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Effects of canola oil on the Deposition of n-3 fatty acids in the Abdominal Fat of male Turkey's

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ABSTRACT

An experiment was conducted to study the effect of different level of canola oil on the abdominal fat omega 3 deposition fatty acid profiles in Iranian native turkeys. A total of 90 turkey chicks were randomly divided into 3 experimental treatments with 3 replicates were arranged in a completely randomized design. The experimental period lasted 20 weeks. Experimental diets consisted of: Basal diet with 0% canola oil; basal diet with 2.5% canola oil and basal diet with 5% canola oil. Results show that canola oil could change n-3 fatty acids composition and significantly increased compared with control group, this status have beneficial effects on the increase omega 3 fatty acids of native turkeys and this status could help to enrichment of meat products.

Keywords: Native turkey, abdominal fat, omega 3, canola oil.

INTRODUCTION

The current intake of omega-3 fatty acids in some of Asian countries diets is lower than the recommended level and the intake of PUFAs consists primarily of omega-6 fatty acids [1, 2]. The most of present diets are estimated to have 10 to15 times higher intake of omega-6 than omega-3 fatty acids [2]. The low intake of omega-3 fatty acids and increasing scientific evidence of the beneficial effects of EPA and DHA has led to introduction of omega-3 fatty acids enriched foods in the market [3]. Meat and meat products are the focal point in the diet of developed countries [4]. Meat is a major source of saturated fatty acids and conventional meat products have an n-6: n-3 ratio of higher than 15 [5]. Therefore, meat products could benefit from the addition of omega-3 PUFAs. The primary approach to enrich meat with omega-3 fatty acids is by incorporation of omega-3 sources such as some of seeds and or oils in the diet of animals. This strategy has been reported by several researchers in pigs [6], lamb [7] and poultry [8]. Meat products such as sausages prepared from these animals have been found to be enriched with omega-3 fatty acids. Sausages made from pigs fed ALA [9] and chicken frankfurters from chickens fed fish oil at 2-4% [10] had increased levels of n-3 fatty acids. The modification of the ratio of fatty acids in meat products could be achieved by replacement of animal fat with vegetable oils as vegetable oils are a rich source of PUFAs [11]. The objectives of this study was to evaluate canola oil usage in the Iranian native turkeys and its effects on he abdominal fat fatty acids composition.

MATERIALS AND METHODS

2.1. Animals and Diets

One-day-old male Iranian native turkey chickens were obtained from a commercial hatchery of the east Azerbaijan Research Center for Agriculture and Natural Resources (Tatar Research Station) and were placed in 9 floor pens with 10 birds per pen. All chicks were fed experimental diets containing 0% CO, 2.5% CO and 5%CO in the fattening period Data's recording was performed at four period 4-8, 8-12, 12-16 an 16-20 week. The experimental diets formulated isonitrogenouse and isoenergetic, accordance with the 1994 recommendations of the National Research Council [12] (table 1). The birds were given access to water and diets ad-libitum. The composition and calculated nutrient composition of the treatment diet is shown in Table 1.

2.2. Abdominal Fat Pad

Abdominal fat pad (including fat surrounding gizzard, bursa of Fabricius, cloaca, and adjacent muscles) was removed at 20 wk of age for turkeys. The abdominal fat was stored at −20 C until analysis. Fatty acid composition was determined by gas chromatography (GC).

2.3. Gas chromatography of fatty acids methyl esters

Sample preparation

Total lipid was extracted from breast and thigh according to the method of Folch [13]. Approximately 0.5 g of meat weighed into a test tube with 20 mL of (chloroform: methanol = 2:1, vol/vol), and homogenized with a poltroon for 5 to 10 s at high speed. The BHA dissolved in 98% ethanol added prior to homogenization. The homogenate filtered through a Whatman filter paper into a 100-mL graduated cylinder and 5 mL of 0.88% sodium chloride solution added, stopper, and mixed. After phase separation, the volume of lipid layer recorded, and the top layer completely siphoned off. The total lipids converted to fatty acid methyl esters (FAME) using a mixture of boron-trifluoride, hexane, and methanol (35:20:45, vol/vol/vol). The FAME separated and quantified by an automated gas chromatography equipped with auto sampler and flame ionization detectors, using a 30 m´ 0.25 mm inside diameter fused silica capillary column, as described. A (Model 6890N American Technologies Agilent) (U.S.A) Gas chromatography used to integrate peak areas. The calibration and identification of fatty acid peak carried out by comparison with retention times of known authentic standards. The fatty acid results form gas chromatography with Chem Station software analyzed and expressed as weight percentages.

