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Effects of Replacing Palm Oil with Rapeseed Oil on Growth Performance in different Stages of Broiler Chicken

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ABSTRACT: Fats and oils vary in their fatty acid composition. Rapeseed oil (*Brassica napus* var.) has been known as a good source of α-linolenic acid compared to palm oil. Thus a study was carried out to evaluate the effect of incorporation of rapeseed oil in broiler ration on growth performance. A total of 160 day-old broilers (vencobb 400) were randomly allotted into four treatment groups (G1, G2, G3 and G4) having four replicates of ten chicks each. The basal diets (R1) were prepared to meet Bureau of Indian Standards (IS 1374; 2007) nutrient requirements, with vegetable oil (palm oil) included at the rate of 1.5, 3, and 4.5 per cent in pre-starter, starter and finisher ration, respectively. The experimental broiler rations R2, R3 and R4 was prepared with rapeseed oil replacing 25, 50 and 100 per cent of palm oil which included in R1, respectively. Growth performance of pre-starter, starter period was found to similar. During the finisher period feed conversion ratio and weight gain was significantly (P<0.05) influenced due to dietary replacement of palm oil with rapeseed oil. Body weight gain during finisher period was significantly higher in G3 and G4 groups compared to other groups and better feed conversion ratio (FCR) (P<0.01) was observed in G4 (100 per cent rapeseed oil) group and G3 (50 per cent rapeseed oil replaced group) in the basal diet. Replacement of rapeseed oil at 50 per cent and 100 per cent of palm oil in broiler ration during the finisher period can improve the growth performance of broilers.

Keywords: Broiler chickens, Palm oil, Rapeseed oil, Growth performance.

INTRODUCTION

Fat and oil are commonly used in poultry diets to increase the energy density as they yield 2.25 times more calories than carbohydrates and protein. Fat-supplemented diets increase the feed efficiency and profitability in poultry. Besides, oil improves the palatability of diets, reduces the dustiness of feeds and decreases the passage rate of feed through the intestinal tract of poultry, which gives more time for the adequate absorption of all nutrients present in the diet (Baião and Lara 2005). Poultry nutritionists invariably incorporates different sources of oil as an energy source to increase the palatability of feed, feed efficiency and for deposition of fat in broilers. The dietary supplementation vegetable oils alter the fatty acid profile of thigh and breast muscles broiler meat (Valavan *et al*., 2006; Abdulla *et al*. 2015) and dietary composition influences the nutritive quality of poultry meat. Rapeseed oil (*Brassica napus* var.) has been known as a good source of α-linolenic acid (ALA, C18:3 n-3), which can be readily converted to n-3 long chain polyunsaturated fatty acids (LC-PUFA) in poultry and can be included in vegetable oil blends along with sunflower oil, rice bran oil and palm oil to improve omega -3- fatty acid content of broiler ration (Valavan *et al*., 2006). Thus a study was proposed to find effects of replacing palm oil with rapeseed oil on growth performance in different stages of broiler chicken.

MATERIALS AND METHOD

Experimental details and data: This work was supported by the research grant of Kerala Veterinary and Animal Sciences University, Wayanad, Kerala, India. Experimental study was approved by Institutional animal ethical committee under 1271/GO/Re/S/09/CPCSEA-IAEC/COVAS/PKD/10/2019. The feeding experiment was conducted in Instructional Livestock Farm Complex, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Science University, Wayanad, Kerala from the period of January to February 2019.

One hundred sixty, day-old Vencobb 400 broiler chicks were purchased from local hatchery and were separated

into four groups (G_1, G_2, G_3 and G_4) with four replicates with ten chicks. The experimental rations was prepared as per BIS (IS: 1374; 2007) recommendations. The basal diets (R_1) were prepared with vegetable oil (palm oil) included at the rate of 1.5, 3.0, and 4.5 per cent in pre-starter, starter and finisher ration, respectively. The treatment rations R_2, R_3 and R_4 was prepared with rapeseed oil replacing 25, 50 and 100 per cent of palm oil included in R_1, respectively. The ingredient composition of the experimental ration of broiler pre-starter, starter and finisher diet are presented in Table 1, 2 and 3. The feed was prepared at feed mill facilities in Instructional Livestock Farm Complex (ILFC). Feed and water were supplied *ad libitum* up to 42nd day of its age.

