Global Veterinaria 5 (1): 26-29, 2010
ISSN 1992-6197

Effect of Canola Oil on Mufa and Pufa Deposition in Breast Meat of Iranian Native Turkey

[1]Ramin Salamatdoustnobar, [1]Abolfazl ghorbani, [1]H. Aghdam Shahryar,
[1]Kambiz Nazer Adl, [1]Jamshid Ghiyasi, [2]A. Ayazi, [2]A. Hamidiyan and [2]A. Fani

[1]Islamic Azad University, Shabestar Branch, Department of Animal Science, Shabestar, Iran
[2]Department of Agriculture, Natural Resources and Animal Science,
East Azerbaijan Research Center, Tabriz, Iran

Abstract: The aim of this research was to evaluate the effect of Canola oil on the carcass selected tissues of male Iranian native turkey chicks. 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. Meat fatty acids profiles with Gas Chromatography technique were measured. Data was analyzed with one way ANOVA and means compared with Duncan multiple range test. Polyunsaturated fatty acids in breast meat affected on the usage of canola oil and has a ascending rate and from 25.87 percent from control group significantly reached to 40.09 and 44.81 percent, respectively ($p<0.05$). mono saturated fatty acid with significantly with decline rate from 25.4 percent reached to 23.12 and 22.20 percent in experimental treatment include 2.5 and 5 percent canola oil, respectively ($p<0.05$). Result show that canola oil could affected MUFA and PUFA content in breast meat.

Key words: Turkey · Canola oil · Breast meat · Fatty acid · MUFA and PUFA

INTRODUCTION

Pectoral muscle is a valuable constituent of human food. Owing to its improve fatty acid profile and, it is recommended for the healthy diet. However, the pectoral muscle content of fat and cholesterol can be changed by variations in the feeding schedule [1, 2]. The importance of a relatively high intake of polyunsaturated fatty acids (PUFA) in human nutrition is nowadays generally accepted; PUFA should constitute 7% of total energy consumed [3-5]. Within PUFA, fatty acids essential for man are linoleic acid (C18:2n-6; LA) and á-linolenic acid (C18:3n-3; LNA), the precursors of PUFA n-6 and n-3 series, respectively. Quantitatively and qualitatively most important metabolites of LA and LNA are arachidonic acid (C20:4 n-6; AA) and eicosapentaenoic acid (C20:5 n-3; EPA) and docosahexaenoic acid (C22:6 n-3; DHA). [3]. Linolenic acid (18:3 n-3) is important, but long chain EPA (20:5 n-3) and DHA (22:6 n-3) and monounsaturated fatty acids (MUFA) and PUFA amounts and ratios are the most effective. In recent years, besides the technological aspects related to the susceptibility of meats to oxidation, the effects of dietary fat sources with different degrees of unsaturation and double bond positioning on the lipid composition of meat are specially considered. Chicken lipids are a good source of essential n-6 fatty acids for humans but generally have high n-6/n-3 fatty acid ratio. Decreasing this ratio could be one desirable aspect in poultry lipids. Canola oil are one of the few lipid sources rich in n-3 and their inclusion in poultry diets could contribute to increased the concentrations of n-3 in poultry lipids [6]. Fat inclusion in broiler diets affects carcass fat quality because dietary fatty acids are incorporated with little change into the bird body fats [7]. Thus, the source of oil used in the feed influence the composition of broiler body lipids. Objective of the present study was to evaluated canola oil effects on the breast meat fatty acids and compared MUFA and PUFA percent in Iranian native turkey's meat.

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,

Crresponding Author: R. Salamatdoust Nobar, Department of Animal Science, Islamic Azad University, Shabestar Branch, Shabestar, Iran, E-mail: salamatdoust@gmail.com.

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

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 [8] (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*. (1957)[9]. 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 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 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.

