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Effect of chitosan and L-carnitine supplementation on carcass characteristics of broiler chicken#

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Abstract

The experiment was conducted to compare the effect of chitosan and L-carnitine supplementation on carcass characteristics of broiler chicken. A total of 150, day-old Vencobb 430Y broiler chicks were randomly selected and divided into three treatments with five replicates of ten birds each. The dietary treatment groups were as follows: T_1 -standard broiler ration (SBR) formulated as per BIS (2007); T_2–SBR supplemented with chitosan at 30 g/kg diet; T_3–SBR supplemented with L-carnitine at 0.05 g/kg diet. The results indicated that the mean abdominal fat pad per cent of broilers in chitosan supplemented group (T_2) was significantly ($p<0.01$) lower than L-carnitine supplemented group (T_3) and both were statistically lower than the control group. However, there was no significant difference in other carcass characteristics among treatment groups except the heart yield percentage. The mean heart yield per cent of broilers showed a significantly ($p<0.05$) lower value in broilers fed with chitosan as compared to the other treatment groups. The results obtained from the study indicated that supplementation of chitosan and L-carnitine caused a significant reduction in the abdominal fat pad per cent without any adverse effects on growth performance as well as carcass characteristics of broiler chicken.

Keywords: *Chitosan, L-carnitine, abdominal fat pad per cent*

The choice of a health-conscious society is to reduce the intake of cholesterol and saturated fats without compromising on eating habit. Poultry meat is one of the major types of meat consumed by humans because the consumption pattern has shifted from red meat to white meat which is low in cholesterol and saturated fat. However, modern broilers contain fat not less than 100

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g per kg body weight, which is physiologically inessential and cause high risk because of the increase in eating habits of processed chicken (Ramamoorthy, 2011).

Chitosan is a linear polysaccharide with low viscosity and it is produced commercially from crab and shrimp shell waste by deacetylation of chitin. Chitosan has potent hypolipidaemic effect due to its high anion exchange property and it exhibit a bile acid binding capacity which can interrupt enterohepatic bile acid circulation. It can reduce the levels of bile acids and thereby decrease lipid absorption and increase faecal cholesterol excretion (Kobayashi *et al*., 2002).

The dietary supplementation of certain organic compounds results in the reduction of carcass fat in broiler. According to Hariharan and Gowrishanker (2002), niacin, a form of vitamin-$B_{3,}$ reduced the total body lipid and carcass fat in broiler chicken. Similarly, L-Carnitine, an amino acid derivative which can reduce the carcass fat in broiler chicken by transporting long-chain fatty acids across the inner mitochondrial membrane during beta-oxidation. The dietary supplementation of L-carnitine decreases fat deposition by reducing the activities of glucose-6-phosphate dehydrogenase (G-6-PDH), malate dehydrogenase (MDH) and lipoprotein lipase (LPL) as suggested by Xu *et al.* (2003).

The abdominal fat pad is a reliable parameter for judging the total body fat content because it is directly linked to the total body fat content in avian species. It is also accepted that reducing the absorption of dietary fat and fatty acid synthesis or promoting fatty acid beta-oxidation declines abdominal fat deposition in broiler. Therefore, this study was conducted to compare the effects of chitosan and L-carnitine supplementation on carcass characteristics as well as abdominal fat pad per cent in broiler chicken.

Materials and methods

Experiment was conducted in the Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy using 150, day-old commercial broiler chicks (Vencobb-430Y) from day-old to 42 days of age. All the chicks were wing banded, weighed individually and randomly allotted to three dietary treatment groups, each group consisting of five replicates of ten birds each, in a completely randomized design. At the end of the experiment (42nd day), 10 birds from each treatment group were randomly selected, weighed and starved for 12 hours and humanely slaughtered.

Experimental diets

The three experimental treatments in the trial were: **T_1-**The standard broiler ration (SBR) formulated using maize and soybean meal as per BIS (2007) specifications, **T_2-**SBRsupplemented with chitosan at the rate of 30 g/kg diet (Razdan and Petterson, 1997),**T_3-**SBR supplemented with L-carnitine at the rate of 0.05 g/kg diet (Kheiri *et al.*, 2011).

