

Original Research Article

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Effect of Emulsifier in Low Energy Ration Containing Rice bran oil on Growth Performance of Broiler Chickens

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ABSTRACT

Growth study was conducted to study the effect of emulsifier in low energy diets containing rice bran oil as fat source in the growth performance of commercial broiler chicken. Three treatment groups were fed with basal diet contains crude rice bran oil as energy source (T_1), basal diet supplemented with emulsifier at the rate of 250g per MT of feed (T_2) and 80 kcal Metabolizable energy reduced from basal diet supplemented with emulsifier at the rate of 250g per MT of feed (T_3). Significantly higher cumulative body weight was noticed in T_3 group (2605g) which was comparable with T_2 (2569g) and differs significantly with T_1 (2422g) at 6th week of age. Improved cumulative feed conversion ratio was obtained in T_3 (1.76) and T_2 (1.76) groups and differed significantly with T_1 (1.89) group at 6th week of age. Slaughter studies revealed comparable dressing percentages between T_2 (68.43%) and T_3 (67.34%) and significantly lower dressing percentage in T_1 (66.94%). No significant difference noticed between treatments in carcass parameters and serum biochemical parameters. Inclusion of emulsifier in the low energy broiler ration containing crude rice bran oil has improved cumulative body weight and cumulative feed conversion ratio at market age of broiler chicken.

Keywords

Broilers, Crude rice bran oil, Emulsifier, Lipase, Growth performance

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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). Mostly in broiler feeds oil

is used as concentrate source of energy. Fat digestion is mainly done by lipase. Fat provides twice the energy than either carbohydrates or protein source. Oils increase the feed intake by its flavour and improve the absorption of fat soluble vitamins in the gut.

Digestion of fat mainly done by lipase enzyme, which cannot work until fat is emulsified. In broilers, emulsification mainly done by bile salts, but most of the time its production is not sufficient to emulsify the fat and oil added to the diet.

Hence, Addition of emulsifiers to broiler diet is a recent practice to improve utilization of fat source. (Roy *et al.*, 2010) which increase the active surface of fats allowing more action of lipase to hydrolyse the fats and increases absorption. Emulsifiers can be used to improve fat digestibility and improve energy efficiency (Maertens *et al.*, 2015). As a result, broiler ration can be formulated with low energy diet to maintain the same performance, lower feed cost and economical production. The rice bran is a promising vegetable oil widely used in broiler feed as energy source. Hence, this study was undertaken to study the effect of emulsifier in low energy ration containing rice bran oil on growth performance in broilers.

Materials and Methods

A total of 90 day old Vencobb- 320 broiler chicks belonging to single hatch were procured from local hatchery, wing banded, weighed and randomly distributed into three treatments at the rate of 30 birds per treatment with 5 chicks per replicate using completely randomized design. All the chicks were reared under standard managerial conditions under deep litter system of rearing with ad libitum provision of feed and water throughout the experimental period. The fat emulsifier used in this experiment was purchased from Jubliant Life Sciences, Noida. Crude rice bran oil was used as fat source in all the treatments. The Iso nitrogenous experimental diets were prepared (Table 1) as per Bureau of Indian Standards (BIS, 2007). The chicks were offered with basal diet, basal diet supplemented with fat emulsifier at the rate of 250g per MT of feed and 80 kcal energy reduced from basal diet supplemented with emulsifier at the rate of 250g per MT of feed in treatments T₁, T₂ and T₃ respectively. Cumulative body weight and, cumulative feed consumption were recorded weekly. Blood samples were collected at the end of the

experiment from wing vein of birds in sterile tube and used to study the serum biochemical profile like uric acid (mg/dl), creatinine (mg/dl), total Protein (g/dl), albumin (g/dl), globulin (mg/L), ALT (IU/L), AST (IU/L), triglycerides (mg/dl), total cholesterol (mg/dl), HDL Cholesterol (mg/dl) and Glucose (mg/dl) were estimated. At the end of experiment, three birds from each replicate were selected randomly and slaughtered ethically to study the dressing yield, breast meat, drumstick meat yield and abdomen fat percentage. Data were analysed using completely randomized design the procedures of Snedecor and Cochran (1989) using statistical analysis system (IBM SPSS Version 20.0).

