

Serum Lipid Profile and Carcass Quality of Broilers Supplemented with Rapeseed Oil and Palm Oil

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ABSTRACT

The objectives of this study were to study effect of feeding rapeseed oil (RO) and palm oil (PO) on qualitative carcass traits and serum lipid profile of broilers. 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. The birds were slaughtered on 42nd day to study serum lipid profile and carcass parameters. The triglycerides and total cholesterol levels in G₄ group were significantly ($P < 0.01$) reduced compared to other palm oil and mixed oil fed group (G₁, G₂ and G₃). The crude fat content of G₄ group carcass was significantly ($P < 0.001$) decreased compared to G₁. However, moisture, crude protein, total ash content was not affected by the dietary fat alterations. The qualitative parameters like colour and pH value of carcass are not affected by the different oil sources in their diet. This study clearly demonstrated that omega-3 fatty acid rich rapeseed oil and their combination had significantly reduced the serum lipid concentration and crude fat concentration in carcass which is desirable character in consumer's preference.

Keywords: Broilers, Carcass composition, Colour, Rapeseed oil, Serum lipid

INTRODUCTION

Even though, the broiler meat contains higher protein and low fat content with better omega-3-fatty acids than other livestock meat. The increased risk of coronary heart diseases and

atherosclerosis with consumption of broiler meat among human beings are reported alarmingly. Consumers are more aware that of diet quality and demand healthier, wholesome, nutritious meat.

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Unlike, beef or lambs, dietary fatty acids supplemented in diets are absorbed and deposited in the muscle without significant modification in mono-gastric animals. The study conducted with dietary supplementation of selenium, copper, garlic and omega-3-fatty acids proved reduced cholesterol level in poultry meat (Esenbuga et al., 2013). During recent years, different research findings recommend dietary supplementation of different fat sources in broiler ration to increase the energy density.

The poultry nutritionists invariably incorporate low-priced oil (palm oil) as energy source in broiler ration and also various sources of dietary oil for the purpose of increasing the level of n-6 and n-3 poly unsaturated fatty acids. Rapeseed oil is also one of the omega-3 rich fatty acid sources included in broiler ration along with other vegetable oil blends like sunflower oil, De-oiled Rice Bran oil and Palm oil. Dietary saturated fatty acids are related to high plasma cholesterol levels and consumption of Polyunsaturated Fatty Acids (PUFA) has been shown to have beneficial effects on human health (Mensink & Katan, 1995). Like that, oils rich in monounsaturated fatty acids (MUFA) were found also to be effective in lowering plasma cholesterol level. Meat colour also plays a major role in consumers preferences and it is influenced by sex, age, muscle pigments, meat pH, preslaughtering condition and processing (Sabow et al., 2016; Salwani et al., 2016). Hence, the proposed study is to ascertain the carcass composition and serum lipid profile after inclusion of rapeseed oil replacing palm oil at different ratio in broiler ration for 42 days.

MATERIALS AND METHODS

Experimental details and data

One hundred sixty, day-old Vencobb 400 broiler chicks was purchased from local hatchery and was separated into four groups (G1, G2, G3 and G4) with four replicates with ten chicks. The experimental rations was prepared as per BIS (IS: 1374; 2007) recommendations. The basal diets (R₁) were

prepared to 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 R₂, R₃ and R₄ was prepared with rapeseed oil replacing 25, 50 and 100 per cent of palm oil which included in R₁, respectively. The feeding experiment was conducted in Poultry Farm, Instructional Livestock farm complex, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Science University, Wayanad, Kerala. Feed and water were supplied *ad libitum* up to 42nd day of its age. At the end of the experiment four birds per treatment group were randomly selected for slaughtering and blood serum was collected for lipid profile and carcass parameter study.

Chemical composition of carcass

The sample of broiler carcass collected as mentioned in FSSAI, 2017. The deboned meat was passed through meat chopper with 1/8th inch or 3 mm opening to chop meat with 3 mm size and chopped fresh meat was mixed thoroughly and analyzed for chemical composition (AOAC., 2016).

