Abdominal Fat of Broilers as Influenced by Dietary Level of Animal Fat

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(Received for publication October 9, 1980)

ABSTRACT In an attempt to determine the effect of dietary energy source on the quantity of abdominal fat in broilers, three levels of dietary animal fat (4, 7, and 10%) in isocaloric and isonitrogenous diets were fed in place of a carbohydrate energy source. Three trials were conducted. As dietary animal fat increased, the amount of abdominal fat in broilers increased under both a moderate- and a high-temperature rearing regimen. However, as dietary animal fat increased, the body weight gain in broilers tended to increase. It is possible that the benefits of increased growth outweigh the disadvantages of increased abdominal fat when dietary fat is added. Data are presented to provide the industry with figures to help in this decision.

(*Key words:* broiler, abdominal fat, dietary animal fat, growth, temperature)

1981 Poultry Science 60:1250–1253

INTRODUCTION

Kubena *et al.* (1972) noted a growing concern about the quantity of animal fat consumed by humans. Disposal of fat-contaminated water at poultry processing plants is a problem. Lin *et al.* (1980) noted that obesity in broiler chickens represents a waste for the consumer, as it results in extra cooking loss. Internal fat (i.e., leaf, gizzard, mesenteric, and crop fat) contributes nothing to meat quality. Problems such as these have created considerable interest in the body composition of broiler chickens. The abdominal fat content of broiler chickens is receiving considerable attention because it can be highly visible to the consumer. Kubena *et al.* (1974) noted that as dietary energy levels increase, the quantity of abdominal fat in broilers increases. Hamm *et al.* (1973) demonstrated that the quantity and type of dietary fats in the finisher diet influence the quantity of fat in the poultry processing effluents.

The objective of this study was to determine the effect of dietary energy source on the quantity of abdominal fat in broilers.

MATERIALS AND METHODS

Three trials were conducted with commercial broiler chicks. Each pen, in which 36 male and 36 female broiler chicks were placed on litter, was 1.51 × 3.7 m. The feeder and waterer space consisted of two 38.1-cm-diameter tube feeders and 244 cm of linear waterer space for each 72-bird group.

The experimental design consisted of three dietary treatment combinations with 4 pens per dietary treatment under 2 temperature regimens for each trial. All chicks were brooded at 32 C for the first week, 29 C for the second week, and 27 C for the third week after placement in the pens. For the 4th to 7th week, one-half of the broilers were reared at 29 C and the others were reared at 24 C (for the 4th week) and 21 C (for the 5- to 7-week period).

For the first 3 weeks, all chicks were given a basal starter diet containing 22% protein and a metabolizable energy value of 3200 kcal/kg of diet. From 4 to 7 weeks of age, the broilers were given isocaloric and isonitrogenous diets containing added animal fat (7716 kcal/kg) at 3 levels, 4, 7, and 10% (Table 1). All broilers were provided with their diet and water *ad libitum.* Feed and weight gain data were recorded at 3 and 7 weeks of age. Mortality was recorded as it occurred.

At 7 weeks of age in each trial, 40 males and 40 females (10 males and 10 females from each pen) were randomly selected and killed and abdominal fat removed and immediately weighed. This abdominal fat was the fat that surrounded the gizzard and lay between the abdominal muscles and the intestines. The layer of fat extended within the ischium and surrounded the bursa of Fabricius and cloaca, where it was attached to the abdominal muscles in the area of the bursa of Fabricius and the cloaca.

At 7 weeks of age in each trial and each dietary treatment, a random sample of 8 birds of each sex was individually weighed and fasted

TABLE 1. *Composition of diets fed to broilers from 4 to 7 weeks of age*

Ingredient	Composition (%) of diet with indicated animal-fat content		
	4%	7%	10%
Yellow corn	60.400	52.600	44.700
Soybean meal (49% protein)	27.323	28.138	29.002
Corn gluten meal (61% protein)	4.000	4.000	4.000
Rice meal feed (6% protein)	.700	4.700	8.700
Dicalcium phosphate (22% Ca, 18.5% P)	1.860	1.880	1.900
Limestone	1.060	1.030	1.010
Salt	.350	.350	.350
Premix[1]	.250	.250	.250
MHA-Ca (93%)	.007	.002	.038
Coccidiostat	.050	.050	.050
Animal fat (7716 kcal/kg)	4.000	7.000	10.000
Total	100.00	100.00	100.00
Calculated analysis:			
Metabolizable energy, kcal/kg	3185	3185	3185
Crude protein (%)	21.00	21.00	21.00
Lysine (%)	1.05	1.05	1.05
Methionine (%)	.40	.40	.40
Methionine + cystine (%)	.71	.71	.71
Calcium (%)	.90	.90	.90
Available phosphorus (%)	.46	.46	.46

