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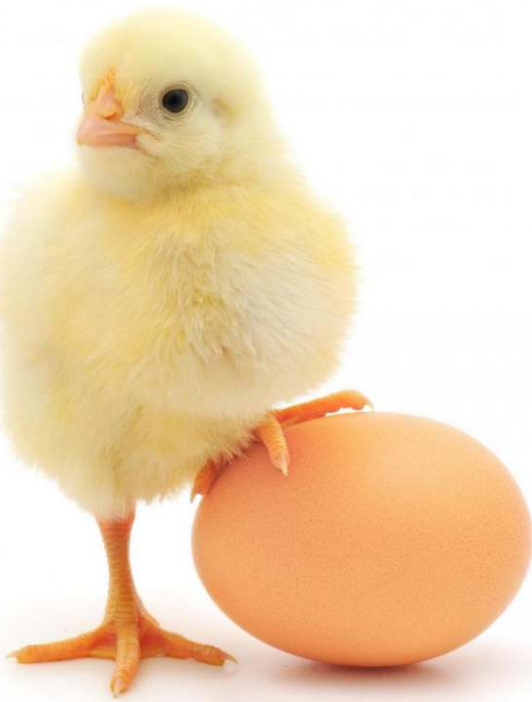

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ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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The Effect of Dietary Supplement Coriander Seed (*Corindrum sativum L*) on Fatty Acid Composition of Selected Tissues in Japanese Quail (c)

Osman Nihat Ertas
Department of Plant and Animal Production, Firat University,
Sivrice Vocational School, 23119 Elazig, Turkey

Abstract: In This Experiment, Four hundred ninety, 3 day-old Japanese quails were randomly divided into five trial groups of 98 birds (49 males and 49 females) in each group according to diets, in the control group, the birds were fed with a basal diet (24% Crude proteins and 2900 Kcal metabolizable energy/kg. Four different levels of coriander seeds 0.5% (0.5 coriander group), 1% (1% coriander group), 2% (2% coriander group) and 4% (4% coriander group) were added to the basal diets. We were conducted to evaluated the effect of dietary supplemented coriander seed on fatty acid composition of selected tissues (Heart Tissues, Thigh Muscle and thigh Skin) in quails. Fatty acid profiles for selected tissues were altered by added coriander seeds in diets. While all tissues total PUFA concentration (especially n-3 PUFA) was higher 4%, 2% coriander seed according to 0.5%, 1% and control groups ($P<0.001$), Total SFA decreased. In conclusion, because of hypolipidemic and antioxidative properties of coriander, addition of 2 to 4% of coriander seed into quail diets significantly reduced SFA, unchanged total MUFA ($P>0.05$) and increased PUFA ($P<0.001$) (especially n3 PUFA) in selected tissues (Heart Tissues, Thigh Muscle And Thigh Skin) lipids.

Key words: Japanese quail, coriander sativum, fatty acids, selected tissues

INTRODUCTION

Omega-3 polyunsaturated fatty acids (n-3 PUFA) play an important role in human nutrition since they help to reduce the incidence of life style diseases such as coronary artery diseases, hypertension and diabetes, as well as some autoimmune and inflammatory disease such as arthritis and dermatitis (Simopoulos, 2000) in addition, it has been shown that the consumption of long-chain n-3 PUFA ensures vital components for the retina and for the membrane phospholipids of the brain (Rymer and Givens, 2005) In recent years, dietary supplements such as n-3 PUFA have been tested in an attempt to further decrease fat and cholesterol contents of poultry meat (Ayerza *et al*., 2002). The n-3 PUFA content of poultry products can be increased effectively through dietary manipulation, either directly using fish oil and fish meal, marine algae or indirectly by increasing levels of precursor n-3 PUFAs. However, n-3 Pufa-enriched diets increase both the susceptibility of cellular membranes to the induction of oxidative stress in animal organism (Miret *et al*., 2003) in this respect, dietary antioxidants such as Vitamin E, carotenoids, herbal extracts, BHT (butylated hydroxy toluene), BHA (butylated hydroxy anisole) and Ethoxyquin widely used in poultry diets. Many synthetic antioxidants are currently in use but there is growing consumer preference for natural antioxidants because of their potentially lower toxicity.

