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Effect of Dietary L-Carnitine Supplementation with Animal Fat on Carcass Characteristics of Broiler Chicken

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ABSTRACT

Study was carried out to find out the effect of L-carnitine supplementation on carcass characteristics in Venncobb broiler chicks fed with diet containing animal fat. Eighty day old commercial broiler chicks were randomly allotted to two treatment groups (T_1 and T_2) with four replicates of ten chicks each. The birds were fed with standard broiler chicken ration (BIS, 1992) containing 5% animal fat. T_1 was the control, while T2 was supplemented with L-carnitine (900 mg/kg feed). At the end of 42 days, five birds from each treatment were slaughtered in order to determine carcass traits and organ weights. The results revealed that the supplementation of L-carnitine lowered the abdominal fat content of birds. However, L-carnitine supplementation had no effect on the body weight gain, slaughter weight, carcass weight, dressing percentage, giblet yield percentage and weight of internal organs.

Keywords: Animal fat, L-carnitine, carcass characteristics, broiler chicken

Broiler industry is growing rapidly throughout the developing countries. In the past 20 years, there was a significant increase in growth rate and feed efficiency in broiler chicken. Researchers have been concerned over the recent years to find out solutions for poultry feeding, to support high broiler performance and to lower feeding costs. Feed cost accounts for 70% of the cost of production of broilers and the cost of energy feeds alone contributes a major part (Saleh *et al*. 2004). Therefore, addition of fat is an alternative strategy for increasing the energy value of feed. Nowadays, due to the use of highly modern rendering technologies, the by-products of abattoirs such as meat cum bone meal, blood meal, animal fat and feather meal are available at competitive prices. Among these, animal fat is a cost effective source of energy. However, the major problem of adding animal fat to commercial broiler diets is the accumulation of excess fat in the bird resulting in a lower dressing percentage.

Fat metabolism can be manipulated by certain feed additives. L-carnitine is used to alter the fat metabolism and deposition, mainly through their lipolytic and growth promoter properties. Carnitine is a quaternary amine compound (β-hydroxy γ-trimethylaminobutyrate) found in two stereo isomeric forms, D and L-carnitine (McDowell, 2000). It is synthesized from two essential amino acids, lysine and methionine in the animals. Endogenous biosynthesis of L-carnitine is sufficient for normal requirements. However, it may not be sufficient in the case of neonates, during stress and when birds are fed diets rich in fat (Rabie and Szilagyi, 1998). L-Carnitine supplementation of diets could be used to

augment carnitine supply for use in metabolism and thereby facilitating fatty acid oxidation and reducing the amount of long-chain fatty acids available for storage in adipose tissue. Previous researches indicated that supplementation of L-carnitine reduces abdominal fat deposition in broilers (Rezaei *et al.,* 2007). Likewise, Deniz *et al.* (2006) and Oladele *et al.* (2011) noticed that supplementation of L-carnitine improved the carcass yield and dressing percentage in broilers. Thus addition of L-carnitine in the diet could enhance the utilization of dietary fat and other dietary components would be metabolized in favour of protein accretion.

In view of the key role of L-carnitine in energy metabolism, it is hypothesized that its incorporation into broiler diets may contribute to a reduction in the degree of adiposity in broiler chickens, particularly when they are fed on diet with added animal fat. Thus, the purpose of the current study was to investigate the responses to supplemental dietary L-carnitine in diets with animal fat on carcass characteristics of broiler chicken.

MATERIALS AND METHODS

Eighty day old vencobb broiler chicks were used for the study and the chicks were randomly divided into two treatment groups (T1 and T2) with four replicates of ten chicks each. The chicks were reared under deep litter system throughout the experiment. The dietary treatments were control group (T_1) fed standard broiler ration (BIS, 1992) containing 5 per cent animal fat while the second treatment group (T_2) was offered the same ration supplemented with L-carnitine at 900 mg/kg diet. The birds were fed with standard broiler starter ration

