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EFFECT OF RANCID SOYBEAN OIL WITH OR WITHOUT ANTIOXIDANT ON THE PERFORMANCE OF BROILER CHICKS

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Normal soybean oil or the oil oxidized to a peroxide value of 292 milli-equivalent per kg and free fatty acids 2.91%, was incorporated at a level of 2% in broiler starter rations and 3% in broiler finisher rations, with or without the addition of 125 mg butylhydroxy toluene (antioxidant) per kg ration. These rations were fed to 120 day-old broiler chicks for periods of 4 and 3 weeks, respectively, in a completely randomized design. The chicks grew normally with no adverse effect on weight gain or feed conversion efficiency between groups, during both periods. The only difference was noticed in feed consumption during finisher period which decreased significantly while the addition of antioxidant did not exert any effect on either of the tested parameters.

INTRODUCTION

To improve the efficiency of broiler production the trend has been shifted towards increased energy content of the ration which is usually achieved through the addition of fats and oils. Most of the commercial rations are fortified with low grade rancid fat which may become detrimental to most of the feed nutrients instead of having beneficial effect. At the same time many feed ingredients are subjected to long storage period before being used in the feed. Due to poor storage conditions, feed ingredients particularly fish meal and vegetable oil meals, containing sufficient amount of fat, get deteriorated due to rancidity of fat. Free radicals formed by the unsaturated fatty acids react with oxygen to form peroxides that serve as the entry point into a multitude of reactions producing numerous byproducts and decomposition of vital nutrients contained in the feed. Aldehydes, ketones, acids, esters and polymerized fats are direct products of the oxidation process and result in reduced energy values, off-taste and off-odors which may ultimately result in reduced feed intake (Awad *et al.*,1983; Mohamed *et al.*, 1983) and low performance of broiler chicks. (Calabotta and Shermer, 1985)

The quality of fat has frequently been determined by the quantitative measurement of free fatty acids and peroxide values. However, there is some controversy on the safe limits of these values in feed grade fat. The present experiment was conducted to study the effect of added rancid oil, with peroxide value of 292 milli-equivalent per kg and free fatty acid value of 2.91% on the performance of broiler chicks in the presence or absence of synthetic antioxidant.

MATERIALS AND METHODS

Soybean oil was placed in a heat chamber at 60 °C and air was bubbled through it at the rate of 350 ml per minute per kg of oil for a period of 6 days. Peroxide value and free fatty acids were measured twice daily according to the methods of A.O.A.C. (1984). The treatment was terminated after attaining the maximum level of peroxides in the oil beyond which it started declining. Initially the oil had peroxide value of 3.20 milli-equivalent per kg and the free fatty acids 0.66% which rose to 292 and 2.91, respectively, in the rancid oil.

Based on completely randomized design, the experiment was conducted in two phases, using 120 day-old broiler chicks of mixed sexes. The chicks were randomly

Table 1. Nutrient composition of the experimental rations

Description		Rations							
		A*	A'*	B*	B'**	C+	C'+	D++	D'++
Crude protein	(%)	23.03	19.01	23.03	19.01	23.03	19.01	23.03	19.01
Metabolizable energy	Kcal/ kg	3004.18	3018.72	3004.18	3018.72	3004.18	3018.72	3004.18	3018.72
Crude fibre	(%)	3.68	3.40	3.68	3.40	3.68	3.40	3.68	3.40
Calcium	(%)	1.13	1.05	1.13	1.05	1.13	1.05	1.13	1.05
Available phosphorous	(%)	0.56	0.50	0.56	0.50	0.56	0.50	0.56	0.50
Lysine	(%)	1.19	1.01	1.19	1.01	1.19	1.01	1.19	1.01
Methionine	(%)	0.58	0.40	0.58	0.40	0.58	0.40	0.58	0.40
Energy/ protein ratio		130.45	158.80	130.45	158.80	130.45	158.80	130.45	158.80

*Normal soybean oil; **Normal soybean oil plus BHT; + Rancid soybean oil ; ++ Rancid soybean oil plus BHT.

distributed into twelve experimental units of ten chicks each and assigned to floor pens (4.0' x 2.5') which were maintained under standard managemental conditions. Feed and water were supplied *ad libitum*. Continuous lighting was provided throughout the experiment.

Four isocaloric (3000 Kcal ME/kg) and isonitrogenous (23% CP) broiler starter rations, A, B and C, D containing 2% normal or rancid soybean oil respectively, each with or without the addition of 125 mg butylhydroxy toluene (BHT) per kg ration, were prepared and fed to day-old broiler chicks for a period of four weeks (phase I). The nutrient composition of experimental starter and finisher rations has been shown in Table 1.

Similarly four broiler finisher rations A', B' and C', D' contained 3% normal or rancid soybean oil respectively, each with or without the addition of the same level of antioxidant as in case of starter rations.

