Sunflower oil production wastes (acidulated soap stock) as an energy source in broiler chickens diet

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ABSTRACT

The current experiment was performed to investigate effects of different levels of sun flower oil and fatty acids (as a waste of plant oil production) on performance and carcass characteristics of broiler chickens in a 42d experimental period. To achieve this aim, two hundred and eighty eight day-old male chicks were used in a completely randomized design with 2×2 factorial arrangement to provide four treatments with six replicates (12 birds per replicate). Treatments included two types of fat (acidulated sunflower oil soap stock and sunflower oil) and two levels of fats (3 and 6%). Experimental diets were formulated for two periods of starter (7 to 21d) and grower (21 to 42d) and tried to have compliance to NRC (1994) guidelines. Diets were similar in all of nutrients except metabolizable energy (ME). Feed intake (FI), weight gain (Wg) and feed conversion ratio (FCR) were evaluated weekly. At 42d, one bird from each replicate was selected and killed to evaluate carcass characteristics. The results showed that there is no significant difference between treatments in FI, Wg and FCR ($P>0.05$). Diet contains lowest amount of fatty acids (3%) had highest FI and Wg and lowest FCR numerically. Carcass characteristics results were demonstrated that type and levels of fat affect thigh ($P<0.01$), abdominal fat ($P<0.05$) and also breast muscle weight ($P<0.05$) significantly, so that the diet contain lowest amount of fatty acids had highest breast muscle weight. In conclusion, it is possible to formulate diets with more economical fat source (fatty acids) without any negative effect on performance.

Key words: sunflower oil – acidulated soap stock – performance – carcass – broiler chickens

1. INTRODUCTION

Energy is most important nutrient of broiler chicken's diets, because of its feed intake regulatory role and there are many sources to provide it. Fats are most valuable source of energy in poultry rations (Lesson and Summers, 2005). One of the new sources of fats is acidulated sunflower oil soap stock that is a by-product of the caustic refining process of sunflower oil. This by-product has traditionally been used fatty acid producers and animal feed manufacturers and contains 75

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to 95 percent free fatty acids and variable amounts of triglycerides, sterols, tocopherols, pigments and other fat soluble materials (NRC, 1994). It has showed that inclusion of fatty acids, oils or their mixture in diets can improve performance of broiler chickens (Shivazad et al., 2007). Also, one of the main problems of this by-product inclusion is their high amounts of fatty acids (Blanche et al., 1996). This characteristic cause depression of digested material absorption and it would be more obvious in young birds especially when the by-product contains saturated free fatty acids (Sklan and Ayal, 1989). Nevertheless, according to human consumption of the refined oils and their high prices, it has considered to use oil refining by-products such as acidulated sunflower soap stock. The aim of the current experiment is investigation of acidulated sunflower soap stock as energy source and its best inclusion rate in broiler diets instead of sunflower oil.

2. MATERIALS AND METHODS

The current experiment was carried out in experimental farm of Zanjan university. Two hundred and eighty eight male day-old chicks (Ross 308) in a completely randomized design with 2×2 factorial arrangement in a 42d experimental period were used to provide four treatments with six replicates (12 chicks per replicate). Treatments include two types of fat (acidulated sunflower oil soap stock and sunflower oil) and two levels of fat (3 and 6%). Diets formulated for two periods of time (7 to 21d and 21 to 42d) and nutrients requirements were supplied according to NRC (1994) guidelines (Table 1).

Table 1. Chemical composition of experimental diets in starter and grower periods

	Starter (7 to 21d)		Grower (21 to 42d)	
Chemical composition	3% fat	6% fat	3% fat	6% fat
Metabolizable energy (Kcal/Kg)	2965	3100	2965	3100
Crude protein (%)	21	21	19	19
Calcium (%)	1	1	0.9	0.9
Available P (%)	0.45	0.45	0.4	0.4

Chicks had available to fresh water and fed ad libitum and nourished with a standard diet until 7d old. Feed intake, weight gain and feed conversion ratio were evaluated weekly and mortality was recorded daily. Hen-day amounts were calculated to correct expressed performance parameters. At 42d of age, one bird from each replicate randomly selected and killed for determination of carcass characteristics. Data were analyzed with mixed procedure of SAS (9.1) within a completely randomized design and the differences were compared by Duncan's multiple range tests at $P<0.05$.