Serum lipid profile

The peroxidase coupled method and CHOD-PAP method were used to estimate serum triglycerides and total cholesterol, respectively using standard kits supplied by Agappe Diagnostics, Maharashtra, India.

pH

The pH content carcass samples were measured by using a digital pH meter (EUTECH instruments pH 510, Singapore). Ten grams of meat sample was blended with 50 ml distilled water and homogenized for one minute at 4000 rpm using tissue homogenizer (Kinematica, Switzerland). The pH of the homogenate was recorded by immersing the combined glass electrode of a digital pH meter (AOAC., 2016).

Hunter Lab colour (L* a* b*) values

Colour values of the treatment and control poultry meat samples were determined objectively as per Mancini *et al.* (2013) using Hunter Lab Mini Scan XE plus Spectrophotometer (Hunter Lab, Virginia, USA) with diffuse illumination. The instrument was set to measure Hunter L* a*

and b^* using illuminant 45/0 and 10° standard observer with an aperture size of 2.54 cm. It was calibrated using black and white calibration tiles before starting of the measurement and colorimeter score recorded with 'L' of black equals zero and 'L' of white equals 100, 'a' of lower numbers equals more green (less red), higher numbers equals more red (less green) and 'b' of lower numbers equals more blue (less yellow), higher numbers equals yellow (less blue). The colour coordinates L^* (lightness), a^* (redness) and b^* (yellowness) of the samples were measured thrice and mean values were taken.

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.

RESULTS AND DISCUSSION

Serum lipid profile

The serum lipid profile of broilers fed on different fat source is presented in Table 1. Dietary supplementation of the rapeseed oil in place of palm oil at different ratio had not affected the total protein concentration of blood serum between groups. However, dietary inclusion of rapeseed oil replacing palm oil significantly ($P < 0.01$) decreased the serum total triglycerides and cholesterol level.

Similar to our findings, Ghasemi et al. (2016) reported reduction in serum cholesterol and triglycerides level in diet fed with canola oil while it was compared to sunflower oil at five percent inclusion level in broiler ration. The research findings of Bharath et al. (2014) and Kannan et al. (2013) with linseed oil or fish oil replacing sunflower oil in the broiler diet reduces total triglycerides and cholesterol level. The reasons for reduction in blood triglycerides and cholesterol concentrations in the rapeseed oil-fed broilers might be due higher rate of β -oxidation of unsaturated fats, leading to a higher rate of triglyceride uptake from the blood stream to the tissues (Sanz et al., 2000). However, other researcher Burlikowska et al. (2010) reported different vegetable oil sources had no effect on blood serum lipids.

Carcass chemical composition

The present study revealed that feeding palm oil and rapeseed oil at different proportions in broilers affected the crude fat content in their muscle composition. The chemical composition estimated in G1, G2, G3 and G4 group birds carcass is presented in Table 2. The crude fat content of G4 group birds carcass were decreased ($P < 0.001$) compared to other groups. However, moisture, crude protein, total ash was not affected by the dietary fat source.

In corroborates to our findings, Ghasemi et al. (2015) and Bostami et al., (2017) reported decreased crude fat content of meat fed with canola oil at 5 per cent in broiler ration compared to sunflower oil fed group ($P < 0.05$). Like that, Kavouridou et al. (2008) concluded in his research that body fat content of linseed oil fed group was lower ($P < 0.001$) than soya bean oil and palm oil fed groups. Another researcher, Bharathi et al. (2014) concluded that lower fat content on intramuscular fat in both breast and thigh muscle when vegetable fat of SFO was replaced by LO and FO. Whereas, Gallardo et al. (2012) reported dietary fat source was not affected fat deposition in broiler chicken muscle. Reason for the difference in body fat accumulation was attributed by various metabolic use of the absorbed dietary, dietary PUFA levels, n-6/n-3 ratio and decreased rate of fatty acid synthesis (Bharathi et al., 2014).