Table 1. Ingredient composition of broiler starter and finisher ration, %

	Broiler starter rations, %		Broiler finisher rations, %	
Ingredients	**T1**	**T2**	**T1**	**T2**
Maize	40	40	48.5	48.5
Soybean meal	41.4	41.4	32.89	32.89
Wheat bran	9	9	9	9
Animal fat	5	5	5	5
Di calcium phosphate	2	2	2.1	2.1
Calcite	1.79	1.79	1.8	1.8
DL-methionine	0.14	0.14	0.04	0.04
Choline chloride	0.1	0.1	0.1	0.1
Trace mineral mixture	0.01	0.01	0.01	0.01
B complex vitamins	0.01	0.01	0.01	0.01
Vitamin-AB_2D_3K	0.1	0.1	0.1	0.1
Toxin binder	0.1	0.1	0.1	0.1
Coccidiostat	0.05	0.05	0.05	0.05
Liver supplement	0.05	0.05	0.05	0.05
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
To 100kg of the above mixture following are added				
L-Carnitine (mg/kg)	—	900	—	900

up to 4 weeks of age and finisher ration up to 6 weeks of age as per BIS (1992). The ingredient and chemical composition of the two different broiler starter and finisher rations are presented in Table 1 and 2. All birds were maintained under identical management conditions. Feed and clean drinking water were provided *ad libitum* in all the pens throughout the experimental period. The chemical composition of experimental rations was determined as per the standard procedures (AOAC, 2012). At the end of the experimental period of 42 days, five birds from each treatment were fasted overnight, slaughtered and dressed as per the procedure described in BIS (1973). Data on carcass weight, dressed weight, weight of internal organs and abdominal fat were also recorded. Data collected on various parameters were statistically analyzed (Snedecor and Cochran 1994). Means were compared by Independent Samples t Test.

Trace mineral mixture containing Manganese sulphate-60 g, Zinc sulphate-50 g, Ferrous sulphate-40 g, Iodide-2 g, Copper-5 g, Cobalt-2 g and Selenium-0.3 g. B complex vitamins containing Vitamin B_1-8 mg, Vitamin B_6-16 mg, Vitamin B_{12}-80 mcg, Vitamin E_{50}-80 mg, Niacin-120 mg, Folic acid-8 mg, Pantothenate-80 mg and Calcium-86 mg. Vitamin-AB_2D_3K Vitamin A-82,500 IU, Vitamin B_2-52 mg, Vitamin D_3-12,000 IU, Vitamin K-10 mg, Calcium-166 mg and Phosphate-395 mg. Carniking-® (Lonza Group Ltd, Muenchensteinerstrasse, Switzerland) containing lab grade L-carnitine.

RESULTS AND DISCUSSION

Carcass characteristics

The live weight, slaughter weight, carcass weight, dressing percentage, giblet yield percentage and abdominal fat percentage of birds are presented in Table 3. There was no significant difference between the treatment groups for live weight, slaughter weight, carcass weight and giblet yield per cent. However, abdominal fat percentage was higher ($P<0.05$) in T_1 than that of T_2.

Similarly, Celik and Ozturkan (2003) observed that carcass yield was not affected by dietary L-carnitine (50 ppm) in broiler chickens. Likewise, no significant effect was noticed on dressing percentage of broiler (Daskiran and Teeter, 2001), when they were fed with L-carnitine at 40, 80, 120, 160 and 200 mg/kg of diet. While, Oladele *et al.* (2011) from his study on the effect of L-carnitine in broilers, found that dressing percentage was increased, when L-carnitine was included in the diet at 60 ppm compared to control group.

In accordance with the above results on abdominal fat content, several authors had reported significant reduction in abdominal fat content as a result of L-carnitine supplementation. Oladele *et al.* (2011) reported that broiler chicks fed at a level of 60 ppm of L-carnitine in feed, had the least abdominal fat weight compared to

Table 2. Chemical composition of broiler starter and finisher rations*

Parameters	Broiler starter ration	Broiler finisher ration
Dry matter, %	86.83	87.10
Crude protein, %	23.25	20.14
Ether extract, %	5.48	5.73
Crude fiber, %	4.38	4.16
Nitrogen free extract, %	57.47	62.09
Total ash, %	9.42	7.88
Acid insoluble ash, %	1.90	1.25
	Calculated values	
Metabolisable energy, kcal/kg	2805.22	2900.19
Lysine, %	1.27	1.07
Methionine, %	0.34	0.31

