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Effect of Dietary Saturated and Unsaturated Fats on Body Performance and Accumulation of Abdominal in Broiler Chickens

Research Article

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ABSTRACT

Two hundred eighty days old male broiler chicks (Ross strain) were randomly distributed into seven groups with four replicates (10 birds in each replicate) and were fed diets supplemented with different dietary fat sources. The results indicated that the different dietary treatments did not affect weight gain, feed intake and feed conversion ratio at 21 d (P>0.05). However, addition of dietary fats to diets increased body weight gain and improved feed conversion ratio in grower (22-42 d) and whole period (7-42 d) of the experiment (P<0.01). Chicks fed diets supplemented with 6% of tallow or soybean oil and 3% tallow+3% soybean oil had the most body weight gain and the best value for feed conversion ratio (P<0.01). There were no significant differences between carcass characteristics (except for abdominal fat pad) due to dietary treatments (P>0.05). Increasing the dietary fat level increased significantly abdominal fat pad deposition (P<0.01). Abdominal fat pad deposition was significantly higher in birds fed diets supplemented with dietary fats than in those fed control diet (P<0.01).

KEY WORDS broilers, carcass quality, live weight gain, saturated, tallow and soybean oil.

INTRODUCTION

The most practical method for increasing the energy density of diets in poultry feeding is through the addition of fats and oils (Peebles *et al*. 2000). It was reported that fat metabolism and deposition in poultry could be affected by different dietary fats and fatty acids (Snaz *et al*. 2000; Pesti *et al*. 2002). Tallow (T), as a processing by-product, is available to the poultry industry as a cheaper dietary fat source. However, plant oils contain high levels of unsaturated fatty acids and are completely digested by fowl than animal fats, although, combinations of the two may result in some synergism (Wiseman and Salvador, 1991; Leeson and Atteh, 1995).

There is lack of enough information on the effects of various dietary fat sources on the growth and body composition of broiler chickens. Therefore, this study was carried out to investigate the effects of dietary saturated and unsaturated fats and their binary mixture (0.5:0.5 w/w) on the body performance and carcass characteristics in broiler chickens grown to market age.

MATERIALS AND METHODS

In this study, two hundred eighty days old male broiler chicks (Ross strain) were randomly distributed into seven groups with four replicates (10 birds in each replicate) and were fed diets supplemented with Tallow (T) and soybean

oil (SO). Dietary treatments were: control diet (with no added fat), 3% SO, 3% T, 1.5% SO+1.5% T, 6% SO, 6% T and 3% SO+3% T (Table 1).

All diets were calculated to be isocaloric and isonitrogenous. Diets were presented as mash. Mean body weight and feed intake per cage were measured on days 21 and 42. On day 43, two birds were randomly selected from each cage and individually weighed. The birds were slaughtered and eviscerated by hand. The processed carcasses were chilled by immersion in crushed ice and water for 2 h and weighed. The chilled carcasses were further processed by removal of the abdominal fat pad and by splitting into breast meat, thi-

Table 1 Ingredient percentage and calculated analysis of starter and grower diets

	Composition of dietary treatments (g/100 g)													
	Starter diets (days 7-21) [1]							Grower diets (days 22-42) [1]						
Feed ingredients	A	B	C	D	E	F	G	A	B	C	D	E	F	G
Corn	60.40	47.70	49.52	48.98	31.23	41.03	38.72	70.06	50.78	51.77	52.43	38.61	41.69	42.93
Wheat	4.00	7.04	6.99	7.03	15.00	7.05	9.00	0.32	10.05	10.01	10.00	11.99	10.02	10.03
Wheat bran	-	5.00	3.10	4.30	8.00	8.00	8.00	-	7.60	6.31	5.50	13.52	14.01	12.75
Soybean meal	25.27	27.87	28.21	27.88	27.90	28.08	28.02	20.86	20.46	20.74	20.91	20.19	19.94	20.14
Fish meal	7.00	5.00	5.00	5.00	5.00	5.00	5.00	5.83	5.00	5.00	5.00	5.00	5.00	5.00
Fat	-	3.00	3.00	3.00	6.00	6.00	6.00	-	3.00	3.0	3.0	6.00	6.00	6.00
Oyster	1.16	1.15	1.15	1.14	1.12	1.13	1.13	1.18	1.20	1.19	1.2	1.19	1.19	1.19
Dicalcium Phosphate	0.53	0.95	0.96	0.95	0.97	0.95	0.95	0.37	0.47	0.48	0.49	0.46	0.45	0.46
Salt	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
$NaHCO_3$	0.20	0.25	0.25	0.24	0.25	0.25	0.23	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Sand	-	0.58	0.36	0.02	3.06	1.05	1.49	-	0.03	0.09	0.08	1.62	0.29	0.09
DL- methionine	0.19	0.21	0.21	0.21	0.22	0.21	0.21	0.07	0.09	0.09	0.09	0.09	0.09	0.09
Lysine-HCL	-	-	-	-	-	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01
Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Mineral premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Coccidiostate	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Crude protein (%)	20.91	20.91	20.91	20.91	20.91	20.91	20.91	18.67	18.67	18.67	18.67	18.67	18.67	18.67
Metabolism Energy (Kcal/Kg)	2909	2909	2909	2909	2909	2909	2909	2987	2987	2987	2987	2987	2987	2987
Lysine (%)	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Met+Cys(%)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Calcium (%)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Available P (%)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Sodium(%)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.15	0.15

[1] A= control (with no added fat); B=3% soybean oil (SO); C=3% tallow (T); D=1.5% SO+1.5% T; E=6% SO; F=6% T and G=3% SO+3% T.

gh muscle wings and skeletal rack yield. The SAS Gene-ral Linear Models (GLM) procedure was used for statistical analysis of the data (SAS Institute, 1996).