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

Whereas

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

Least square means for fatty acid profiles in turkey breast meat presented in Table 2. Results show that breast meat fatty acid profile with application of canola oil is changed. Monounsaturated fatty acid (MUFA) in breast meat include C16:1n7 affected canola oil fatty acid profile and has descending rate and from 7.11 percent significantly reached to 5.95 and 4.8 percent in experimental group, respectively (p<0.05). Also C18:1n9 has descending rate and from 17.43 percent in control group significantly reached to 15.60 and 15.30 percent in experimental group, result show that between experimental group has not significantly difference, C18:1t11 not affected with application canola oil and not changed content of this fatty acid and for C20:1n-9 with ascending rate wit 0.60 percent in control group reached to 1.35 and 1.61 percent in experimental group (p<0.05). Polyunsaturated fatty acids include C18:2, C18:2 t12, C22:4n6 and C22:6n3 has not affected of canola oil and not significance difference with control group. Poly unsaturated fatty acid include C18:2, C18:2 t12, not affected of canola oil in the diet and not significance change, but C18:2n has ascending rate and from 4.41 percent in control group significantly reached to 8.28 and 9.33 percent in experimental group (p<0.05). n-3 fatty acids as á-linoleic acid (C18:3n-3) using canola oil had positive effect on the values of this fatty acid and amount of this fatty acid in the control of 3.5562 percent reached to 6.7994 and 8.2447 percent respectively in the experimental treatments (P<0.05). C22:4n-6 and C22:5n-3 fatty acids significantly increased with usage of canola oil (p<0.05) and Eicosapentaenoic acid (C20: 5-3) also from 1.3421 percent in control treatment significantly reached to 2.3737 and 2.1263 percent in treatments and docosohexaenoic acid (C22-6n-3) in 1.9138 percent, respectively, significantly reached to 2.5467 and 2.4275 percent (P<0.05). A number of studies have examined the effects of dietary long-chain PUFA, such as those contained in vegetable oil, on the FA composition of the broiler carcass [10, 11, 2, 13]. Many of these studies were conducted with the aim of enhancing the human dietary intake of long chain n-3 PUFA and the specific aim of conferring beneficial effects to human health and resistance to disease. These studies have shown that the deposition of n-3 polyunsaturated fatty acids in muscle and adipose tissues should be increased by supplementing the diet with sources rich in these FA. Results indicated mono saturated fatty acid with significantly with decline rate from 25.4 percent reached to 23.12 and 22.20 percent in experimental treatment include 2.5 and 5 percent canola oil, respectively (p<0.05). Polyunsaturated fatty acids in breast meat affected on the usage of canola oil and has a ascending rate and from 25.87 percent from control group significantly reached to 40.09 and 44.81 percent, respectively (p<0.05). Similar results have previously been reported by other authors who found a higher deposition of long-chain PUFA in breast muscle compared with thigh [9, 10, 13, 14].

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.

ACKNOWLEDGMENT

Financial support for this study (Islamic Azad University, Shabestar Branch) was provided.

REFERENCES

1. Hargis, P.S. and M.E. Van Elswyk, 1993. Manipulation of fatty acid composition of poultry meat and eggs for health conscious consumer. J. World's Poultry Sci., 49: 251-264.
2. Has-Schön, E., Z. S¡krtic and G. Kralik, 2008. Beneficial effects of different dietary oils on cholesterol level and fatty acids profile of turkey pectoral muscle. Ital. J. AnIm. ScI., 7: 161-171.
3. Adam, O., 2003. Dietary fatty acids and immune reactions in synovial tissue. European J. Medical Res., 8: 381-387.
4. Lo´pez-Ferrer, S., M.D. Baucells, A.C. Barroeta and M.A. Grashorn., 1999. N-3 enrichment of chicken meat using fish oil: Alternative substitution with rapeseed and linseed oils. Poult. Sci., 78: 356-365.
5. Salamat Doust Nobar, R., H. Aghdamshahriar and A. Gorbani, 2008. Enrichment of broiler meat with n-3 polyunsaturated fatty acids. Asian J. Animal and Veterinary Advances., 3(2): 70-77.
6. Salamat Doust Nobar, R., K. Nazeradl, A. Gorbani, H. Aghdamshahriar and J. Gheyasi, 2007. Incorporation of DHA and EPA Fatty Acids into Broiler Meat Lipids. J. Animal and Veterinary Advances., 6(10): 1199-1203.
7. Scaife, J.R., J. Moyo, H. Galbraith, W. Michie and V. Campbell, 1994. Effect of different dietary supplemental fats and oils on the tissue fatty acid composition and growth of female broilers. Br. Poult. Sci., 35: 107-118.
8. NRC. 1994. Nutrient Requirements of poultry. 9th rev. ed. National Academy Press. Washington, DC, 1994.
9. Folch, J., M. Lees and G.H. Sloane-Stanley, 1957. A simple method for the isolation and purification of total lipids from animal tissues. J. Biology Chemical, 226: 497-507.
10. Hulan, H.W., R.G. Ackman, W.M.N. Ratnayake and F.G. Proudfoot, 1988. Omega-3 fatty acid levels and performance of broiler chickens fed redfish meal or oil. Can. J. Anim. Sci., 68: 533-547.
11. Miller, D. and P. Robisch, 1996. Comparative effect of herring, menhaden and safflower oils on broiler tissue fatty acid composition and flavour. Poultry Sci., 48: 1246-2157.
12. Nash, D.M., R.M.G. Hamilton and H.W. Hulan, 1995. The effect of dietary herring meal on the omega-3 fatty acid content of plasma and egg yolk lipids of laying hens. Can. J. Anim. Sci., 75: 247-253.
13. Phetteplace, H.W. and B.A. Watkins, 1990. Lipid measurements in chickens fed different combinations of chicken fat and menhaden oil. J. Agric. Food Chem., 38: 1848-1853.
14. Crespo, N. and E. Esteve-Garcý´a, 2001. Dietary fatty acid profile modifies abdominal fat deposition in broiler chickens. Poult. Sci., 80: 71-78.
15. Gonza´lez-Esquerra, R. and S. Leeson, 2000. Effects of menhaden oil and flaxseed in broiler diets on sensory quality and lipid composition of poultry meat. Br. Poult. Sci., 41: 481-488.