Results and Discussion

Growth performance

The data on cumulative body weight was given in Table 2. There was significant difference ($P < 0.05$) in cumulative body weight between treatment groups in all weeks of age. The emulsifier supplementation significantly increased body weight in all the weeks of trial period. Emulsifier added with energy reduced treatment group (T₃) shown significantly higher body weight (182.6g, 448.7g, 857g, 1313.2g, 1927.2g and 2652g) than basal diet (T₁) treatment group (162.7g, 427.9g, 787.8g, 1219.9g, 1759.8g and 2468g) from first to sixth week of age. Except first and fifth weeks of age body weight of T₃ was comparable with Emulsifier added group (T₂).

At 6th week of age highest body weight was recorded in T₃ group (2652g) followed by T₂ (2617g) and T₁ (2468g) group. Results of this experiment agreed with An *et al.*, (2020) who found that at the end of the experiment, the final body weight of the broilers was significantly higher ($p < 0.05$) in broilers fed the diet supplemented with 0.2% exogenous

emulsifier than in the other treatment groups. Findings of Bontempo *et al.*, (2018) showed a significant improvement in average daily gain with the supplementation of synthetic emulsifier to the feed for one to 12 days. However, the results of the study disagreed with findings of Ferreira *et al.*, (2005) who did not find any significant difference in production performance among birds fed with soya bean oil and tallow with emulsifier.

Similarly, Guerreiro Neto *et al.*, (2011) did not find any difference in broiler growth performance on addition of emulsifier with fat source at 42 days of age. In a similar study, Dabbou *et al.*, (2019) reported that there were no significant differences in Body weight gain or feed intake by supplementation with natural emulsifiers for one to 10 days.

Cumulative feed intake

The cumulative feed intake of birds fed with or without emulsifier is presented in Table 3 revealed no significant difference in feed intake noticed between treatment groups at 6th week of age, but numerically lowered feed intake was observed in T₃ and T₂ groups.

Kulkarni, *et al.*, (2019) reported that supplementing emulsifier in the diet prepared with different oil sources like soya bean oil and rice bran oil as fat source, the feed intake was comparable among different treatment groups during starting phase (0-3 week) but significant increase in feed intake was observed during finishing (3-6 weeks).

Aguilar *et al.*, (2013) reported that supplementing emulsifier and increasing levels of energy provided by palm oil did not affect the feed intake in any period. However, the feed intake of broilers may vary depending on the size of the feed, which requires a more precise study of growth performance.

Feed conversion ratio

The data on cumulative FCR presented in Table 4. At 6th week of age significant difference ($p < 0.05$) in FCR was noticed between T₃ (1.76) and T₁ (1.89) group but comparable FCR was noticed between T₂ and T₃ groups. There was no significant difference noticed between T₂ and T₃ groups in all weeks of trial period, however, except first week numerically improved FCR was noticed in T₃ group.

The improved feed conversion ratio may be due to effect of fat emulsifier which improves fat digestibility and energy utilization. Results of this experiment agreed with An *et al.*, (2020) who reported that supplementing emulsifier at the rate of 0.1% and 0.2% in T₁ and T₂ treatment groups had significantly lower feed conversion ratios ($p < 0.05$) than broilers in the control group. Guerreiro Neto *et al.*, (2011) reported that improved FCR was noticed in broiler diet containing soya bean oil with emulsifier. Bontempo *et al.*, (2018) who reported that FCR was lower when fed AMT emulsifier from 22nd day to 44th day.

The result of this experiment was also agreed with Roy *et al.*, (2010) with exogenous emulsifiers reported beneficial effects on digestibility, body weight, FCR, weight gain and abdominal fat in broiler chicks. The improved FCR could be due to improved energy digestibility depending on the fat source in the normal diet.

Carcass parameters

The effects of supplementing emulsifier on carcass parameters were given in Table 5. The data revealed that there is no significant difference ($p < 0.05$) was noticed in dressing percentage, breast meat yield and drumstick percentage and abdominal fat percentage among treatment groups.