3. RESULTS AND DISCUSSION

Weight gain (Wg), feed intake (FI) and feed conversion ratio (FCR) had no significant differences between treatments (P>0.05). Treatment contains 3% fatty acids had highest Wg, FI and lowest FCR numerically (Table 2). But, none of factors such as fat types and levels and their interactions could affect performance parameters significantly.

Table 2. effects of defferent types and levels of fat on performance of broiler chickens (0 to 42d)

Fat types or levels	FI (gr)	Wg (gr)	FCR	Nutritional benefits (Tomans)
Fat type				
Oil	4679	2091	2.24	2986
Fatty acids	4718	2128	2.23	3139
SEM	68.88	35.35	0.04	-
p-value	0.77	0.6	0.92	-
Fat level (%)				
3	4690	2119	2.22	3102
6	4707	2100	2.25	3024
SEM	68.99	35.52	0.04	-
p-value	0.9	0.78	0.67	-
Fat type × fat level				
3% oil	4581	2038	2.25	3049
6% oil	4777	2143	2.22	2924
3% fatty acids	4800	2200	2.18	3155
6% fatty acids	4636	2056	2.28	3124
SEM	69.37	34.29	0.04	-
p-value	0.62	0.32	0.87	-

Diets include with fatty acids caused to increase thigh weight percent significantly (P<0.05). Carcass weight percent in all of treatments showed no significant differences (Table 3). It is demonstrated that treatments include 3% fat had higher breast muscle weight percent (P<0.05). diets included with fatty acids and also diets 3% fat had lower abdominal fat significantly (P<0.05). In addition, diet contains 6% sunflower oil had highest abdominal fat (P<0.05). Mosavat (2010) has demonstrated that fatty acid in broiler diet cause to improve body weight, FCR and carcass efficiency that is in agreement with current experiment. Our results showed that 6% fatty acids had worst FCR and it could be probably due to low quality of this by-product or because it could decrease digestion of nutrients by incomplete hydrolysis in chick's digestion process. The research performed by Zollitch et al. (1997) showed that unsaturated plant oils cause to decline energy loss in broiler's excreta and eventually provide higher metabolizable energy. It is anticipated that this increased available energy cause to accumulate fats as triglycerides in fat tissues. It is accepted our founding that 6% fat inclusion caused to extent fat tissues.

Table 3. Effects of different types and levels of fat on carcass characteristics of broiler chickens

Fat types or levels	Carcass (%)	Thigh (%)	Breast (%)	Abdominal fat (%)
Fat type				
Oil	75.46	20.29[b]	25.98	1.68[a]
Fatty acids	75.49	21.15[a]	25.51	1.31[b]
SEM	0.25	0.15	0.23	0.09
p-value	0.96	0.01	0.32	0.06
Fat level (%)				
3	75.64	20.81	26.19[a]	1.25[b]
6	75.31	20.63	25.29[b]	1.75[a]
SEM	0.25	0.17	0.22	0.09
p-value	0.51	0.59	0.05	0.01
Fat type × fat level				
3% oil	75.89	20.41	26.32	1.37[b]
6% oil	75.03	20.18	25.64	2.00[a]
3% fatty acids	75.39	21.22	26.06	1.12[a]
6% fatty acids	75.58	21.08	24.95	1.50[ab]
SEM	0.25	0.16	0.22	0.08
p-value	0.69	0.08	0.17	0.01

Using of fatty acids as an energy source in broiler chickens without any negative effects on performance was proved in other research. Its founding showed that chickens received highest levels of fatty acids had highest FI and FCR (Balevi et al., 2001). Pardio et al. (2001) showed that fatty acid source inclusion caused to increase body weight and FCR in broiler chickens between 1 to 7d old.

4. CONCLUSIONS

According to human consumption of oils and increasing price of this product, finding of alternatives for poultry nutrition seems to be essential. One of these alternatives is oil production by-products such as acidulated sunflower oil soap stock that we used in this research. In conclusion, it is possible to replace sunflower oil with acidulated sunflower oil soap stock without any negative effects on performance and with economic benefits. Between diets, treatment included with 3% fatty acid was most economical and efficient.

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