RESULTS AND DISCUSSION

The effects of dietary fat supplementation (SO and T) at different levels on feed intake, body weight gain and feed conversion ratio of broiler chicks in starter (7-21 d), grower (22-42 d) and whole growth (7-42 d) periods of the experi ment are summarized in Table 2. The different dietary treatments did not affect weight gain, feed intake and feed conversion ratio on 21 d. Added fat to diets increased body weight gain and improved feed conversion ratio in the grower (22-42 d) and whole growth periods (7-42 d) ($P<0.05$).

Table 2 Effects of dietary treatments on body weight, feed intake and feed conversion ratio of broiler chicks during the experimental periods*

	Dietary treatments [1]						
	control	3% SO	3% T	1.5%SO+1.5% T	6% SO	6% T	3% SO+3% T
Experimental periods (d)	Body weight gain (g) [2]						
7-21	480	475	481	482	482	475	497
22-42	1267^{e}	1343^{d}	1326^{d}	1407^{c}	1467^{b}	1469^{b}	1523^{a}
7-42	1747^{e}	1817^{d}	1806^{d}	1889^{c}	1949^{b}	1944^{b}	2020^{a}
	Feed intake (g)[2]						
7-21	848	862	841	845	822	852	839
22-42	2870	2854	2905	2875	2855	2857	2848
7-42	3718	3716	3746	3721	3677	3709	3687
	Feed conversion ratio[2]						
7-21	1.77	1.82	1.75	1.76	1.70	1.80	1.69
22-42	2.27^{a}	2.13^{bc}	2.19^{ab}	2.05^{dc}	1.95^{de}	1.95^{de}	1.87^{e}
7-42	2.13^{a}	2.04^{bc}	2.08^{ab}	1.97^{dc}	1.89^{de}	1.91^{d}	1.83^{e}

[1] SO= soybean oil and T=tallow.
*The means within the same row that have at least one common letter, do not have significant difference ($P>0.05$).

Table 3 Effects of dietary treatments on carcass characteristics composition of broiler chicks*

	Carcass characteristics (%)[2, 3]					
Dietary treatments[1]	Carcass yield	Breast meat	Thigh	wings	skeletal rack	Abdominal fat pad
control	65.51	21.04	19.19	7.72	17.57	2.06^{c}
3% SO	67.07	21.44	19.66	7.76	18.22	2.24^{b}
3% T	66.16	22.03	19.64	6.79	17.70	2.25^{b}
1.5%SO+1.5%T	66.39	21.73	19.21	7.76	17.69	2.24^{b}
6% SO	65.82	21.09	19.71	7.39	17.62	2.42^{a}
6% T	66.77	21.53	19.91	7.17	18.17	2.47^{a}
3% SO+3% T	67.15	21.15	20.09	7.40	18.50	2.47^{a}

[1] SO= soybean oil and T=tallow.
[2] Expressed as a percentage of body weight.
*The means within the same column that have at least one common letter, do not have significant difference ($P>0.05$).

Chicks fed diets supplemented with 3% SO +3% T had the most body weight gain and the best value for feed conversion ratio.

The effects of dietary fat supplementation on carcass characteristics (relative weights, expressed as a percentageof body weight, for breast meat, thigh, wings, skeletal rack yield and abdominal fat pad) are shown in Table 3.

There were no significant differences between carcass characteristics (except for abdominal fat pad) due to dietary treatments (P>0.05).

Deposition of abdominal fat was significantly greater in fat-fed birds compared to those fed on the control diet. Increasing the dietary fat level increased significantly abdominal fat pad deposition (P<0.05).

The results of this study indicated significant effects of dietary fat supplementation on body weight gain and feed conversion ratio in grower (22-42 d) and whole growth period (7-42 d) of the experiment (P<0.05). At a given level for SO and T, the lack of performance differences due to fat source is consistent with the observation of Leeson and Atteh (1995) and Pesti *et al*. (2002). This result is not in accordance with the results of Snaz *et al*. (1999) and Snaz *et al*. (2000) who reported a lower abdominal fat deposition in birds fed unsaturated fat than those fed saturated fat. According to Newsholme and Leech (1984); at high fat intakes, β-oxidation is enhanced through the increased activity of the enzymes involved which could hide the different effect of polyunsaturated and saturated fatty acids on abdominal fat deposition. Addition of T, SO or a binary mixture (0.5:0.5 w/w) of two fats had proportional effect on accumulation of abdominal fat. Increasing the dietary fat level increased significantly abdominal fat pad deposition (P<0.05). Similar findings have been previously reported for abdominal fat deposition in birds fed diets containing fats (Peebles *et al*. 2000; Ghazalah, 2008).

CONCLUSION

The findings of this study indicate that fat source and the degree of saturation of dietary fats does not affect their metabolic use for body weight gain, carcass yield and fat pad deposition. However, an increase in the saturated fatty acids at expense of the polyunsaturated fatty acids may increase the risk of coronary arterial disease. Therefore, further research is needed to explore the best ratio of unsaturated to saturated fatty acids of solid fats such as T.

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