Table.1 Ingredients and chemical composition of broiler Pre starter, Starter and Finisher diets (%)

Ingredients (kg/100kg)	PBS			BS			BF		
	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
Maize	49.80	49.80	52.8	50.20	50.20	52.76	61.19	61.19	63.27
Soya	41.90	41.90	40.6	40.11	40.11	39.34	31.99	31.99	31.64
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31
Calcite	1.20	1.20	1.29	0.97	0.97	0.98	1.44	1.44	1.44
DCP	1.81	1.81	1.82	2.00	2.00	2.00	1.06	1.06	1.04
Crude rice bran oil	3.79	3.79	2.0	5.50	5.50	3.70	3.02	3.02	1.34
Methionine	0.32	0.32	0.30	0.22	0.22	0.20	0.17	0.17	0.16
Lysine	0.22	0.22	0.21	0.07	0.07	0.05	0.10	0.10	0.08
Vitamin Premix*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Mineral premix*	0.2	0.2	0.2	0.2	0.2	0.2	0.2	61.19	0.2
Nutrient Composition (Calculated)									
CP (%)	23.0	23.0	23.0	22	22	22	20	20	20
Crude fibre (%)	3.51	3.51	3.48	3.37	3.39	3.42	3.17	3.15	3.16
Ether extract (%)	5.78	5.78	4.47	7.14	7.05	5.85	5.40	5.45	4.04
Metabolizable energy K.cal	3000	3000	2920	3100	3100	3020	3200	3200	3120

*supplies per kg of diet Vitamin A 16,500 IU, Vitamin D₃ 3200 ICU, Vitamin E 12mg, Vitamin K 2 mg, Vitamin B₂ 10 mg, Vitamin B₆ 2.4mg, Vitamin B₁₂ 12 µg, Niacin 18mg, Pantothenic acid 12mg, Mn 90mg, Zn 72mg, Fe 60mg, Cu 10mg, Iodine 1.2mg

Table.2 Mean cumulative body weight (g) of broilers in various periods

Age in weeks	Treatment 1	Treatment 2	Treatment 3
Hatch weight	45.82 ^{Ns} ±0.76	47.82 ^{Ns} ±0.48	46.52 ^{Ns} ±0.66
1 st week	162.68 ^a ±1.26	188.06 ^b ±0.37	182.58 ^c ±1.82
2 nd Week	427.98 ^a ±4.10	452.94 ^b ±1.25	448.7 ^b ±3.06
3 rd Week	787.78 ^a ±17.06	834.8 ^{ab} ±11.88	857 ^b ±25.89
4 th Week	1219.9 ^a ±22.39	1261.2 ^{ab} ±6.85	1313.2 ^b ±32.57
5 th Week	1759.8 ^a ±32.90	2034 ^b ±34.73	1927.2 ^c ±16.69
6 th Week	2468 ^a ±24.63	2617 ^b ±22.89	2652 ^b ±31.65

Mean value sharing any one common superscript in a column did not differ significantly (p<0.05)

Table.3 Mean Cumulative feed intake (g) of broiler in various periods

Age in weeks	Treatment 1	Treatment 2	Treatment 3
1 st week	147.6 ^{Ns} ±0.93	149.4 ^{Ns} ±2.93	149.2 ^{Ns} ±0.86
2 nd Week	493.46 ^b ±4.95	479.8 ^a ±3.28	469 ^a ±3.30
3 rd Week	1034.91 ^{Ns} ±18.82	1032.396 ^{Ns} ±9.42	1032.62 ^{Ns} ±9.33
4 th Week	1782.73 ^{Ns} ±39.45	1736.79 ^{Ns} ±18.92	1777.75 ^{Ns} ±19.76
5 th Week	2794.2 ^a ±67.72	3115.79 ^b ±54.66	2882.25 ^a ±28.26
6 th Week	4590.01 ^{Ns} ±65.21	4520.80 ^{Ns} ±69.36	4586.26 ^{Ns} ±46.32

Mean valve sharing any one common superscript in a column did not differ significantly (p<0.05)

Table.4 Mean Feed Conversion Ratio of broiler chicken in various periods

	Treatment 1	Treatment 2	Treatment 3
1 st week	1.263 ^b ±0.02	1.065 ^a ±0.02	1.097 ^a ±0.02
2 nd Week	1.291 ^b ±0.02	1.184 ^a ±0.01	1.166 ^a ±0.02
3 rd Week	1.39 ^b ±0.04	1.31 ^{ab} ±0.02	1.27 ^a ±0.03
4 th Week	1.51 ^b ±0.03	1.4 ^a ±0.02	1.4 ^a ±0.02
5 th Week	1.63 ^b ±0.02	1.57 ^{ab} ±0.03	1.53 ^a ±0.01
6 th Week	1.89 ^b ±0.04	1.76 ^a ±0.04	1.76 ^a ±0.01