Coriander (*Coriander sativum*) is an umbelliferous annual plant of the parsley family, native to the eastern Mediterranean region and Southern Europe and is found many other parts of the World. It is valued fort he dry ripe fruits, called coriander seeds and also the fresh green leaves called cliantro. Coriander seed contains about from 0.1 to 1.5% essential oil and the essential oil contains d-linolool, Camphene, Sabinene, myrcene, terpinens, limonene and other comtituents. As a medicinal and aromatic plant has been used as a antispasmodic, carminative, stimulant, stomachic and purgative. Previous studies indicate that the degree of influence of a dietary fat on carcass fatty acid composition depends on its origin. Coriander has been reported to have strong lipolytic and antioxidative activity (Leung and Foster, 1996).

The aim of study was to determine lipolytic effects of different levels of coriander seed in diets on Fatty Acid Composition of selected tissues (Heart Tissues, Thigh Muscle and thigh Skin) in Japanese Quail.

MATERIALS AND METHODS

Animals, diets and experimental design: In this experiment, Four hundred ninety, 3 day-old Japanese quails were randomly divided into five trial groups of 98 birds (49 males and 49 females) in each group according to diets, in the control group, the birds were fed with a basal diet (24% Crude proteins and 2900 Kcal metabolizable energy/kg) according to National Research Council (NRC) (1994). Four different levels of coriander seeds 0.5% (0.5 coriander group), 1% (1% coriander group), 2% (2% coriander group) and 4% (4% coriander group) were added to the basal diets. Coriander seeds were ground in a mill (2.5 mm pore). Seeds were homogeneously mixed carefully to basal

Table 1: Chemical and percent composition experimental diets

		Coriander (%)			
Feeds	Control	0.5	1	2	4
Maize	57.07	56.66	56.26	55.45	53.84
Sunflower meal	1.85	1.73	1.60	1.36	0.86
Soybean meal(45CP)	35.00	35.00	35.00	35.00	35.00
Fish meal	3.88	3.91	3.94	4.00	4.11
Salt	0.27	0.27	0.27	0.27	0.27
DL-Methionine	0.08	0.08	0.08	0.08	0.09
Vitamin Premix*	0.12	0.12	0.12	0.12	0.12
Mineral Premix**	0.12	0.12	0.12	0.12	0.12
Dicalcium phosphate	0.69	0.68	0.68	0.68	0.68
Ground limestone	0.92	0.93	0.93	0.92	0.91
Coriander seeds	-	0.50	1.00	2.00	4.00
Calculated values					
Dry Matter	88.23	88.26	88.29	88.35	88.47
Crude protein (CP)	24.00	24.00	24.00	24.00	24.00
Crude cellulose	3.96	4.07	4.18	4.41	4.87
Ash	5.82	5.84	5.86	5.90	5.97
Ether extract	2.84	2.91	2.98	3.12	3.40
Ca	0.80	0.80	0.80	0.80	0.80
P	0.40	0.40	0.40	0.40	0.40
Methionine	0.50	0.50	0.50	0.50	0.50
Lysine	1.36	1.36	1.36	1.36	1.36
ME, Kcal/kg	2900	2900	2900	2900	2900
Analyzed values					
Crude protein (CP)	24.01	23.93	23.98	24.00	23.92
ME, Kcal/kg	2902	2904	2895	2898	2891
Crude cellulose	3.88	4.08	4.11	4.45	4.92

ME: Metabolizable energy.

*: Per 2.5 kg including; 2.000.000 IU vit A, 2.000.000 IU vit D_3; 35.000mg vit E, 4.000 mg vit K_3, 3.000mg vit B_1, 7.000 mg vit B_2, 5.000 mg vit B_6, 15 mg B12, 20.000 mg Niacin, 1.000 mg Folates, 45 mg Biotin, 10.000 mg Cal-D Pentotenot, 125.000 mg Cholin Chlorid and 50.000 mg vit C.

**: Per kg including; 60.000mg Fe, 60.000 mg Zn, 5.000 mg Cu, 1.000mg I, 200 mg Co, 150 mg Se, 80.000 mg Mn.

diet. The experimental diets were prepared freshly each day. Feed ingredients and diets were kept in a cool room throughout the experimental period. The ingredient and chemical composition of diets is a shown in Table 1. The diets were formulated to be isocaloric and isonitrogenous. Chemical composition of feed ingredients (dry matter, crude protein, ash and ether extract) as dried samples were analyzed using AOAC (1990) procedures and crude fiber was determined by the methods of Crampton and Maynard (1983). Photo periods of 24 hours/day during 4 weeks and 14 hours/day during 4-6 weeks were maintained. Feed and water were provided for *ad libitum* consumption. The body weights of the birds were measured individually. On the 42nd day, 10 males and female birds of similar body weights were selected from each treatment group, weighed and slaughtered by CO_2 asphyxiation to determine carcass yields and abdominal fat were obtained and stored in deep freezer at -20°C.