Standard managemental practices were followed throughout the experiment. The feed and water were given *ad-libitum* to the birds. The feed samples were subjected to proximate analysis as per AOAC (2016). The ingredient composition of the experimental rations fed to the birds are presented in Table1.

Data collected on various parameters were analyzed using SPSS Version 24.0.

Results and discussion

Carcass characteristics

The effects of experimental treatments on carcass characteristics are summarized in Table 2.The dietary supplementation of chitosan significantly($p<0.01$) reduced the abdominal fat pad per cent in broiler chicken. These results are in accordance with Razdan and Petterson (1997), (chitosan supplementation at 30 g/kg diet); Kobayashi *et al.* (2002), (chitosan at 50 g/kg diet) and Kim and Kim (2009), (chitosan at the rate of 20 g/kg diet). The reduction in the abdominal fat pad per cent was due to the bile acid binding capacity of chitosan. It reduces the lipase activity and thereby decrease lipid absorption and increase fecal cholesterol excretion (Kobayashi *et al*., 2002). In contrast to our findings, Studies of Chang *et al*. (2020) who supplemented chitosan oligosaccharide

Table 1. Ingredient composition of experimental rations, per cent

Ingredients	Pre-starter (0-7 days)	Starter (8-21 days)	Finisher (22-42 days)
Yellow maize	51. 23	52.70	56.52
SBM	42.00	39.20	34.13
Rice bran oil	2.80	4.20	5.30
Dicalcium phosphate	1.80	1.83	2.06
Calcite	1.40	1.40	1.30
Salt	0.30	0.30	0.30
Sodium bicarbonate	0.15	0.15	0.15
L-Lysine [1]	0.23	0.20	0.07
DL -Methionine[2]	0.17	0.20	0.20
Total	100	100	100

Additional supplements (g /100 kg feed)
Liver tonic- 25 g, Trace mineral mixture, Choline and Toxin binder -100 g,
Anticoccidialand Vitamin premix- 50 g

Table 2. Effect of dietary treatments on carcass characteristics of broilers at six weeks of age

Parameters	Treatments			F-value	p-value
	T1 SBR (control)	T2 SBR + chitosan	T3 SBR + L-carnitine		
Pre-slaughter bodyweight, g	2579.40±84.87	2573.80±53.55	2536.40±46.63		
Carcass yield %	75.45±1.08	75.91±1.02	75.71±1.28	0.19^{ns}	0.83
Abdominal fat pad %	1.51^{a} ±0.19	0.80^{c} ±0.12	1.06^{b}±0.13	27.77**	0.001
Breast %	26.85±1.6	27.48±0.74	25.90±0.82	2.52^{ns}	0.12
Wings %	7.66±0.09	7.93±0.55	7.68±0.09	2.70^{ns}	0.11
Thighs %	11.96±0.64	12.24±0.55	12.02±0.41	0.37^{ns}	0.69
Drumstick %	10.42±0.15	10.24±0.24	10.12±0.26	2.33^{ns}	0.14
Liver %	1.66±0.13	1.56±0.15	1.80±0.31	1.60^{ns}	0.24
Gizzard %	1.79±0.23	1.78±0.13	1.70±0.10	0.50^{ns}	0.62
Heart %	0.46^{ab} ±0.07	0.42^{b} ±0.04	0.49^{a} ±0.01	3.98*	0.04

Mean bearing different superscript within a row differ significantly (p<0.05)
a,b :Means in a row bearing at least one common superscript do not differ significantly
ns-non significant *significance at p<0.05 **significance at p<0.01

(COS) at the rate of 200 mg/kg diet and Tufan and Arslan (2020) who supplemented COS at the rates of 50 mg/kg and 100 mg/kg diet did not have any significant effect on abdominal fat per cent. The reason behind the non-significant effect of chitosan on abdominal fat deposition might be due to the lower levels of inclusion of chitosan.