Mean value sharing any one common superscript in a column did not differ significantly ($p < 0.05$)

Table.5 Mean values of slaughter studies of broiler chicken (%)

Trait	Treatment 1	Treatment 2	Treatment 3
Dressing percentage	66.94±0.23	68.43±1.36	67.34±1.66
Breast percentage	22.72±1.42	21.74±2.41	22.04±2.71
Drumstick percentage	0.85±0.13	0.81±0.16	0.68±0.03
Abdomen fat percentage	8.62±0.33	9.08±0.79	9.18±0.70

Mean bearing different superscript in column differ significantly ($p \leq 0.05$)

Table.6 Mean values of Biochemical parameters of broiler chicken

Parameters	Treatment 1	Treatment 2	Treatment 3
Uric acid mg/dL	5.38±0.69	11.28±2.09	7.7±2.10
Creatinine mg/dL	0.76±0.05	0.96±0.21	0.8±0.1
Total protein g/dL	5.2±0.30	4.82±0.29	5.7±0.4
Albumin g/dL	1.82±0.10	1.56±0.10	1.65±0.15
Globulin mg/L	3.38±0.37	3.26±0.28	4.05±0.25
ALT IU/L	5.6±2.42	5.4±8.18	5.5±4.5
AST IU/L	350.4±50.42	484.6±135.48	472±238
Triglycerides mg/dL	66.1±21.62	72.08±14.80	68.95±13.05
Total cholesterol mg/dL	158.8±15.56	146.4±19.74	147.5±50.5
HDL-Cholesterol mg/dL	54.26±7.79	56.6±10.08	38.4±3.5
Glucose mg/dL	941.44±115.20	985.86±145.87	1192.5 ±266.5

Mean bearing different superscript in column differ significantly ($p \leq 0.05$)

Numerically higher dressing percentage was noticed in T₂ (68.43%) and T₃ group (67.34%) compare to T₁ group (66.94%). Similarly Guerreiro Neto *et al.*, (2011) reported that addition of emulsifier or influence of fat source in the diet did not affect the carcass traits. These results are consistent with Ferreira *et al.*, (2005) reported

that supplementing emulsifier in different fat source in the broiler diet did not affect carcass percentage, parts yield and abdominal fat percentage. An *et al.*, (2020) reported that emulsifier supplementation did not affect meat qualities like water content and drip loss among the treatment groups significantly ($p > 0.05$).

Biochemical parameter

The data on Uric acid (mg/dl), Creatinine (mg/dl), Total Protein (g/dl), Albumin (g/dl), globulin (mg/dl), ALT (IU/L), AST (IU/L), Triglycerides (mg/dl), Total cholesterol (mg/dl), HDL Cholesterol (mg/dl) and Glucose (mg/dl) were presented in Table. 6. The results revealed that no significant difference ($p < 0.05$) in all the biochemical parameters between treatment groups. Serum concentration of glucose is high in T₃ (1192.5 mg/dl) and T₂ (985.86mg/dl) than T₁ group (941.44 mg/dl) indicated that more of glucose is available in T₃ and T₂ group than T₁ group.

This available glucose was utilized for more growth emulsifier supplemented groups. Serum lipid fractions seemed to be more vulnerable to the effects of supplemental emulsifier. The results of this study agreed with Guerreiro Neto *et al.*, (2011) that total cholesterol, HDL or triglycerides not affected by dietary fat source and emulsifier addition. However, Fascina *et al.*, (2009) observed lower serum triglyceride levels reported in broilers fed soya bean oil supplemented with emulsifier than fed tallow in the diet. Similarly Wang *et al.*, (2016) revealed that increased concentration of total cholesterol and LDL cholesterol in emulsifier treated group than control group. This response in serum biochemical parameters may be related to the type of fat source whether vegetable oil or animal source and their inclusion level and multiple potential mechanisms were involved in the regulation of serum cholesterol (Bontempo *et al.*, 2018).

It is concluded that the inclusion of emulsifier at the rate of 250g per metric tonne of feed to the low energy diet that is 80 Kcal lower than the basal diet containing rice bran oil as fat source improved cumulative body weight and feed conversion ratio during market age in broilers. Hence, formulation of low energy

diet with inclusion of emulsifier can be formulated to improve the growth performance in broilers.

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