2.4. Statistical Analysis

The performance and analytical data obtained were analyzed by variance analysis using the procedure described by the SAS version 8.2 [14]. The Duncan mean separation test was used to determine significant differences between mean values.

$$y_{ij} = \mu + a_i + \varepsilon_{ij}$$

Where

y_{ij} = all dependent variable

μ = overall mean

a_i = the fixed effect of oil levels($i = 1,2,3$)

ε_{ij} = the random effect of residual

RESULTS AND DISCUSSION

Fatty acid compositions of the abdominal fat are shown in Table2. Saturated fatty acids such as C14:0, C15:0 were not significantly changed, but C16:0 and C20:0 with descending rate compared with control group significantly decreased, while C18:0 and C22:0 with ascending rate increased compared with control group. Mono saturate fatty acids (MUFA) include C16:1 n7, C18:1 n-9 significantly deceased while other MUFA such as C18:1 t11, C20:1 n-9 has not significantly changed. Poly unsaturated fatty acids (PUFA) C18:2, C18:2 t12, C20:5 n-3, C22:6 n-3 not changed in the experimental treatments but C18:2 n-6 cis and C22:4 n-6 as n-6 fatty acid significantly increased with usage canola oil in the turkeys diets, and C18:3 and C22: 5n-3 as a n-3 fatty acids significantly increased compared with control group and for C18:3 n-3 from 4.1790 percent in control group reached to 7.1479 and 7.3953 percent, respectively and for C22:5 n-3 from 3.2516 percent reached to 6.9323 and 8.0224 percent respectively. Replacing soy oil with tallow increased the amount of abdominal fat in chickens[15]. Vila` and Esteve-Garcia (1996) found that sun- flower acid oil produced less abdominal fat deposition in broilers than tallow acid oil at different levels of fat inclusion, although the ME of tallow was lower than that of sunflower[16]. Abdominal fat deposition increased with increasing fat inclusion level in birds fed tallow, whereas it remained constant in birds fed sunflower. Sanz et al. (1999) found less abdominal fat in broilers fed sunflower oil than in those fed tallow or lard. All these studies suggest that dietary fatty acid profile could affect abdominal fat deposition [17]. However, there are still few experiments designed to study this effect on poultry abdominal fat, Howe ever results show that canola oil could affected abdominal fat fatty acids profile and have beneficial effects on the human health and could application this poultry fat enriched with omega 3 fatty acids and usage in meat products.