L-carnitine supplementation also significantly (p<0.05) reducedthe abdominal fat pad per cent in broiler as compared with control group. Similarly, Kheiri *et al.* (2011) and Farrokhyan *et al*. (2014) found that there was a significant reduction in the abdominal fat deposition in broiler chicken by the supplementation of L-carnitine at the rate of 50 mg/kg and 150 mg/kg diet, respectively.

The dietary supplementation of chitosan and L-carnitine caused a significant reduction in the abdominal fat deposition without any adverse effects on carcass characteristicsof broiler chicken. Moreover, the findings of the present experiment showed that the abdominal fat pad per cent was lowest in chitosan supplemented

group as compared with L-carnitine supplemented group.

Conclusion

The results obtained by the present study indicated that supplementation of chitosan and L-carnitine at the current levels of inclusion caused a significant reduction in the abdominal fat pad per cent without any adverse effects on carcass characteristics of broiler chicken and thereby proved to be beneficial in producing low-fat broiler meat. Moreover, the statistical analysis of the data showed that the abdominal fat pad per cent was lowest in chitosan supplemented group as compared with L-carnitine supplemented group.

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Conflict of interest

The authors report no conflict of interest.

References

AOAC [Association of Official Analytical Chemists]. 2016. Official methods of analysis of AOAC International. (19th Ed.) Gaitherburg, Maryland, USA.

BIS [Bureau of Indian Standards]. 2007. Indian standards poultry feed specification. 5th revision. IS 1374: 2007.

Chang, Q., Lu, Y. and Lan, R. 2020. Chitosan oligosaccharide as an effective feed additive to maintain growth performance, meat quality, muscle glycolytic metabolism and oxidative status in yellow-feather broilers under heat stress. *Poult. Sci*. **99**: 4824-4831.

Farrokhyan, P., Bouyeh, M., Frederick, L.M., and Seidavi, A. 2014. The effects of dietary L-carnitine and gemfibrozil on performance, carcass characteristics, cholesterol and triglycerides in broiler chicks. *Avian Biol. Res*. **7**: 160-166.

Hariharan, P. and Gowrishanker, B. 2002. Effect of nicotinic acid on plasma and body proteins and lipids in broilers. *J. Vet. Anim. Sci.***33**: 41-45.

Kheiri, F., Pourreza, J., Ebrahimnezhad, Y., Nazerad, K. and Abadi, S.M.A.J.H. 2011. Effects of supplemental ractopamine and L-carnitine on growth performance, blood biochemical parameters and carcass traits of male broiler chicks. *Afr. J. Biotech*. **10**: 15450-15455.

Kim, Y.J. and Kim, B.K. 2009. Effects of dietary chitosan supplementation with chitosan feeding levels and feeding forms on growth performance and carcass characteristics of thigh muscular in broiler. *Korean J. Poult. Sci*. **36**: 29-37.

Kobayashi, S., Terashima Y. and Itoh H. 2002. Effects of dietary chitosan on fat deposition and lipase activity in digesta in broiler chickens. *Br. Poult. Sci*. **43**: 270-273.

Ramamoorthy, D. 2011. Lean meat efficiency in broiler. *Engormix*. **9**: 11-14.

Razdan, A. and Petterson, D.1997. Broiler chicken body weights, feed intakes, plasma lipid and small intestinal bile acid response to feeding of chitosan and pectin. *Br. J. Nutr*. **78**: 283-291.

Tufan, T. and Arslan, C. 2020. Dietary supplementation with chitosan oligosaccharide affects serum lipids and nutrient digestibility in broilers. *S. Afr. J. Anim. Sci*. **50**: 663-671

Xu, Z.R., Wang, M.Q., Mao, H.X., Zhan, X.A. and Hu C.H. 2003. Effects of L-carnitine on growth performance, carcass composition and metabolism of lipids in male broilers. *Poult. Sci*. **82**: 408-413.

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