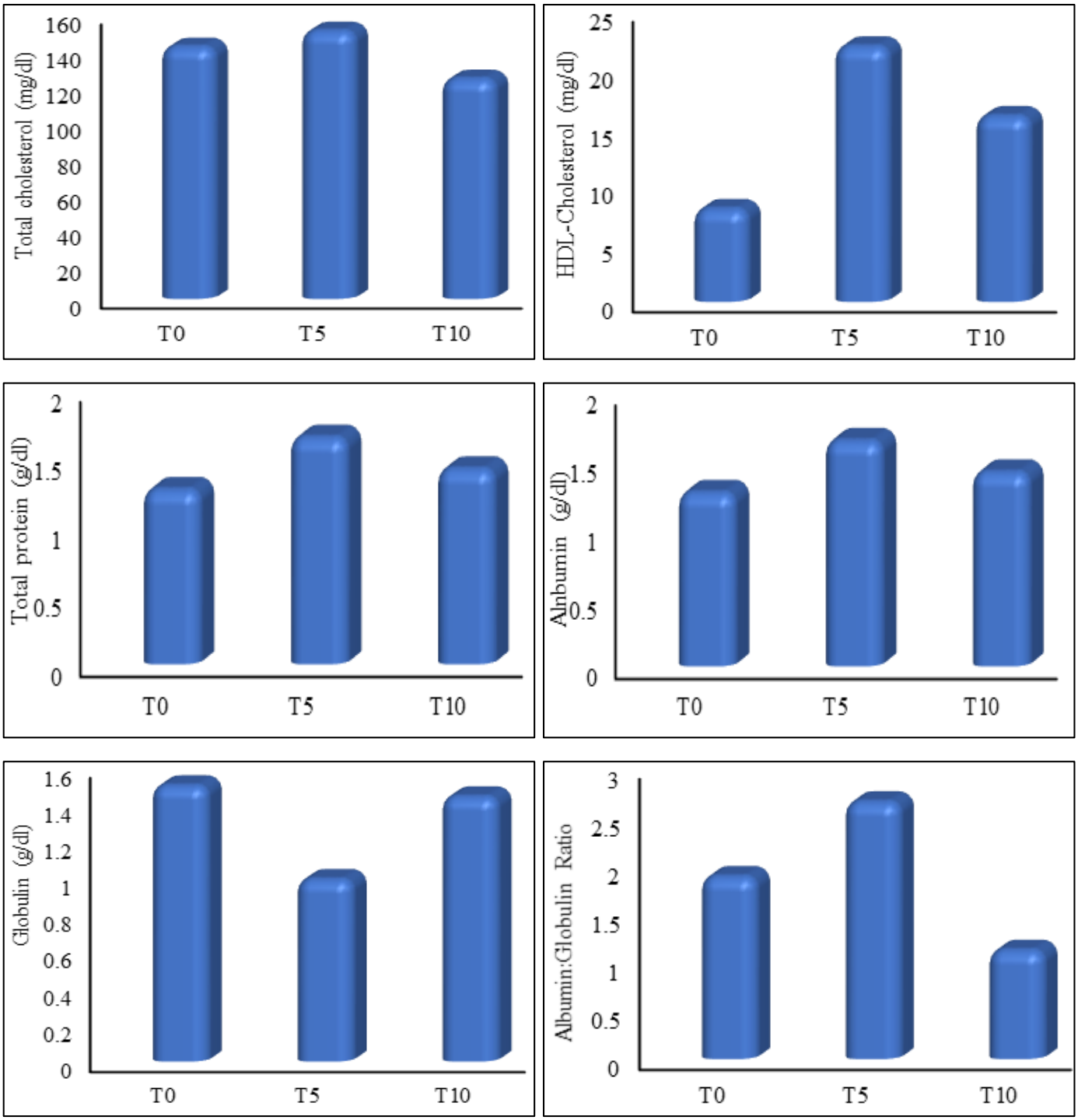


Fig 1: Biochemical profile of broiler chicken supplemented with rice bran oil

4. Conclusion

Diets containing 5% and 10% of total metabolizable energy from rice bran oil in the group T_5 and T_{10} respectively did not produce any detrimental effect on blood biochemical profile of broilers. All the parameters lied within their normal range. Therefore, it can be concluded that 5% to 10% of total metabolizable energy in broilers can be supplemented through rice bran oil to further assess the effects on growth performance and carcass characteristics.

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