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Turkey Breast Meat Change of EPA and DHA Fatty Acids Content During Fed Canola Oil

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Abstract: The aim of this study was to evaluate the effects on omega 3 fatty acids include of Docosahexaenoic (DHA) and eicosapentaenoic (EPA) content when canola oil (CO) was included in Iranian native turkey rations. Ninety one turkey chicks were randomly distributed into 3 treatment: control (0 % CO), 2.5% CO and 5% CO for 20wk. These diets were isonitrogenous and isoenergetic were given to chicks throughout growth period. Eicosapentaenoic and docosahexaenoic acids and other fatty acids were analyzed by gas chromatography. Data was analyzed with one way ANOVA and means compared with Duncan multiple range test. In conclusion, EPA and DHA fatty acids content of breast meat samples significantly affected by dietary polyunsaturation level and were significantly ($p< 0.05$) and canola oil could successfully enriched turkey meat.

Key words: Native Turkey · Barest Meat · DHA · EPA

INTRODUCTION

Omega-3 is the name given to a family of polyunsaturated fatty acids. The parent omega-3 - linolenic acid (C18:3)- is described as 'essential' as, like vitamins. In theory, humans are able to synthesis eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) from dietary LNA.Since, in practice this process is inefficient, n-3 should be obtained from diet. Omega-3 fatty acids also have positive effects on human health. Routin consumption of omega-3 may reduce blood pressure, hypertension and tumor formation [1- 6]. Many authors have studied how the inclusion of different fat sources in the broiler's diet affect 1) the proportion of fatty acids (FA), mainly polyunsaturated fatty acids (PUFA), in meat [7- 11] and 2) the amount of fat deposited by the birds [12-15]. Due to the current limited availability and high cost of fish and low acceptance of fish meat to many consumers, poultry meat and eggs enriched by n-3 PUFA seems to be a feasible alternative to meet this recommendation. Fish oil [16], linseed oil and rapeseed oil [8] are used most commonly in the diets with an aim to manipulate the n-3 PUFA composition of poultry meat. The objective of this trial was to determine the rate of incorporation of dietary fatty acids from feeding a PUFA-rich diet to turkey breast meat lipids.

MATERIALS AND METHODS

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, 2.5% CO and 5%CO in the fattening period. The experimental diets formulated isonitrogenouse and isoenergetic, accordance with the 1994 recommendations of the National Research Council (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.

Gas Chromatography of Fatty Acids Methyl Esters Sample Preparation

Fatty Acids: Total lipid was extracted from breast and thigh according to the method of Folch *et al*.[17]. Approximately 0.5 g of meat weighed into a test tube with 20 mL of (chloroform: methanol = 2:1, vol/vol) and

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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

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 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 lipid composition was determined by gas chromatography (Model 6890N American Technologies Agilent). 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.

Statistical Analyses: Data were analyzed in a complete randomized design using the GLM procedure of SAS version 8.2 (SAS Inst. Inc. Cary, NC).

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

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.

RESULTS AND DISCUSSION

We used various rations with different levels of canola oil to study of it effects on the meat fatty acid profiles.

Table 2: 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
MUFA	25.4532[a]	23.1271[b]	22.2077[b]	0.0059	0.4539

Different superscripts in each raw indicate significant difference.

Results of breast meat samples quality parameters show that in table 2. With increasing levels of dietary polyunsaturated caused the higher accumulation of n-3 (C18:3n3, C20:5n3, C22:5n3 and C22:6n3) in breast meat. The n-3 fatty acids content in breast meat was significantly affected by canola oil and treatment with 2.5 and 5 % CO was higher level of PUFA fatty acids compared in control group($p<0.05$). EPA and DHA fatty acids content of breast meat samples significantly affected by dietary polyunsaturation level and were significantly ($p< 0.05$). DHA (C22:5n-3) content from 1.91 percent in ontrol group significantly reached to 2.54 and 2.42 percent in experimental treatment($p<0.05$) and EPA (C20:5 n-3) content from 1.34 percent reached to 2.37 and 2.12 percent and were significant($p<0.05$). Some authors showed that the dietary polyunsaturation level of fat does not influence intramuscular lipid content of breast [14, 19], but Ajuyah *et al* [18] found a higher fat content in breast muscle with increasing levels of PUFA in the diet that according with this research finding. However, other authors found lower lipid content of breast of chickens fed diets enriched with polyunsaturated oils [15]. Such discrepant findings in intramuscular fat content of breast muscles may be attributed to several factors, such as the analytical procedure used to extract fat from samples. In general, modification of FA composition of intramuscular fat seems to be more limited [19, 20]. It may be due to the fact that FA in intramuscular fat are used mainly as components of cellular membranes and the cell has to maintain its physical characteristics to ensure fluidity and permeability of different compounds. In conclusion this results show that canola oil could influence meat quality and DHA and EPA contents in native Iranian turkey meat.

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