The Effect of Liquid Nanocapsule Level on Broiler Fat Quality

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ABSTRACT: This research investigated the effects of liquid extract turmeric nanocapsule levels in drinking water on abdominal and subcutan fat and meat fatty acid of broiler chickens. Eighty-four Lohmann broiler chicks MB-202 were randomly divided into 7 treatments with 3 replications, each complied 4 broilers. Seven treatments were: drinking water (DW) + 12 mg/1000 ml additive bacitracin (P1), DW only (P2), DW + 2% liquid nanocapsule (P3), DW + 4% liquid nanocapsule (P4), DW + 6% liquid nanocapsule (P5), DW + 8% liquid nanocapsule (P6) and DW + 10% liquid nanocapsule (P7). The analyzed variables covered level and weight of abdominal fat, subcutan fat level and meat fatty acid composition of broiler chickens. The data were subject to one way ANOVA analysis followed by Duncan's test in case of significant effect. The results showed that the liquid nanocapsule levels had non significant ($P>0.05$) effects on weight and level of abdominal and subcutan fat. However, liquid nanocapsule provided a positive influence on fatty acid composition and the ratio of omega-3 and omega-9 in broiler chicken meat. The use of liquid nanocapsule at low level (2%) equivalent to 1.73 mg/100 ml curcumin resulted in the lowest weight of abdominal and subcutaneous fat level. While liquid nanocapsule at medium level (6%) equivalent to 4.31 mg /100 ml curcumin had complete composition of meat fatty acid with EPA/DHA and 5: 1 omega-3 and omega-6 as a functional food.

Keywords: liquid-nanocapsule, turmeric-extract, fat, fatty-acids, broiler.

INTRODUCTION

Fatty acids commonly found in broiler meat are oleic, palmitic and stearic. This is in accordance with Piliang and Djojosoebagio (2000) that animal products generally contain large amounts of saturated fatty acids e.g. palmitic and stearic, unsaturated fatty acids for example oleic and a small proportion of polyunsaturated fatty acids (PUFA). Balance ratio of omega-3 and omega-6 is essential because the poultry body is constituted of membrane lipid composition, metabolic and physiological function. The increasing absorption of omega-3 is always with the role of other fatty acids in feed, especially the balance of omega-3 and omega-6 can be utilized optimally in the body that plays a role in physiological functions. Zuheid (1990) reported that body fat resulted from the composition of ration and consumption of excess energy is stored in body tissue in form of intramuscular, subcutaneous and abdominal fat. Excess energy in chickens will produce a carcass that is high in fat, but low energy consumption causes fat and carbohydrates stored in low glycogen.

MATERIALS AND METHODS

The research was subject to one-way completely randomized design, rationing 84 broilers aged 2 - 6 weeks into seven treatments each with three repetitions. The seven groups were given additive in drink water namely: drinking water + bacitracin 12 mg/1000 ml (P1), drinking water only (P2), drinking water + 2% nanocapsule (P3), drinking water + 4% nanocapsule (P4), drinking water + 6% nanocapsule (P5), drinking water + 8% nanocapsule (P6) and drinking water + 10% nanocapsule (P7). Feed and drinking water were given ad-libitum.

In this study, 400 g of turmeric was blended in 500 mL of aquadest (equivalent to 5 g turmeric extract with ethanol). Five g chitosan was dissolved in 400 mL of 2.5% citric acid concentrate and mixed with a blender for 20 minutes, then the 2.5 g STPP was dissolved in 100 mL aquadest and mixed with blender for 20 minutes. Nanocapsule was supplied to the drinking water of experimental animals in each treatment level during week 2 - 6. Broilers were fed with commercial diet BR1 from Japfa Comfeed ® from the age of 0 to 2 week, then fed with basal rations. The variables included percentage (relatively) of meat fatty acids and level of abdominal and subcutaneous fat. The data obtained were subject to analysis of variance (ANOVA), followed by Duncan's test in case of significant effect using SPSS-16.