Carcass colour and pH

The carcass pH, L^* (lightness), a^* (redness) and b^* (yellowness) values for different treatment groups is presented in Table 3. Dietary oil had no influence on L^* (lightness), a^* (redness), b^* (yellowness) and pH value of pooled carcass among treatment groups. These results are similar to the findings of Khatun et al. (2018) on pH, L^* (lightness), a^* (redness) and b^* (yellowness) value of carcass fed with palm oil, sunflower oil and their combination at 6 per cent in broiler ration. Jankowski et al. (2012) in turkey, reported that meat colour parameters did not change with the dietary supplementation of soyabean oil, rapeseed oil and linseed oil.

Table 1: Serum lipid profile of broilers supplemented with rapeseed oil and palm oil

Parameter	GROUP				SEM	P-value
	G1	G2	G3	G4		
Total protein (g/dl)	3.58 ± 0.14	3.18 ± 0.03	3.43 ± 0.02	3.31 ± 0.16	0.070	0.195 ^{ns}
Triglycerides (mg/dl)	135.50 ± 3.50 ^a	120.00 ± 1.00 ^b	112.50 ± 2.50 ^b	97.00 ± 4.00 ^c	5.361	0.004**
Cholesterol (mg/dl)	145.00 ± 1.00 ^a	132.50 ± 0.50 ^b	121.00 ± 2.00 ^c	107.50 ± 4.50 ^d	5.328	0.002**

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

**Significance at p<0.01

^{ns} Non- significant

Table 2: Chemical composition of carcass supplemented with rapeseed oil and palm oil

(As such basis)

Attributes (%)	Groups				SEM	p-value
	G1	G2	G3	G4		
Moisture	75.76 ± 0.38	75.09 ± 0.30	75.85 ± 0.36	76.32 ± 0.27	0.194	0.151 ^{ns}
Ether extract	6.43 ± 0.31 ^a	5.42 ± 0.12 ^b	5.31 ± 0.14 ^b	5.47 ± 0.03 ^b	0.156	0.008**
Crude protein	86.15 ± 0.44	87.01 ± 0.27	87.23 ± 0.02	84.19 ± 2.65	0.681	0.422 ^{ns}
Total ash	4.11 ± 0.08	4.36 ± 0.18	4.14 ± 0.07	4.19 ± 0.06	0.055	0.428 ^{ns}

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

**Significance at P < 0.01

^{ns} Non- significant

Table 3: Color and pH values broiler meat supplemented with rapeseed oil and palm oil

Attribute (%)	Groups				SEM	P-value
	G1	G2	G3	G4		
Ph	5.49 ± 0.04	5.48 ± 0.06	5.61 ± 0.09	5.53 ± 0.08	0.033	0.594 ^{ns}
L*	52.83 ± 1.43	54.49 ± 1.87	52.45 ± 1.41	55.68 ± 3.05	0.986	0.667 ^{ns}
a*	5.78 ± 0.20	5.91 ± 0.33	5.71 ± 0.39	6.01 ± 0.72	0.203	0.967 ^{ns}
b*	14.40 ± 1.81	15.13 ± 0.44	16.21 ± 1.69	15.69 ± 0.75	0.612	0.792 ^{ns}

^{ns} Non- significant

CONCLUSION

It may be concluded that, dietary inclusion of rapeseed oil reduced the serum cholesterol content and improved meat quality by reducing crude fat content without affect protein content. Meat colour and pH was not affected by the dietary added fat source is a desirable character. The lower meat fat content which might be preferred by the consumer and maybe branded as designed meat.

REFERENCES

AOAC. (2016). Official Methods of Analysis. (20th Ed.). Association of Official

Analytical chemists, Virginia, USA: pp. 1-85.

Bureau of Indian Standards (BIS) IS 1374: (2007). Poultry Feeds – Specification (5th revision).