Growth performance: Daily feed consumption was calculated by the amount of feed consumed by each bird by subtracting the leftover feed from total feed offered in a day. The live body weight of experimental birds were recorded at weekly intervals in morning hours after withdrawing feeders. Weight gain and body weight was calculated for all replicates from the data collected. Feed conversion ratio (FCR) was calculated by dividing the feed consumption by weight gain at different stage of growth.

Statistical Analysis: The data obtained in this study were analyzed statistically as per the methods described by Snedecor and Cochran (1994) using the SPSS version 21.0 ® software.

Table 1: Ingredient composition of broiler pre-starter feed, (%).

Ingredients	Groups			
	G1	G2	G3	G4
Maize	56.60	56.60	56.60	56.60
SBM	38.00	38.00	38.00	38.00
Palm Oil	1.50	1.13	0.75	0.00
Rapeseed oil	0.00	0.38	0.75	1.50
Salt	0.25	0.25	0.25	0.25
Shell grit	1.00	1.00	1.00	1.00
Di-calcium phosphate	1.60	1.60	1.60	1.60
Trace mineral[5]	0.10	0.10	0.10	0.10
Vitamin premix[6]	0.05	0.05	0.05	0.05
L-Lysine[1]	0.27	0.27	0.27	0.27
DL-Methionine[2]	0.15	0.15	0.15	0.15
L-Threonine[3]	0.05	0.05	0.05	0.05
Choline Cloride[4]	0.10	0.10	0.10	0.10
Feed additive[7]	0.33	0.33	0.33	0.33
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analytical values				
Metabolizable Energy (kcal/kg)	3025.48	3024.75	3024.27	3023.05
Crude Protein (%)	23.01	23.01	23.01	23.01

Table 2: Ingredient composition of broiler starter feed, (%).

Ingredients	Groups			
	G1	G2	G3	G4
Maize	58.15	58.15	58.15	58.15
SBM	35.10	35.10	35.10	35.10
Palm Oil	3.00	2.25	1.50	0.00
Rapeseed oil	0.00	0.75	1.50	3.00
Salt	0.25	0.25	0.25	0.25
Shell grit	1.00	1.00	1.00	1.00
Di-calcium phosphate	1.60	1.60	1.60	1.60
Trace mineral[1]	0.10	0.10	0.10	0.10
Vitamin premix[2]	0.05	0.05	0.05	0.05
L-Lysine	0.22	0.22	0.22	0.22
DL-Methionine	0.07	0.07	0.07	0.07
L-Threonine	0.04	0.04	0.04	0.04
Choline Chloride	0.10	0.10	0.10	0.10
Feed additive[3]	0.32	0.32	0.32	0.32
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analytical values				
Metabolizable Energy (kcal/kg)	3130.04	3128.58	3127.61	3125.18
Crude Protein (%)	21.80	21.80	21.80	21.80

Table 3: Ingredient composition of broiler finisher feed, (%).

Ingredients	Groups			
	G1	G2	G3	G4
Maize	60.97	60.97	60.97	60.97
SBM	30.80	30.80	30.80	30.80
Palm Oil	4.50	3.37	2.25	0.00
Rapeseed oil	0.00	1.13	2.25	4.50
Salt	0.25	0.25	0.25	0.25
Shell grit	1.00	1.00	1.00	1.00
Di-calcium phosphate	1.60	1.60	1.60	1.60
Trace mineral[1]	0.10	0.10	0.10	0.10
Vitamin premix[2]	0.05	0.05	0.05	0.05
L-Lysine	0.20	0.20	0.20	0.20
DL-Methionine	0.06	0.06	0.06	0.06
L-Threonine	0.04	0.04	0.04	0.04
Choline Cloride	0.10	0.10	0.10	0.10
Feed additive[3]	0.33	0.33	0.33	0.33
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analytical values				
Metabolizable Energy (kcal/kg)	3234.16	3231.97	3230.51	3226.87
Crude Protein (%)	20.02	20.02	20.02	20.02