Chemical analysis: The total lipid was extracted with Hexan-isopropanol (3:2, v/v) by the method of Hara and Radin (1978). Selected tissues (Heart Tissues, Thigh Muscle and thigh Skin) were homogenized with the mixture of chloroform-methanol (2:1, v/v) in MICRA D 8 homogenizator. Non-lipid contaminants were removed by washing with 0.88% KCl solution. The extracts were evaporated in a rotary evaporator flask and dissolved in n-hexane and stored at -25°C until the further analysis. Fatty acids in lipid extracts were converted to methyl esters by using 2% sulphuric acid (v/v) in methanol (Husveth *et al*., 1982). Fatty Acid Methyl Esters (FAME) were extracted with n-hexane. Gas chromatography analysis was employed GC-17A instrument with FID and AOC-20i Auto injector and Auto sampler from Shimadzu (Kyota, Japan). FAMEs were separated by fused silica capillary column, 25 m length and 0.25 mm diameter, Permabond (Machhery-Nagel, Germany). Column temperature was programmed between 120-200°C, 4°C/min and 200-220°C, 3°C/min and final temperature was held 8 min. Injector and FID temperatures were 240 and 80°C, respectively. Nitrogen was used as carrier gas under head pressure of 50 kPa corresponding to 1.2 ml/min, 43 cm/s column flow rate). Identification of the individual methyl esters was performed by frequent comparison with authentic external standard mixtures analyzed under the same conditions. CLASS GC 10 software version 2.01 assisted at workup of the data. Heptadecanoic acid (margaric acid) was used as internal standard.

Statistical analysis: Data were subjected to analysis of variance and when significant differences were obtained, means were further subjected to Duncan's multiple range test (SPSS for Windows: 10.1, SPSS inc. (1993). The results were considered as significant when p values were less than 0.05 and 0.01.

RESULTS

The fatty acid composition of diets is shown in Table 2. The proportions of Saturated Fatty Acids (SFA), Monounsaturated Fatty Acids (MUFA) and Polyunsaturated Fatty Acids (PUFA) were similar what ever diets. The fatty acid composition of heart tissue was significantly altered by dietary coriander seed supplementation (Table 3). In coriander treated groups, the percentages of total SFA significantly decreased compared to the control group (p<0.01). Significant reductions were also observed in birds receiving 4% coriander seed (p<0.01). MUFA contents were not significantly affected by coriander seed supplementation compared to the control group (p>0.05). Significant changes in PUFA contents were also evidenced in the coriander groups. Marked increases of total PUFA contents were observed in all coriander treated groups (p<0.001). Again, maximal effects on PUFA percentages were obtained with the highest dosage of coriander seed into diets (4%). The fatty acid composition of thigh skin of quails feed Coriander seed (especially 2% and 4% coriander seed) was characterized by a significant improvement total PUFA (P<0.01) while Total SFA was reduced (P<0.05) (Table 4). Total MUFA contents was not altered feed supplementation. Table 5 demonstrates fatty acids composition of thigh muscle. While significant difference was observed total PUFA and SFA concentrations in heart tissue (P<0.01), No significant was differences total MUFA concentrations by supplemented dietary Coriander seed. All selected

Table 2: Fatty acid composition of experimental diets, %

		Coriander (%)			
Fatty acid	Control	0.5	1	2	4
Σ SFA	11.88	11.89	11.91	11.92	12.03
ΣMFA	22.54	22.51	22.57	22.66	22.74
Σ n3 PUFA	12.83	12.88	12.96	13.06	13.06
Σ n6 PUFA	50.73	50.53	50.38	50.30	50.22
Σ PUFA	63.56	63.41	63.34	63.36	63.28

ΣSFA: Total saturated fatty acids; ΣMUFA: Total monounsaturated fatty acids; ΣPUFA: Total polyunsaturated fatty

Table 3: Fatty acid Composition of Heart, % lipids in quail fed with coriander seed (0.5, 1, 2 and 4%) supplemented diets with basal diet (control group)

		Coriander (%)				
Fatty acid	Control	0.5	1	2	4	P
Σ SFA	37.95±0.2^{a}	37.01±0.3^{a}	35.73±0.3^{b}	35.11±0.2^{b}	33.43±0.3^{c}	**
Σ MFA	16.61±0.2	15.16±0.1	16.57±0.3	15.11±0.3	16.93±0.4	NS
Σ n3 PUFA	7.77±0.1^{c}	10.12±0.2^{b}	10.28±0.2^{b}	10.72±0.1^{b}	12.81±0.1^{a}	***
Σ n6 PUFA	37.67±0.4	37.80±0.5	37.72±0.4	38.21±0.6	36.83±0.5	NS
Σ PUFA	45.44±0.3^{c}	47.83±0.3^{b}	48.00±0.3^{ab}	49.78±0.6^{a}	49.64±0.5^{a}	***

*: P<0.05, **: P<0.01, ***: P>0.001, NS: P>0.05.

a,b,c,d,e: Mean values with different superscripts within a row differ significantly.