TABLE 1. Percentage composition of experimental diets in four period

	4 -8 week			8 - 12 week			12 - 16 week			16 - 20 week		
Ingredients'	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**
Corn	42.50	38.00	36.00	45.60	43.00	35.00	56.64	48.50	40.00	64.41	58.00	48.00
SBM	34.40	36.00	31.15	28.25	27.30	28.24	26.00	27.00	27.50	21.00	21.00	21.00
Oi	0.00	1.25	2.50	0.00	2.50	5.00	0.00	2.50	5.00	0.00	2.50	5.00
Fish	4.80	3.70	6.60	8.00	8.00	8.00	2.64	1.82	1.50	0.65	0.70	0.67
Starch	3.10	3.22	1.56	7.46	3.32	3.37	6.57	6.51	6.50	7.10	5.56	6.71
Alfalfa	3.47	5.00	6.00	3.00	5.00	6.00	1.50	4.00	6.00	1.00	3.80	6.00
DCP	1.38	1.52	1.11	0.63	0.61	0.62	1.03	1.15	1.18	1.17	1.15	1.15
Met	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Lys	1.50	1.50	1.50	1.50	1.50	1.50	1.40	1.50	1.50	1.50	1.50	1.50
Oyster	1.02	1.02	0.86	0.73	0.67	0.62	0.92	0.87	0.82	0.90	0.81	0.73
wheat bran	2.00	3.00	6.00	2.50	5.00	6.00	1.00	3.00	6.00	0.00	1.70	5.00
Vit supp[1]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Min supp[2]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sand	3.58	3.54	4.47	0.08	0.85	3.40	0.05	0.90	1.75	0.02	1.03	1.99
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated nutrient content												
ME kcal/kg	2755	2755	2755	2850	2850	2850	2945	2945	2945	3040	3040	3040
Crude protein (%)	24.7	24.7	24.7	20.9	20.9	20.9	18.1	18.2	18.1	15.7	15.7	15.7
Calcium (%)	0.95	0.95	0.95	0.81	0.81	0.81	0.71	0.71	0.71	0.62	0.62	0.62
Available P (%)	0.48	0.48	0.48	0.40	0.40	0.40	0.36	0.36	0.36	0.31	0.31	0.31
ME/CP	112	112	112	136	136	136	163	162	163	194	194	194
Ca/P	2	2	2	2	2	2	2	2	2	2	2	2

1Vitamin content of diets provided per kilogram of diet: vitamin A,D, E and K.

2 Composition of mineral premix provided as follows per kilogram of premix: Mn, 120,000mg; Zn, 80,000 mg; Fe, 90,000 mg; Cu, 15,000 mg; I, 1,600 mg; Se, 500 mg; Co, 600 mg

Table2. Least square means for fatty acid profiles of abdominal fat of turkey

	Treatments				
	control	2.5	5	P value	SEM
C14:0	1.2165 [a]	1.4522 [a]	1.3742 [a]	0.7390	0.2131
C15:0	1.2771 [a]	0.5059 [a]	0.3885 [a]	0.1375	0.2882
C16:0	28.4081 [a]	18.7950 [b]	17.4684 [b]	0.0001	0.4044
C16:1 n7	7.6068 [a]	5.7254 [b]	4.4209 [c]	0.0008	0.2973
C18:0	8.9256 [b]	9.3932 [b]	10.7676 [a]	0.0083	0.2789
C18:1 n9	16.8759 [a]	16.2074 [a]	15.3501 [b]	0.0127	0.2439
C18:1 Trans t11	1.5751 [a]	1.3419 [a]	1.2573 [a]	0.4846	0.1820
C18:2	2.9398 [a]	2.9254 [a]	3.3203 [a]	0.6853	0.3532
C18:2 Trans t12	0.6668 [a]	0.6790 [a]	0.6101 [a]	0.9897	0.3606
C18:2n6Cis	4.1588 [c]	8.5061 [b]	10.3379 [a]	0.0001	0.3453
C18:3 n-3	4.1790 [b]	7.1479 [a]	7.3953 [a]	0.0002	0.2600
C20:0	2.1870 [a]	1.5371 [ab]	1.0091 [b]	0.0986	0.3160
C20:5n-3	2.8226 [a]	2.4456 [a]	2.0535 [a]	0.6334	0.5483
C20:1n-9	0.8976 [a]	1.6235 [a]	1.2297 [a]	0.4429	0.3761
C22:0	1.7060 [a]	2.0410 [a]	2.0112 [a]	0.8309	0.4247
C22: 4n-6	8.3875 [b]	9.5746 [ab]	10.1304 [a]	0.0498	0.3927
C22:5 n-3	3.2516 [c]	6.9323 [b]	8.0224 [a]	0.0001	0.2636
C22:6 n-3	2.3414 [a]	2.5786 [a]	2.6517 [a]	0.7924	0.3301
PUFA	28.7480 [b]	40.790 [a]	44.5220 [a]	0.0018	1.7644
n3	12.5950 [b]	19.104 [a]	20.1230 [a]	0.0027	0.9475

CONCLUSION

Result show that canola oil could affected abdominal fat fatty acids profile and have beneficial effects on the increase omega 3 fatty acids of native turkeys and this status could help to enrichment of meat products such as chicken sausage and salami.

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