RESULTS AND DISCUSSION

Table 2. Relatively percentage of meat fatty acids (%)

Type of fatty acids	Treatments						
	P1	P2	P3	P4	P5	P6	P7
Lauric acids (C12:0)	-	-	-	-	0.07	-	-
Miristic acids (C14:0)	0.26	0.25	0.63	0.36	0.63	0.1	0.83
Palmitic acids (C16:0)	6.68	6.72	1.77	10.85	1.65	3.3	23.94
Stearic acids (C18:0)	9.57	9.64	3.12	15.59	24.09	4.76	31.7
Palmitoleic acids (C16:1)	0.98	0.72	0.18	1.37	2.29	0.35	2.79
Oleic acids (C18:1)	-	-	-	7.44	11.44	-	20.89
Linoleaic acids (C18:2)	3.36	3.6	2.31	1.94	2.12	2.9	-
Linolenic acids (C18:3)	0.19	0.21	0.63	0.26	0.43	1.02	0.33
EPA	-	-	-	-	0.25	0.45	0.69
DHA	-	-	-	-	0.38	-	-
SAFA	16.51	16.61	5.52	26.8	26.44	8.16	56.47
MUFA	0.98	0.72	0.18	8.81	13.73	0.35	23.68
PUFA	7.55	6.81	1.94	3.2	4.48	4.37	1.02
n6/n3 ration	17.68	17.14	3.67	7.46	4.93	2.84	0.00

Table 3. Percentage of abdominal and subcutan fat

Treatments	Parameter		
	Abdominal fat weight[ns] (g)	Abdominal fat percentage[ns] (%)	Subcutan fat percentage[ns] (%)
P1 (positive control)	20.76 ± 1.56	2.05 ± 0.13	49.73 ± 18.16
P2 (negative control)	24.66 ± 3.10	2.53 ± 0.22	58.45 ± 8.52
P3 (2% nanocapsule)	14.55 ± 2.09	1.45 ± 0.55	45.74 ± 10.31
P4 (4% nanocapsule)	15.36 ± 4.75	1.61 ± 0.36	47.47 ± 13.26
P5 (6% nanocapsule)	17.06 ± 5.27	1.88 ± 0.73	48.31 ± 14.15
P6 (8% nanocapsule)	19.05 ± 2.02	1.98 ± 0.40	51.84 ± 11.52
P7 (10% nanocapsule)	24.89 ± 3.92	2.24 ± 0.68	46.24 ± 5.34

ns Non-significant

Results in Table 2. demonstrated that treatment of liquid nanocapsule turmeric extract influenced the ratio of omega-3 and omega-6. Balance ratio of omega-3 and omega-6 is essential because the poultry body is constituted of membrane lipid composition, metabolic and physiological function. Meliandasari *et al.* (2015) reported that the imbalance concentrations between omega-3 and omega-6 is obvious from high concentration of omega-6 that can inhibit the formation of omega-3 in the bird's body and vice versa. Sundari *et al.* (2014) reported that 0.4% nanocapsule could improve meat protein and fatty acids containing EPA /DHA because curcumin feed inhibited the metabolism of arachidonic acid and increased the synthesis of EPA and DHA in broiler meat (Calder, 1998). Coetzee and Hoffman (2002) supported that fatty acids in the diet is absorbed by monogastric animals (broilers) so fatty acids in feed is a viable alternative to manipulate fatty acid profile of body tissue.

Table 3. presented weight-abdominal and subcutaneous fat content of broiler research. The statistical results of abdominal fat weight and subcutaneous fat level showed no significant differences across treatments ($P>0.05$). The lowest and the highest level of abdominal and subcutaneous fat was on P3 and P6, respectively. The percentage of abdominal fat ranging from 1.08 to 2.16% in this research was consistent with and even better than that of previous studies. Leeson and Summers (1980) suggested that abdominal fat level of live weight of male and female broiler was 1.4 to 2.6% and 3.2 to 4.8%, repsectively. According to North (1984), abdominal fat percentage of 6-week-old male broilers was 2.62% while Yuniza (2002) is 2.85% of live weight. The use of turmeric extract caused a decrease in broiler abdominal fat (Al-Sultan, 2003). The decrease of abdominal fat levels by increasing supplemented levels of turmeric extract curcumin compound is suspected to cause immunostimulatory effects to stimulate the gall bladder wall to increase the secretion of bile in fat breakdown process (Wijayakusuma, 2005). Rations plus 0.4% nanoparticles could reduce levels of subcutaneous fat much more significantly ($P<0.05$). Nanocapsule granting higher level did not automatically reduce subcutaneous fat because the antioxidant properties of curcumin worked on the low level (Sundari, 2014) and turned into pro-oxidant at high level (Lopez and Lazaro, 2008).

CONCLUSIONS

The use of liquid nanocapsule at low level (2%) equivalent to 1.73 mg / 100 ml curcumin resulted in the lowest weight of abdominal and subcutaneous fat level. While liquid nanocapsule at medium level (6%) equivalent to 4.31 mg/100 ml curcumin had complete composition of meat fatty acid with EPA / DHA and 5: 1 omega-3 and omega-6 as a functional food.

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