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Enrichment of Iranian native turkey breast meat with n-3 polyunsaturated fatty acids

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ABSTRACT

Ninety male Iranian native turkey were randomly distributed into three experimental treatments to determine of the amount canola oil fatty acids deposited in raw chicken tissues. These diets were isonitrogenous and isoenergetic were given to broiler chickens throughout a 20 wk growth period. This trial was conducted in completely randomize design. Birds were slaughtered at 20 wk of age. Breast meat samples were separated and frozen at -20 C until to determine as fatty acid profile. Data was analyzed with one way ANOVA and means compared with Duncan test. Results show that canola oil could influence fatty acid profile and improved breast meat nutritional value. Total omega3 FA content in breast meat, were significantly (P>0.0001) increased (from 9.5372 percent for control group to 18.4461 and 21.0941 percent for experimental group, respectively. Applications of 5 percent have high effect of breast meat.

Keywords: native turkey, breast, fatty acid, omega 3

Abbreviations*:FA, Fatty Acid; SFA, saturated fatty acids; LA, linoleic acid; LNA, linolenic acid; PUFA, poly unsaturated fatty acid; FAME, fatty acid methyl esters; CO, Canola oil; GLM, general liner model.*

INTRODUCTION

The most practical method for increasing the energy density in poultry diets has been by the addition of fats and oils [1], but addition energetic advantage, could change fatty acid composition of whole carcass there are two reasons for the increasing level of polyunsaturation in chicken meat. First, human nutritionists recommend reducing the intake of SFA because of its relationship with the development of cardiovascular diseases[2]. Secondly, the use of animal fats has been reduced approximately in world, in favor of vegetable oils that are more polyunsaturated. The lipid composition of broiler meat can be modified by adding LA and LNA,

vegetable oils [3], fish oils [4, 5] and canola oil [6]. However, there are few reports on the effect of increasing levels of dietary PUFA on the amount and type of FA deposited in chicken tissues, especially in the edible portions[7,8]. Objective of this study was to evaluate canola oil effects on the Iranian turkey breast meat enrichment of n-3 polyunsaturated fatty acids.

MATERIALS AND METHODS

2.1. Animal and diet

The investigation was performed on 90 male native Iranian turkeys in their fattening period (from 4th to 20th week of age). The turkey chicks with completely randomized design of 3 treatments, with 3 repetitions and 10 chicks in each box were fed experimental diets containing 0% CO(T1) , 2.5% CO(T2) and 5%CO (T3) in the fattening period. The experimental diets formulated isonitrogenouse and isoenergetic, accordance with the 1994 recommendations of the National Research Council [9] (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. At the end of the growing period the number of two pieces from each pen randomly selected and slaughtered with cutting the neck vessels and experimental samples from each breast meat samples prepared and sent to the laboratory at temperature - 20°C below zero were stored.

2.2. Gas chromatography of fatty acids methyl esters

Total lipid was extracted from breast and thigh according to the method of Folch [10], Approximately 0.5 g of meat weighed into a test tube with 20 mL of (chloroform: methanol = 2:1, vol/vol), and homogenized. 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 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 Pattern of fatty acids of breast samples was determined by gas chromatography (Model 6890N American Technologies Agilent). The composition of breast meat samples fatty acid of supplemented lipids is shown in Tables 3 data were statistically analyzed using one-way ANOVA, and means with significant F ratio were compared by Duncan multiple range test.

2.3. Statistical Analyses

Data were analyzed in a complete randomized design using the GLM procedure of SAS version 8.2.

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

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; Duncan multiple range test used to compare means.*

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

RESULTS AND DISCUSSION

We used various regimens with increasing levels of canola oil to study affects of breast meat fatty acid profiles. Table 2 show that meat quality parameters of the breast samples of turkey according to the amount of canola oil in the diet. Fatty acids of breast meat without skin were modified by dietary polyunsaturation level. N-3 fatty acids include C18:3 n-3, C20:5n-3, C22:5 n-3 and C22:6 n-3 were evaluated. C18:3 n-3 content from 3.5562 percent I control group reached to 6.7994 and 8.2447 percent in experimental treatment, respectively. C20:5n-3 affected on the anola oil in the turkey diet and significantly reached to 2.3737 and 2.1263 percent. C22:5 n-3 good affected canola oil and approximately 2-3 time increase in experimental group and reached to 6.7263 and 8.3857 percent, respectively, but C22:6 n-3 only numerically increased and not significant. Total omega 3 FA content in breast meat, were significantly (P>0.0001)

increased (from 9.5372 percent for control group to 18.4461 and 21.0941 percent for experimental group, respectively. Recent studies showed that fatty acids content of this tissues influence by usage canola oil in diets. This results agreement with other researcher reports[3, 8, 11, 12].

Table2. Least square means for fatty acid profiles in turkey breast.

	Treatments				
	T1	**T2**	**T3**	**SEM**	**P>F**
C14:0	0.7424[a]	0.8457[a]	1.0254[a]	0.2436	0.1068
C15:0	0.2114[a]	0.2562[a]	0.2917[a]	0.8880	0.1158
C16:0	28.590[a]	19.30[b]	16.94[c]	0.0001	0.4042
C16:1 n7	7.11[a]	5.95[b]	4.83[c]	0.0001	0.1427
C18:0	8.97[b]	9.26[b]	10.75[a]	0.0016	0.2000
C18:1 n9	17.43[a]	15.60[b]	15.30[b]	0.0134	0.3725
C18:1 Trans t11	0.2987[a]	0.2077[a]	0.4518[a]	0.5209	0.1447
C18:2	2.5059[a]	2.8915[a]	3.1760[a]	0.2014	0.2314
C18:2 Trans t12	0.5293[a]	0.3253[a]	0.5655[a]	0.7134	0.2168
C18:2n6Cis	4.4154[c]	8.2898[b]	9.3383[a]	0.0001	0.2439
C18:3 n-3	3.5562[c]	6.7994[b]	8.2447[a]	0.0001	0.1993
C20:0	1.3194[a]	1.2867[a]	1.2688[a]	0.9898	0.2536
C20:5n-3	1.3421[b]	2.3737[a]	2.1263[a]	0.0390	0.2230
C20:1n-9	0.6001[b]	1.3501[a]	1.6164[a]	0.0141	0.1718
C22:0	0.93269[b]	2.0205[a]	2.6262[a]	0.0054	0.2291
C22: 4n-6	8.8864[a]	10.1375[a]	10.6384[a]	0.1111	0.5019
C22:5 n-3	2.7250[c]	6.7263[b]	8.3857[a]	0.0002	0.4243
C22:6 n-3	1.9138[a]	2.5467[a]	2.4275[a]	0.2282	0.2436
PUFA	25.87[c]	40.09[b]	44.812[a]	0.0001	1.1283
n3	9.5372c	18.4461b	21.0941a	0.0001	0.6627

Different superscripts in each raw indicate significant difference.

CONCLUSION

Results of the percent study conclude that 2.5 and 5 percent canola oil can provide optimal performance according to omega 3 fatty acids in breast meat and could usage this oil in broiler diets and could replace with energetic ingredients in diet with any problems and increase nutritional value of breast meat.

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