*On dry matter basis

Table 3. Slaughter data of birds maintained on two dietary treatments

Parameter	Carcass parameters†		P value
	T_1	T_2	
Live weight, kg	2.24 ± 0.04	2.29 ± 0.05	0.34
Slaughter weight, kg	2.08 ± 0.03	2.09 ± 0.05	0.48
Carcass weight, kg	1.66 ± 0.02	1.64 ± 0.02	0.78
Dressing percentage	74.05 ± 0.54	71.72 ± 0.80	0.51
Giblet yield, %	4.06 ± 0.09	3.86 ± 0.22	0.06
Abdominal fat, %	2.16 ± 0.22[a]	1.75 ± 0.06[b]	0.04

Table 4. Weight of internal organs of birds as percentage of carcass weight, %

Parameter	Weight of internal organs†, %		P value
	T_1	T_2	
Heart	0.61 ± 0.02	0.57 ± 0.04	0.43
Liver	2.73 ± 0.15	2.70 ± 0.22	0.09
Gizzard	2.15 ± 0.12	2.13 ± 0.16	0.46
Intestine	6.55 ± 0.37	6.81 ± 0.35	0.88
Spleen	0.19 ± 0.01	0.16 ± 0.02	0.10

†Mean of five values with SE

a, b – Means bearing different superscripts within the same row differ significantly (P<0.05)

†Mean of five values with SE

chicks fed at lower levels (40 and 50 ppm). Simlarly, Zhang *et al.* (2010) indicated that supplementing acetyl-L-carnitine either at 600 or 900 ppm levels decreased the abdominal fat percentage in broilers when compared to the control group.

On dietary supplementation of L-carnitine at 120 mg/kg of diet in male broiler chickens, Kheiri *et al.* (2011) found that abdominal fat percentage was reduced. The reduction of abdominal fat content mainly by decreasing the activities of glucose-6- phosphate dehydrogenase, malate dehydrogenase and lipoprotein lipase enzymes in the fat and increases intramuscular fat by reducing the activity of L-carinitine palmitoyltransferase-I enzyme in muscles. Thereby, L-carnitine in broiler diet enhances mitochondrial permeability to fatty acids and consequently more β-oxidation and catabolism of fat and fatty acids, therefore more energy availability to broilers for better growth. On contrary to the above findings, Daskiran and Teeter (2001) reported that abdominal fat content in broilers was not affected by L-carnitine supplementation at 40, 80, 120, 160 and 200 mg/kg of diet. Similarly, Ardekani *et al.* (2012) demonstrated that supplementary L-carnitine (50 mg/kg diet) did not influence the abdominal fat content in broilers.

Weight of internal organs

The data on average weight of internal organs as percentage of carcass weight of experimental birds belonging to the two dietary treatments were presented in Table 4. There was no difference between two treatment groups with regard to any of the organ weight studied.

L-carnitine supplementation had no effect on internal organs weight at 50 ppm in broilers (Celik and Ozturkcan 2003) and at 30, 40 and 50 ppm in Japanese quails (Sarica *et al.* 2005). Furthermore, Rezaei *et al.* (2007) observed that heart and liver weight was not affected by L-carnitine at 250 ppm in broiler diet containing five per cent soybean oil, which is in agreement with the present study. On contrary, Geng *et al.* (2007) found that the addition of L-carnitine in broiler diet improved the heart weight. Likewise, Cakir and Yalcin (2007) found a significant increase in liver weight by L-carnitine (100 ppm) supplementation in broilers.

CONCLUSION

Present study revealed that supplementation of L-carnitine does not affects the live weight, slaughter weight, carcass weight, dressing percentage, giblet yield percentage and weight of internal organs of birds, however significantly reduces the abdominal fat content of the broiler chicken.

REFERENCES

A.O.A.C. 2012.Official Methods of Analysis Association of Official Analytical Chemists, 19 Edn., Washington, D.C., USA.

