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Effects of Saturated and unsaturated fats in starter and grower feeds on performance and carcass traits of broilers

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ABSTRACT

This experiment was conducted to evaluate the effects of saturated and unsaturated fats in starter and grower feeds on performance and carcass parts of broilers. In this experiment 288 day old broiler chicks (Ross- 308 strain) were used in a completely randomized design for 42 days with 8 treatments in 3 replicates and 12 chicks in each replicate. The experimental groups included: T1) control group, T2) 4% canola oil in starter and grower feed, T3) 4% beef tallow in starter and grower feed, T4) 4% canola oil in starter feed and 4% beef tallow in grower feed, T5) 4% beef tallow in starter feed and 4% canola oil in grower feed, 6) 4% canola oil in starter feed and 4% canola oil and beef tallow blend (2% canola oil + 2% beef tallow) in grower feed, 7) 4% beef tallow in starter feed and 4% canola oil and beef tallow blend (2% canola oil + 2% beef tallow) in grower feed, 8) 4% canola oil and beef tallow blend (2% canola oil + 2% beef tallow) in both starter and grower feeds. The results showed that using saturated and unsaturated fats in starter and grower feeds significantly affected the performance of broilers ($P<0.05$). The highest amount of daily weight gain (47.59g) and the best feed conversion (1.77) were resulted in group7 by using 4% of beef tallow in starter feed and 4% of canola oil and beef tallow blend (2% canola oil + 2% beef tallow) in grower feed, however there were not observed significant difference between group 4, 7 and 8 about the performance. About carcass percent, except liver percent, there were not significant difference between treatments. The addition of canola oil to starter diets significantly decreased the percent of liver, also the lowest percent of liver (1.97%) was resulted in group 2 by using 4% of canola oil in starter and grower feeds. The overall results showed that using 4% of saturated and unsaturated fat in broiler diets, especially 4% beef tallow in starter diets and blend of canola oil and beef tallow in grower feeds significantly improve the performance of broilers.

KEY WORDS: Beef tallow, broiler, carcass traits, canola oil, performance, poultry fat.

INTRODUCTION

Feed grade fats and oils rank among the most important ingredients used in poultry and livestock feed both in volume consumed and in nutritional importance. The value of fats and oils is based on both their safety and their efficacy. The factors affecting the quality of fats and oils can be divided into two principle categories: safety and efficacy. The safety criteria relate to the presence of substances that may have deleterious effects on the health and performance of the animal or the presence of substances that may result in the accumulation of toxic residues related to human health concerns [1]. The efficacy criteria relate primarily to the energy value of the fat product and secondarily to such factors as essential fatty acid content, oxidative stability and palatability. Fats are rich sources of energy and are frequently included in broiler diets to increase the energy density. Several experiments have shown that an increase in energy concentration produces a decrease in feed intake but does not negatively affect daily gain, resulting in an improvement in feed efficiency [2]. A number of different fat sources are available for poultry from the vegetable sources and the rendering industry [3]. The primary sources are poultry fat, tallow, yellow grease, lard, blends and vegetable fats such as sunflower oil, soybean oil, or palm oil. Generally, the fats that are also used for human consumption are relatively expensive when compared to rendered products, resulting in lower fat utilization and thus lower ME diets when rendered fats are not available [4]. Canola is the name given to rapeseed that contains less than 2% of erucic acid (docosenoic acid, C22:1, ω-9) in relation to the total fatty acid and less than 30 umoles of glucosinolates per gram of free oil on seed dry matter basis. In birds, the adverse effects of adding erucic acid to the diets are reflected on intake, growth and the apparent digestibilities of total lipid and individual fatty acids Furthermore, chicks fed with diets containing erucic acid deposit less fat and utilize energy from this lipid less frequently [5]. In a study using canola oil in broiler diets improved their performance [6]. Broilers fed with 8% of sunflower oil, fish oil or beef tallow in the diet and observed poorer feed conversion in the birds fed with beef tallow [7]. Formulated broiler diets containing sunflower oil and bovine/swine fat and reported that the inclusion of saturated fats produced higher accumulation of intramuscular fat and abdominal fat [8]. In a study using one saturated (beef tallow) and one unsaturated (sunflower oil) lipid source at 8% of inclusion, a significant reduction in the deposit of abdominal fat observed in the birds that received diets with sunflower oil [9]. The location of fat deposition

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depends on the kind of fatty acid added to the diet (saturated and polyunsaturated) [10]. In digestibility of fats (especially saturated fats) in younger chicks is low and increases as the chick ages [11, 12, 13].

Since exists limited research results regarding the effects of saturated and unsaturated fats on performance and carcass traits of broilers, therefore the present study was conducted to evaluate the effects of using beef tallow (as saturated fat) and canola oil (as unsaturated fat) on performance and carcass traits of broilers.