RESULT AND DISCUSSION

A. Growth performance

Growth performance of pre-starter, starter and finisher period of broiler is presented in Table 4. During the finisher period feed conversion ratio and weight gain was significantly (P<0.01) influenced due to dietary replacement of palm oil with rapeseed oil in the present study. Body weight gain during finisher period was significantly higher in G3 group (1490.55g) and G4 (1481.74g) compared to other groups and better feed conversion ratio (FCR) (P<0.01) was observed in G4 (100 per cent rapeseed oil) group and G3 (50 per cent rapeseed oil replaced group) in the basal diet. Feeding palm oil and rapeseed oil at different proportions does not affect feed intake of birds between treatment groups. Similar to our findings, Wang *et al*. (2013); Khatun *et al*. (2016) concluded in their study that weight gain and FCR was in increasing trend with the increased levels of sunflower oil replacing palm oil when included at 6 per cent in the broiler ration during the finisher period. The research findings of other researchers were compared with different oils like rapeseed oil, sunflower oil, soyabean oil and palm oil and their combinations at 5 per cent (Ghasemi *et al*., 2015); 6 per cent (Khatun *et al*., 2016; Baighi and Nobakht 2017) not affected the feed intake during grower and finisher periods in broilers (Abbasi *et al.,* 2021). The improved feed conversion efficiency and weight gain might be due to ratio of saturated and unsaturated fatty acids present in broiler diets. The higher saturated and unsaturated fatty acid ratio in diet needs a higher concentration of bile salts and pancreatic lipase, which are essential for fat digestion and absorption which affect their growth (Burlikowska *et al*., 2010). Hence, rapeseed oil containing diet, which has a higher ratio of UFA and SFA which leads to better fat digestibility (Nobakht *et al.,* 2012).

Table 4: Pre-starter, starter and finisher period growth performance of broiler.

Attribute	GROUP				SEM	p-value
	G1	G2	G3	G4		
Pre-starter						
Feed intake (g/bird)	142.38±2.75	151.16±7.27	153.79 ±5.95	143.9±5.38	2.788	0.434 ^{ns}
Weight gain (g/bird)	126.31±2.53	125.95±2.47	131.11±2.87	127.50±2.59	1.314	0.480^{ns}
FCR	1.15 ±0.04	1.22±0.03	1.20±0.03	1.14±0.02	0.016	0.267^{ns}
Starter						
Feed intake (g/bird)	881.81±16.68	843.76±10.39	875.20±11.77	872.36±23.16	8.197	0.400 ^{ns}
Weight gain (g/bird)	629.38±10.57	593.39±9.81	627.75±11.20	613.79±9.52	5.236	0.056 ^{ns}
FCR	1.42 ±0.03	1.45±0.03	1.43±0.03	1.43 ±0.02	0.013	0.909 ^{ns}
Finisher						
Feed intake (g/bird)	3057.84±93.44	29454.68 ±125.88	3081.67 ±81.49	3058.90±60.28	43.633	0.776^{ns}
Weight gain (g/bird)	1343.85 ^{b}±51.35	1312.07 ^{b}±31.92	1490.55 ^{a}±31.48	1481.74 ^{a}±24.08	18.641	>0.001**
FCR	2.62 ^{a}±0.21	2.40 ^{ab}±0.09	2.17 ^{b}±0.05	2.10 ^{b}±0.04	0.058	0.007**

^{a,b}Mean values with different superscripts within a row differ significantly

** Significance at p<0.01 ^{ns} Non- significant

CONCLUSION

The assessment of dietary inclusion rapeseed oil replacing palm oil at 0, 25, 50 and 100 per cent in broiler feed revealed G3 and G4 group birds shown better weight gain and feed conversion ratio with similar feed intake during the finisher period. So it can be concluded that replacing palm oil with omega-3 rich rapeseed oil at 50 and 100 per cent in the finisher period is having better growth performance.

FUTURE SCOPE

Future scope for this experiment can be carried out on The omega 3 fatty acid rich oil source in other species of poultry for it is recommendation.

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Conflict of Interest. None.

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