Ardekani, H.M., Shevazad, M., Chamani, M., Aminafshar, M. and Arani, E.D. 2012. The effect of L-carnitine and low crude protein supplemented with crystalline essential amino acids diets on broiler chickens. *Ann. Biol. Res.,* **3**(2): 1085-1093.

BIS, 1973. Bureau of Indian Standards. *Code for handling, processing, quality evaluation and storage*. IS: 7049-1973. Manak Bhavan, 9, Bahadur Shah Zafer Marg, New Delhi, p. 39.

BIS, 1992. Bureau of Indian Standards. *Requirements for Chicken feeds*. IS: 1374-1992. Manak Bhavan, 9, Bahadur Shah Zafer Marg, New Delhi. pp. 1-3.

Cakir, S. and Yalcin, S. 2007. Effects of L-carnitine supplementation in diets with low or normal energy level on growth performance and carcass traits in broilers. *Rev. Med. Vet.,* **158**(6): 291-296.

Celik, L. and Ozturkcan, O. 2003. Effects of dietary supplemental L-carnitine and ascorbic acid on performance, carcass composition and plasma L-carnitine concentration of broiler chicks reared under different temperature. *Arch. Anim. Nutr.,* **57**(1): 27-38.

Daskiran, M. and Teeter, R.G. 2001. Effects of dietary L-carnitine (Carniking®) supplementation on overall performance and carcass characteristics of seven week old broiler chickens. *Anim. Sci. Res. Rep*. Oklahoma Agricultural Experiment Station. http://www.ansi.okstate.edu/research/2001rr/35/35.html.

Deniz, G., Turkmen, I.I., Orhan, F. and Biricik, H. 2006. Effect of hepabial carnitine ® supplemented to drinking water on the performance of broilers under different stress conditions. *Rev. Med. Vet.,* **157**(3): 115-120.

Geng, A., Li, B. and Guo, Y. 2007. Effects of dietary L-carnitine and coenzyme Q_{10} at different supplemental ages on growth performance and some immune response in ascites susceptible broilers. *Arch. Anim. Nutr.,* **61**(1): 50-60.

Kheiri, F., Pourreza, J., Ebrahimnezhad, Y., Nazeradl, K. and Haji-Abadi, M.A.J. 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**(68): 15450-15455.

McDowell, L.R. 2000. *Vitamins in Animal and Human Nutrition*. Second edition, Iowa State University Press, Ames, Iowa. 794p.

Oladele, O.A., Adeboye, F., Richard, S. and Zainob, H. 2011. Growth response, carcass yield and serum biochemistry of broiler chicken feds with supplemental L-carnitne in feed or drinking water. *J. Poult. Sci.,* **48**: 223-228.

Rabie, M.H. and Szilagyi, M. 1998. Effects of L-carnitine supplementation of diets differing in energy levels on performance, abdominal fat content, and yield and composition of edible meat of broilers. *Br. J. Nutr.,* **80**: 391-400.

Rezaei, M., Attar, A., Ghodratnama, A. and Kermanshahi, H. 2007. Study the effects of different levels of fat and L-carnitine on performance, carcass characteristics and serum composition of broiler chicks. *Pak. J. Biol. Sci.,* **10**(12): 1970-1976.

Saleh, E.A., Watkins, S.E., Waldroup, A.L. and Waldroup, P.W. 2004. Effects of dietary nutrient density on performance and carcass quality of male broilers grown for further processing. *Int. J. Poult. Sci.,* **3**(1): 1-10.

Sarica, S., Corduk, M., and Kilinc, K. 2005. The Effect of dietary L-carnitine supplementation on growth performance, carcass traits, and composition of edible meat in Japanese quail (*Coturnix coturnix japonica*). *J. Appl. Poult. Res.,* **14**: 709-715.

Snedecor, G.W. and Cochran, W.G. 1994. *Statistical Methods*. Eighth edition. The Iowa State University Press, Ames, IA. 314p.

Zhang, Y., Ma, Q., Bai, X., Zhao, L., Wang, Q., Ji, C., Liu, L. and Yin, H. 2010. Effects of dietary acetyl-L-carnitine on meat quality and lipid metabolism in arbor acres broilers. *Asian-Aust. J. Anim. Sci.,* **23**(12): 1639-1644.