ΣSFA: Total saturated fatty acids; ΣMUFA: Total monounsaturated fatty acids; ΣPUFA: Total polyunsaturated fatty.

Table 4: Fatty acid composition of thigh Skin, % lipids in quail fed with coriander seed (0.5, 1, 2 and 4%) supplemented diets with basal diet (control group)

		Coriander (%)				
Fatty acid	Control	0.5	1	2	4	P
Σ SFA	33.85±0.2^{a}	32.88±0.3^{ab}	31.51±0.1^{b}	30.06±0.2^{c}	30.13±0.4^{c}	*
Σ MFA	38.56±0.3	39.18±0.4	38.73±0.5	38.84±0.5	38.33±0.6	NS
Σ n3 PUFA	1.20±0.05^{d}	1.25±0.03^{d}	1.49±0.05^{c}	2.49±0.06^{b}	3.93±0.08^{a}	**
Σ n6 PUFA	26.39±0.8	26.69±0.5	27.67±0.7	28.61±0.6	27.61±0.5	NS
Σ PUFA	27.59±0.3^{c}	27.94±0.4^{c}	29.76±0.6^{b}	31.10±0.5^{a}	31.54±0.3^{a}	**

*: P<0.05, **: P<0.01, ***: P>0.001, NS: P>0.05

a,b,c,d,e: Mean values with different superscripts within a row differ significantly.

ΣSFA: Total saturated fatty acids; ΣMUFA: Total monounsaturated fatty acids; ΣPUFA: Total polyunsaturated fatty.

Table 5: Fatty acid Composition of thigh muscle, % lipids in quail fed with coriander seed (0.5%, 1%, 2% and 4%) supplemented diets with basal diet (control group).

		Coriander (%)				
Fatty acid	Control	0.5	1	2	4	P
? SFA	42.79±0.4[a]	42.66±0.5[a]	40.65±0.3[b]	39.68±0.5b	38.63±0.5[c]	*
?MFA	19.05±0.5	19.93±0.5	20.68±0.6	20.31±0.7	20.73±0.6	NS
? n3 PUFA	12.82±0.2[d]	12.69±0.1[d]	13.93±0.2[c]	15.90±0.3[b]	16.07±0.3[a]	***
? n6 PUFA	23.34±0.5	24.88±0.6	24.74±0.6	24.11±0.5	24.57±0.9	NS
?PUFA	38.16±0.5[b]	37.41±0.5[b]	38.57±0.4[b]	40.01±0.4[a]	40.64±0.4[a]	*

*: P<0.05, **: P<0.01, ***: P>0.001, NS: P>0.05

a,b,c,d,e: Mean values with different superscripts within a row differ significantly.

ΣSFA: Total saturated fatty acids; ΣMUFA: Total monounsaturated fatty acids; ΣPUFA: Total polyunsaturated fatty acids.

tissues the highest total n3 PUFA 4% coriander seed groups were observed (P<0.001).

DISCUSSION

The present study indicated that different levels of Coriander seed supplemented with 0.5, 1, 2, and 4% diets caused enriched with n3 PUFAs significantly increased selected tissues (Heart Tissues, Thigh Muscle and thigh Skin) in quails. These effects were probably due to hypolipidemic and antioxidant properties of coriander seed (Lal *et al.*, 2004). An another study conducted on quail showed that different dietary levels (0.5, 1, 2, 4%) coriander supplemented caused higher levels of PUFA breast muscle in quail (Ertas *et al.*, 2005). Chithra and Lehman (1997) have previously reported that Coriander sativum decrease lipid uptake and enhanced lipid breakdown, resulting in lipolytic effects. This action on lipid metabolism could explain the reduction of SFA contents in liver. On the other hand, enhancement of unsaturated fatty acids in liver lipids would result from diminution of fatty acid oxidation in tissue. Indeed, a previous study has shown that the formation of lipid peroxides declined whereas activities of antioxidant enzymes (catalase, glutathione peroxidase) increased in rats treated by Coriander sativum (Chithra and Leelamma, 1999). The antioxidative property of coriander seed is related to the large amounts of tocopherols, carotenoids and phospholipids (Ramadan and Mörsel, 2004) which act through different mechanisms. Carotenoids act as primary antioxidants by trapping free radicals and as secondary antioxidants by quenching singlet oxygen (Reische *et al.*, 2002). Because n-3 PUFAs are fairly unstable to light and oxygen and go rancid quickly, where as n6 PUFAs are relatively more stable, the anti-oxidative effects of coriander seed on PUFA are particularly interesting.