[1] The broiler premix furnished the following amounts of other ingredients per kilogram of feed: vitamin A, palmitate, gelatin coated, 6614 IU; vitamin D_3, 1654 ICU; vitamin E, 2.2 IU; riboflavin, 4.4 mg; niacin, 27.6 mg; d-pantothenic acid, 8.8 mg; folic acid, 275.6 μg; vitamin B_{12}, 8.8 μg; choline chloride, 551 mg; ethoxyquin, 55 mg; menadione sodium bisulfite complex, 2.8 mg, or menadione sodium bisulfite, 1.7 mg; pyridoxine, .55 mg; manganese, 66.25 mg; zinc, 44 mg; iodine, 1.25 mg; iron (in sulfate form), 20 mg; copper (in sulfate form), 2 mg.

for 12 hr before killing for carcass analysis. The birds were ground and pooled for analysis. All analyses were performed in duplicate and samples were analyzed for ether extract in accordance with procedures of the Association of Official Agricultural Chemists (1965).

Analysis of variance for body composition and abdominal fat was conducted with arc-sine percentage transformation for body composition and abdominal fat expressed as a percentage of body weight in accordance with procedures of Steel and Torrie (1960). Significantly different treatment means were separated by the multiple range test of Duncan (1955).

RESULTS AND DISCUSSION

The average weight of the broilers at 3 weeks of age in the three trials was 471 g for the males and 435 g for the females. The average broiler weight of the three treatment groups at 3 weeks of age varied by only 4 g.

As dietary animal fat increased, the amount of abdominal fat increased (Table 2). For each sex and within each temperature regimen the increase in abdominal fat as dietary animal fat increased was statistically significant with the exception of the males reared at 21 C and given 7 and 10% added fat (Table 2).

The percent body ether extract tended to follow the same pattern as the amount of abdominal fat. As percent added dietary fat increased, percent body ether extract increased. Within each temperature regimen the broilers receiving the 10% added fat diet differed significantly only from the broilers given the 4% added fat diet, even though a consistent increase was noted for percent body ether extract (Table 2).

For broilers reared at 21 C, feeding a diet containing 10% animal fat significantly improved growth over that of broilers given diets containing 4 and 7% added fat (Table 2). The females reared at 29 C and given 10% animal fat

TABLE 2. *Effect of added animal dietary fat on abdominal fat, ether extract, body weight, and feed efficiency of broilers reared at 21 and 29 C temperatures*

Factor	Sex	Reared at 21 C and fed diet with indicated fat			Reared at 29 C and fed diet with indicated fat		
		4%	7%	10%	4%	7%	10%
% Abdominal fat	Male	1.72[a]	1.93[b]	2.05[bcd]	1.61[a]	1.88[b]	2.14[cd]
	Female	1.97[bc]	2.19[de]	2.41[f]	1.97[bc]	2.20[de]	2.36[ef]
% Body ether extract	Male	12.89[a]	13.12[abcd]	13.69[cdef]	13.14[abcd]	13.35[abcde]	13.87[ef]
	Female	13.09[abc]	13.55[bcdef]	13.96[ef]	13.06[ab]	13.75[def]	14.15[f]
Body weight, g	Male	1893[a]	1901[a]	1961[b]	1782[c]	1812[c]	1831[c]
	Female	1551[b]	1576[b]	1603[c]	1466[d]	1482[d]	1516[a]
Feed efficiency		2.00[a]	1.99[a]	1.97[a]	1.99[a]	1.98[a]	1.96[a]

[a,b,c,d,e,f] For males and females within percent abdominal fat and percent body ether extract, and within each row for body weight and feed efficiency, differing letters denote significant differences ($P<.05$).

weighed significantly more than the females given the diets containing 4 and 7% added fat (Table 2).

These data agree with those of Dale and Fuller (1979, 1980) concerning weight gain. Under both moderate and high temperature regimens, as dietary fat level increased body weight of the broilers increased. However, added dietary fat also produces increased abdominal fat. It is possible that the benefits of increased growth outweigh the disadvantages of increased fat when dietary fat is added. These data are presented for the industry use in making this decision.

No significant difference existed in feed efficiency between any of the dietary and temperature treatment groups (Table 2). The broilers reared at 29 C weighed significantly less than those reared at 21 C (Table 2). Broilers are generally marketed at specific weight rather than at a specific age. Having to keep broilers on feed longer to obtain a specific weight should increase the broiler maintenance requirement for feed and require more feed per unit of meat produced for the broilers reared at 29 *vs.* 21 C (Deaton *et al.*, 1978).

Mortality was 72 of the 5,184 broilers used during the course of the experiment. The mortality was dispersed throughout the experimental treatments with no significant difference among dietary treatments or temperature regimens.

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