MATERIALS AND METHODS

In this experiment 288 day old broiler chicks (Ross- 308 strain) were used in a completely randomized design for 42 days with 8 treatments in 3 replicates and 12 chicks in each replicate. The experimental groups included: T1) control group, T2) 4% canola oil in starter and grower feed, T3) 4% beef tallow in starter and grower feed, T4) 4% canola oil in starter feed and 4% beef tallow in grower feed, T5) 4% beef tallow in starter feed and 4% canola oil in grower feed, 6) 4% canola oil in starter feed and 4% canola oil and beef tallow blend (2% canola oil + 2% beef tallow) in grower feed, 7) 4% beef tallow in starter feed and 4% canola oil and beef tallow blend (2% canola oil + 2% beef tallow) in grower feed, 8) 4% canola oil and beef tallow blend (2% canola oil + 2% beef tallow) in both starter and grower feeds. The diets were formulated (Table 1) to meet the requirements of broilers as established by the NRC (1994) [14]. The lighting program during the experimental period consisted of a period of 23 hours light and 1 hour of darkness. Environmental temperature was gradually decreased from 33°C to 25°C on day 21 and was then kept constant. Body weight, feed intake and feed conversion were determined weekly on bird bases. Mortality was also recorded. At 42 days of age, six birds/per treatment were randomly chosen, slaughtered and carcass per cent to total weight and per cents of carcass characteristic to carcass weight were calculated.

The data were subjected to analysis of variance procedures appropriate for a completely randomized design using the General Linear Model procedures of SAS Institute (2005) [15].

Means were compared using the Duncan multiple range test. Statements of statistical significance are based on $P<0.05$.

Table 1: The composition of basal diets

days→	1-21 days				21-42 days			
Diets→ Ingredients (% in diets) ↓	Control group	4% Beef tallow	4% Canola oil	2% Beef Tallow + 2% canola oil	Control group	4% Beef tallow	4% Canola oil	2% Beef Tallow + 2% canola oil
Yellow corn	62.33	50.62	49.93	50.27	62.33	54.99	54.32	54.66
Soybean meal	33.92	36.25	36.39	36.33	33.92	30.12	30.27	30.19
Beef tallow	0	4	0	2	0	4	0	2
Canola oil	0	0	4	2	0	0	4	2
Inert	0	5.5	6.05	5.78	2.41	7.54	8.07	7.81
Oyster shell	1.5	1.33	1.33	1.33	1.22	1.20	1.20	1.20
Dicalcium phosphate	1.33	1.35	1.35	1.35	1.27	1.29	1.29	1.29
Salt	0.28	0.28	0.28	0.28	0.3	0.3	0.3	0.3
Vitamin premix[1]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mineral premix[2]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL- Methionine	0.16	0.17	0.17	0.17	0.05	0.05	0.05	0.05
Calculated composition								
Metabolisable energy (Kcal/kg)	2850	2850	2850	2850	2900	2900	2900	2900
Crude protein (%)	20.50	20.50	20.50	20.50	18.125	18.125	18.125	18.125
Calcium (%)	0.96	0.92	0.92	0.92	0.82	0.82	0.82	0.82
Available Phosphorous (%)	0.40	0.40	0.40	0.40	0.37	0.37	0.37	0.37
Sodium (%)	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Linoleic acid (%)	1.51	1.39	2.12	2.20	1.57	1.46	2.20	1.82
Lysine (%)	1.14	1.19	1.19	1.75	0.98	1.02	1.02	1.02
Methionine+ Cysteine (%)	0.83	0.83	0.83	0.83	0.65	0.65	0.65	0.65
Thryptophan (%)	0.27	0.27	0.27	0.27	0.23	0.23	0.23	0.23

RESULTS AND DISCUSSION

The effects 4% of canola oil and 4% of beef tallow and their blends on performance of broiler are presented in table 2.

The addition of fat sources significantly affected the performance of broiler ($P<0.05$). The highest amount of daily weight gain (47.59g) was resulted in group7, by using 4% beef tallow in starter feed, 4% canola oil and beef tallow (2% canola oil+ 2% beef tallow) in grower feed whereas the lowest amount of daily weight gain (43.96) was observed in control group. About daily weight gain, only group 7 was significantly higher than