These rations were fed to the same birds (4 weeks old) till they were seven weeks old (phase II). During the experiment all the birds were weighed individually at the start and at weekly intervals thereafter. Feed consumption was recorded for each replicate at weekly intervals and feed: gain ratio was computed. The data thus collected were subjected to statistical analysis to determine the significant differences among treatment means (Steel and Torrie, 1981).

RESULTS AND DISCUSSION

The results of both the phases of the experiment in respect of weight gain, feed consumption and feed efficiency have been summarized in Table 2.

Weight Gain: The chicks fed on starter rations A, B, C and D gained 601.07, 603.53, 565.57 and 570.53 g weight, respectively (Table 2). Although the birds fed on ration B, containing normal soybean oil supplemented with antioxidant BHT, gained the maximum weight followed by those fed on rations A, D and C, yet the differences were statistically non-singnificant among rations. During the finisher phase the birds fed on A' ration gained the maximum weight (589.99g), followed by those fed on B', D' and C' rations. Here again the differences, among the groups of birds fed on various experimental rations, were statistically non-significant.

The results clearly indicated that there was no adverse effect of oxidized fat on the growth performance of birds as far as the utilization of 2 and 3% in broiler starter and finisher rations is concerned. The present results substantiate the earlier findings of Eschenbach and Hartfiel (1985) who reported no adverse effect of oxidized fat in the rations of chicks and rats. However, these rsults did not agree with the findings of Mohamed *et al.* (1983) who observed growth depression when rancid oils or fats were added in the rations of broiler chicks. These differences in the opinion of various workers may be attributed to higher levels of rancid oil in the latter studies, which resulted in higher levels of peroxides and free fatty acids in rations, which ultimately depressed the growth.

The results further revealed no significant effect of antioxidant addition to the normal or rancid oil which is also in close agreement with some previous studies (Oertel and Hartfiel, 1982; Eschenbach and Hartfiel, 1985). However, some other workers (Pelevin and Novikov, 1977) showed improvement in weight gain with added levels of antioxidant in the ration. This may be true under long storage conditions, where there is risk of destruction of vitamins and other nutrients, and the addition of antioxidant to the ration may be beneficial. In the present study, however, the birds were maintained on freshly prepared rations.

Feed Consumption: Average feed consumption per chick on different starter rations (A,B,C and D) during phase I (0 to

Table 2. Weight gain, feed consumption and feed efficiency of birds fed on various starter (0 to 4 weeks : phase I) and finisher (5 to 7 weeks: phase II) rations

Rations		Weight gain(g)		Feed consumption (g)		Feed efficiency(feed /gain)	
Phase		Phase		Phase		Phase	
I	II	I	II	I	II	I	II
A	A′	601.07	589.99	1099.5	1820.9[a]	1.83	3.10
B	B′	603.53	557.17	1133.5	1731.1[a]	1.88	3.11
C	C′	565.57	460.22	1081.7	1492.5[b]	1.91	3.24
D	D′	570.53	467.75	1079.3	1539.2[b]	1.89	3.29

4 weeks) was1099.5, 1133.5, 1081.7 and 1079.3 g, respectively. Apparently the feed consumption was depressed on rations containing rancid soybean oil but the differences were statistically non-significant. During phase II (5 to 7 weeks), the birds fed on rations A′ , B′ , C′ and D′ consumed 1820.9, 1731.1, 1492.5 and 1539.2 g feed per bird, respectively. These differences were statistically significant among rations. The birds fed on rations containing 3% rancid soybean oil consumed significantly ($P < 0.05$) less feed than those fed on ration containing normal soybean oil. The supplementation of antioxidant also could not exert any significant improvement in feed consumption. The reduction in feed intake during the finisher phase might be due to the higher level of rancid oil (3%) used or it might be the result of appetite depressing effect of prolonged feeding on rancid oil. Similar appetite depressing effects of rancid oil in chicks and rats have been reported in literature by some earlier workers (Awad *et al*,1983; Mohamed *et al.*,1983). Oertel and Hartfiel (1982) also reported no beneficial effect of added antioxidant on feed intake of chicks fed on rations containig rancid oil.

Feed Efficiency: During the starter phase the feed: gain ratio on rations A, B, C and D was 1.83, 1.88, 1.91 and 1.89, respectively which was not significantly different among rations. Similarly in finsher rations the feed efficiency values were 3.10, 3.11, 3.24 and 3.29 on respective rations. Although the efficiency of feed utilization deteriorated on rations containing rancid oil, yet the differences among rations were non–significant. Similar results have also been reported by some earlier workers in respect of efficiency of feed utilization in rations fortified with low levels of rancid oil (Toscano and Tartari, 1979) with or without added antioxidant (Eschenbach and Hartfiel,1985). However, significant adverse effect on feed efficiency has been reported on higher levels of rancidity oil in poultry rations (Calabotta and Shermer, 1985).

It may be inferred from the results of the present study that lower levels of rancid fat may not adversely affect the performance of broiler chicks for short periods, when the feed is prepared from fresh and good quality feed ingredients and also it is not stored for long periods before being fed to the birds.

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