Bharathi, N. (2014). OMEGA-3 fatty acids enrichment of broiler chicken meat through dietary manipulations. *Doctoral dissertation*. P. V. Narsimha Rao Telangana Veterinary University Hyderabad. 101pp

Bostami, A.B.M.R., Mun, H. and Yang, C. (2017). Breast and thigh meat chemical composition and fatty acid

- profile in broilers fed diet with dietary fat sources. *J. Food Process. Technol*, 8, 672.
- Burlikowska, K., Piotrowska, A., & Szymeczko, R. (2010). Effect of dietary fat type on performance, biochemical indices and fatty acids profile in the blood serum of broiler chickens. *J. Anim. Feed Sci*, 19(3), 440-451.
- Esenbuğa, N., Macit, M., Karaoglu, M., Aksu, M.I., & Bilgin, O.C. (2014). Effects of dietary humate supplementation to broilers on performance, slaughter, carcass and meat colour. *J. Sci. Food Agri.*, 88(7), 1201-1207.
- Food safety and standards authority of ndia, (2017). *Manual for analysis of meat and meat products*. pp. 1-86.
- Ghasemi, H.A., Shivazad, M., Mirzapour Rezaei, S.S., & Karimi Torshizi, M.A. (2016). Effect of synbiotic supplementation and dietary fat sources on broiler performance, serum lipids, muscle fatty acid profile and meat quality. *Br. Poult. Sci.*, 57(1), 71-83.
- Jankowski, J., Zduńczyk, P., Mikulski, D., Juśkiewicz, J., Mikulska, M., & Zduńczyk, Z. (2012). Effects of dietary soyabean, rapeseed and linseed oils on performance, slaughter yield and fatty acid profile of breast meat in turkeys. *J. Anim. Feed Sci.*, 21(1), 143–156.
- Kannan, M.S., & Mani, K. (2013). Effect of saturated and unsaturated fat on the performance, serum and meat cholesterol level in broilers. *Vet. Wld.*, 6(3), 159-162.
- Kavouridou, K., Barroeta, A.C., Villaverde, C., Manzanilla, E.G., & Baucells, M.D. (2008). Fatty acid, protein and energy gain of broilers fed different dietary vegetable oils. *Spanish J. Agric. Res.*, 6(2), 210-218.
- Khatun, J., Loh, T.C., Akit, H., Foo, H.L., & Mohamad, R. (2018). Influence of different sources of oil on performance, meat quality, gut morphology, ileal digestibility and serum lipid profile in broilers. *J. Appl. Anim. Res.*, 46(1), 479-485.
- Mancini, R., (2013). 9 Meat Color. *Sci. meat quality*, pp.177.
- Sabow, A.B., Sazili, A.Q., Aghwan, Z.A., Zulkifli, I., Goh, Y.M., Ab Kadir, M.Z.A., Nakyinsige, K., Kaka, U., & Adeyemi, K.D. (2016). Changes of microbial spoilage, lipid-protein oxidation and physicochemical properties during post mortem refrigerated storage of goat meat. *Anim. Sci. J.*, 87(6), 816-826.
- Salwani, M.S., Adeyemi, K.D., Sarah, S.A., Vejayan, J., Zulkifli, I., & Sazili, A.Q. (2016). Skeletal muscle proteome and meat quality of broiler chickens subjected to gas stunning prior slaughter or slaughtered without stunning. *CyTA-J. Food*, 14(3), 375-381.
- Sanz, M., Lopez-Bote, C.J., Menoyo, D., & Bautista, J.M., (2000). Abdominal fat deposition and fatty acid synthesis are lower and β -oxidation is higher in broiler chickens fed diets containing unsaturated rather than saturated fat. *J. nutr.*, 130(12), 3034-3037.
- Snedecor, G.W., & Cochran, W.G. (1994). *Statistical Methods* (8th Ed.). The Iowa State University Press, Ames, Iowa. USA 314p.