control group. As younger broilers have serious limitation in digestion of saturated fat, so using beef tallow in their starter diets, prevent their normal growth, in grower period the addition blend of canola oil and beef tallow, my be supplied suitable profiles of fatty acids, thus they compensate their growth retardation, as the highest amount of feed intake and body weight gain occurred in grower period, so the highest amount of daily weight gain was resulted in 7 experimental group. Our findings in this experiment not supported by Lesson and Summers, (2001) reports who resulted beef tallow in broiler diets has adverse effects on performance of broilers. Between treatments contained fats the lowest amount of daily weight gain was observed in group 2 by addition 4% canola oil to broiler starter and grower diets. Cured canola contained erucic acid (Lesson and Summers, 2001) since it can adverse effects on performance of broiler, so in contrast with other experimental groups, using canola oil in whole experiment period decrease the amount of daily weight gain, however, since this group had the lowest amount of daily feed intake, so the feed conversion in contrast to control group significantly improved. Our results about the effects of canola oil in broilers not in agreement with findings of Shahryar e al. (2011) who reported the addition of canola oil until 6% to broiler diets improve their performance. The differences observed between these experiments may be related to the type and quality of oils are used. Such as weight gain, the best feed conversion (1.77) obtained in grope 7, as this group had the highest amount of daily weight gain and amount of daily feed intake was not high, so the best feed conversion was resulted in this experiment group. However there were not significant difference between 4, 7 and 8 groups in feed conversion.

Table 2. The effects canola oil and beef tallow and their blend on broiler performance (1-42 days)

Performance →	Feed intake (g)	Weight gain (g)	Feed conversion (g: g)
Supplements ↓			
Control group	85.95	43.96^{b}	**1.96^{a}**
4% canola oil in starter and grower feeds	82.20	44.47^{b}	**1.86^{b}**
4% beef tallow in starter and grower feeds	85.75	45.87^{ab}	**1.86^{b}**
4% canola oil in starter feed, 4% beef tallow in grower feeds	84.21	46.04^{ab}	**1.84^{bc}**
4% beef tallow in starter feed, 4% canola oil in grower feed	86.55	45.87^{ab}	**1.89^{b}**
4% canola oil in starter feed, 4% canola oil and beef tallow (2% canola oil+ 2% beef tallow) in grower feed	86.1	46.04^{ab}	**1.87^{b}**
4% beef tallow in starter feed, 4% canola oil and beef tallow (2% canola oil+ 2% beef tallow) in grower feed	84.24	47.59a	**1.77c**
4% canola oil and beef tallow (2% canola oil+ 2% beef tallow) in starter and grower feeds	85.01	46.22ab	**1.84bc**
SEM	**1.46**	**0.69**	**0.02**

Values in the same row not sharing a common superscript differ significantly (P<0.05).

Table3. The effects canola oil and beef tallow and their blend on broiler carcass traits (%)

Performance →	Carcass	Abdominal fat	Gizzard	Liver	Breast	Thigh
Supplements ↓						
Control group	70.01	2.65	2.25	2.37^{a}	21.54	**19.50**
4% canola oil in starter and grower feeds	69.78	2.52	2.52	1.97^{bc}	23.04	**18.63**
4% beef tallow in starter and grower feeds	70.60	2.74	2.74	2.20^{ab}	22.28	**19.26**
4% canola oil in starter feed, 4% beef tallow in grower feeds	70.53	2.65	2.65	2.03^{bc}	21.39	**19.16**
4% beef tallow in starter feed, 4% canola oil in grower feed	70.33	2.83	2.83	2.02^{bc}	22.08	**18.97**
4% canola oil in starter feed, 4% canola oil and beef tallow (2% canola oil+ 2% beef tallow) in grower feed	69.94	2.23	2.23	2.02^{bc}	22.08	**19.05**
4% beef tallow in starter feed, 4% canola oil and beef tallow (2% canola oil+ 2% beef tallow) in grower feed	70.40	2.72	2.72	2.24^{ab}	21.43	**19.35**
4% canola oil and beef tallow (2% canola oil+ 2% beef tallow) in starter and grower feeds	70.24	2.76	2.76	2.01^{bc}	22.39	**19.04**
SEM		**0.23**	**0.23**	**0.1**	**0.77**	**0.32**

Values in the same row not sharing a common superscript differ significantly (P<0.05).

The effects canola oil and beef tallow on carcass traits of broilers are summarized in Table 3.

The addition of fats compared with the control group, significantly decreased the percent of liver ($P<0.05$). The highest percent of liver (2.37%) obtained in control group, whereas the lowest percent (1.97%) was seen in group 2 by using 4% of canola oil in both starter and grower periods. One of the functions of the liver, include biosynthesis of fat from carbohydrates and other diet energy sources, so in the presence of fat in the diet, the liver is less active. On the other hand, by use of fat in the diet that is easy digestible and contain high concentration of energy, the amount of carbohydrate source in the diets decrease, therefore its size compared with control group is significantly decreased. Except liver, there were not any significant differences between experimental groups about other carcass traits. The present findings about carcass traits are inconsistent with the results of Sanz et al, (2000) and Crespo and Esteve-Garcia (2002b), who reported that the addition of unsaturated fats in to broiler diets significantly decrease their abdominal fat, while saturated fats increased it. The differences observed may result from fat sources, compositions of diets and farm management.

Conclusion

It was conclude that in broilers supplementation 4% of saturated and unsaturated fats in broiler diets in contrast with control group, significantly improve their performance and using blends of these fat sources in starter and grower feeds is recommended.

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