Results in this experiment suggest that, because of hypolipidemic and antioxidative properties of coriander, addition of 2 to 4% of coriander seed into fish oil and fish meal as a well known source of long chain n-3 polyunsaturated fatty acids contain quail diets, significantly reduced SFA and increased PUFA in selected tissues (Heart Tissues, Thigh Muscle and Thigh Skin).

REFERENCES

AOAC, 1990. Official Methods of Analysis Association of Agricultural Chemists Virginia, D.C., U.S.A, pp: 746-780.

Ayerza, R., W. Coates and M. Lauria, 2002. Chia seed (*Salvia hispanica* L.) as an ω-3 fatty acid source for broilers: Influence on fatty acid composition, cholesterol and fat content of white and dark meats, growth performance and sensory characteristics. Poult. Sci., 81: 826-837.

Chithra, V. and S. Leelamma, 1997. Hypolipidemic effect of coriander seeds (*Coriandrum sativum*): mechanism of action. Plant Foods Hum. Nutr., 51: 167-72.

Chithra, V. and S. Leelamma, 1999. Coriandrum sativum changes the levels of lipid peroxides and activity of antioxidant enzymes in experimental animals. Indian J. Biochem. Biophys., 36: 59-61.

Crampton, E.W. and L.A. Maynard, 1983. The Relation of cellulose and lignin content to nutritive value of animal feeds. J. Nutr., 15: 383-395.

Ertas, O.N., T. Güler, M. Çiftçi, B. Dalkiliç and O. Yilmaz, 2005. The effect of dietary supplement coriander seed on the fatty acid composition of breast muscle in japanese quail. Revuede Med. Vet., 156: 514-518.

Hara, A. and N.S. Radin, 1978. Lipid Extraction of Tissues with a Low-Toxicity Solvent. Anal. Biochem., 90: 420-426.

Husveth F., F. Karsai and T. Gaal, 1982. Periparatal fluctuations of plasma and hepatic lipid contents in dairy cows. Acta Vet. Hung., 30: 97-112.

Lal, A.A.S., T. Kumar, M.P. Balakrishna and K.S. Pillai, 2004. Hypolipidemic effect of Coriandrum Sativum L. in triton-induced hyperlipidemic rats. Ind. J. Exp. Biol., 42: 913-918.

Leung, A.Y. and S. Foster, 1996. Encyclopedia of common natural ingredients Drugs and Cosmetics, 2nd Edn. John Wiley (Ed.), New York: John Wiley and Sons Inc. Pres.

Miret, S., R.J. Simpson and A.T. McKie, 2003. Physiology and molecular biology of dietary iron absorption. Annu. Rev. Nutr., 23: 283-301.

NRC, National Research Council, 1994. Nutrient Requirements of Poultry. 9th rev. Edn., Natonal Academy Press, Washington, DC.

Ramadan, M.F. and J.T. Mörsel, 2004. Oxidative stability of black cumin (*Nigella sativa* L.) Coriander (*Coriandrum sativum* L.) and niger (Guizotia abyssinica Cass.) crude seed oils upon stripping. Eur. J. Lipid Sci. Technol., 106: 35-43.

Reische, D.W., D.A. Lillard and R.R. Eitenmiller, 2002. Antioxidants in: Food lipids, second Edn., Eds. Akoh, C.C., Min, D.B. Marcel and N.Y. Dekker (Eds.), (USA), pp: 489-516.

Rymer, C. and D.I. Givens, 2005. n-3 Fatty acids enrichment of edible tissue of poultry: A review. Lipids, 40: 121-130.

Simopoulos, A., 2002. Omega-3 fatty acids in inflammation and autoimmune diseases. J. Am. Coll. Nutr., 21: 495-505.

SPSS for Windows. Released 6.0 June 17 1993 Copy right (c. Sps inc. 1989-1993).