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The Effect of Dietary Supplement Coriander Seed on Abdominal Fat Deposition and Fatty Acid Composition in Japonese Quail (A)

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Abstract: An experiment was conducted to evaluated the effect of dieatary supplemented coriander seed on fatty acid composition of abdominal fat and abdominal fat deposition in quails. A total of 490, 3 days old (49 males and 49 females) Japanase quails (Coturnix Coturnix Japonica) were randomly divided into five trial groups in each group according to diets, in the control group. Four different levels of coriander seeds 0.5% coriander group, 1% coriander group, 2% coriander group and 4% coriander group were added to the basal diets. Fatty acid profiles for abdominal fat were altered by added coriander seeds in diets. Total PUFA was higher 4%, 2% coriander seed according to 0.5%, 1% and control groups ($p<0.01$). In conclusion because of hypolipidemic and antioxidative properties of coriander, addition of 2-4% of coriander seed into quail diets significantly reduced SFA, abdominal fat deposition and increased PUFA (especially Ω-3 levels) in abdominal fat ($p<0.01$).

Key words: Japanase quail, coriander sativum, fatty acids, abdominal fat, seeds

INTRODUCTION

Several factors, such as nutrients and genetics, contribute to the tendency for poultry to accumulate excess body fat. Fats, cereal grains and their by products usually represent the major component of the poultry diets. Currently, there is an increasing attention on the direct or indirect effects of fats on human health. There has been efforts to improve the wellbeing of human and animals by feeding formulations (Ozdogan and Aksit, 2003; Alcicek *et al*., 2003). It is reported that the source and fatty acid composition of dietary fat, especially the unsaturated to saturated fatty acids ratio are important factors in poultry rations (Yalcin and Ciftci, 1996). 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). However, n-3 PUFA-enriched diets increase both the susceptibility of cellular membranes to the induction of oxidative stress in animal organisms (Miret *et al*., 2003) and the susceptibility of products to lipid oxidation which can impair meat and egg quality, such as off-tastes and off-odours, thereby reducing consumer acceptability (Sparks, 2006). Oxidative stress constitutes an important mechanism of biological damage in live animals and it is regarded as the cause of several pathologies that affect poultry growth (Van Vleet and Ferrans, 1976; Perkins *et al*., 1980). T his undesirable side effect could be reverted by adding antioxidants to the diet (Valenzuela and Nieto, 1996; Morrissey *et al*., 1997).

Coriander (*Coriander sativum*) is an umbelliferous annual plant of the parsley family, native to the Eastern Mediterranen Region and Southern Europe and is found many other parts of the world. Coriander seed contains about from 0.1-1.5% essential oil and the essential oil contains d-linolool, camphene, sabinene, myrcene, terpinens, limonene and comtituents. As a medicinal and aromatic plant has been used as a antispasmodic, carminative, stimulant, antioxidan, stomachic and purgativ. Coriander has been reported to have strong lipolytic activity (Leung and Foster, 1996).

The aim of the present study was to investigate the effects of different levels corinder seed adminstration via diets on abdominal fat deposition and fatty acid composition in Japonese quail.

MATERIALS AND METHODS

Animals, diets and experimental design: A total of 490, 3 days old (49 males and 49 females) Japanase quails (Coturnix Coturnix Japonica) were randomly divided into five trial groups in each group according to diets in the control group, the birds were fed with a basal diet (24% crude proteins and 2900 Kcal metabolisable energy/kg, according to NRC (1994). Four different levels of coriander seeds 0.5% coriander group, 1% coriander group, 2% coriander group and 4% coriander group were added to the basal diets. Coriander seeds were ground in a mill (2.5 mm pore). Seeds were homogenously mixed carefully

to basal 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 andether extract) as dried samples were analysed using AOAC (1990) procedurs and crude fiber was determined by the methods of Crampton and Maynard (1938). Three or four quails were kept per pen (19×20×22 cm^3) during 42 days. Photoperiods of 24 h day^{-1} during 4 weeks and 14 h day^{-1} during 4-6 weeks were maintaned. The chickens were tired to ensure an environmental temparature at 35°C for the 1st week. Thereafter, the temparature was reduced by 3°C each week to a minimumof 20°C. Feed and water were provided for *ad libitum* consumption. At the end of the experimental periods (42 days of age), 10 males and female birds of smilar 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.

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-Methionin	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)	2900.00	2900.00	2900.00	2900.00	2900.00
Analyzed values					
Crude Protein (CP)	24.01	23.93	23.98	24.00	23.92
ME (Kcal/kg)	2902.00	2904.00	2895.00	2898.00	2891.00
Crude cellulose	3.88	4.08	4.11	4.45	4.92

ME = Metabolisale Energ; *Per 2.5 kg including; 2.000.000 IU vit A, 2.000.000 IU vit D_3; 35.000 mg vit E, 4.000 mg vit K_3, 3.000 mg 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; 60.000 mg Fe, 60.000 mg Zn, 5.000 mg Cu, 1.000 mg I, 200 mg Co, 150 mg Se, 80.000 mg Mn

Chemical analysis: The total lipid was extracted with Hexan-isopropanol (3:2, v/v) by the method of Hara and Radin (1978). Abdominal fat tissues 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 autoinjector and autosampler from Shimadzu (Kyota, Japan). FAMEs were separated by fused silica capiller column, 25 m length and 0.25 mm diameter, Permabond (Machhery-Nagel, Germay). Column temperature was programmed between 120-200°C, 4°C min^{-1} and 200- 220°C, 3°C min^{-1} 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^{-1}, 43 cm sec^{-1} 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 assited 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, 1989-1993)). The results were considered as significant when p-values were <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

Table 2: Fatty acid composition of experimental diets (%)

		Coriander			
Fatty acid	Control	0.5	1	2	4
ΣSFA	11.88	11.89	11.91	11.92	12.03
ΣMFA	22.54	22.51	22.57	22.66	22.74
ΣPUFA	63.56	63.41	63.34	63.36	63.28
Σn3 PUFA	12.83	12.88	12.96	13.06	13.06
Σn6 PUFA	50.73	50.53	50.38	50.30	50.22

ΣSFA = Total Saturated Fatty Acids; ΣMUFA = Total Monounsaturated Fatty Acids; ΣPUFA = Total Polyunsaturated Fatty

Table 3: Fatty acid composition of abdominal fat and abdominal fat deposition (%) 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-values
Abdominal fat	1.25±0.1[a]	1.19±0.10[ab]	1.09±0.1[b]	1.03±0.1[b]	1.08±0.1[b]	*
ΣSFA	31.60±0.2[a]	30.10±0.30[b]	28.99±0.1[c]	28.10±0.2[e]	27.51±0.2[d]	**
ΣMUFA	39.93±0.4	38.34±0.50	41.78±0.3	41.69±0.4	40.78±0.4	NS
ΣPUFA	28.47±0.2[d]	31.56±0.30[a]	29.23±0.4[c]	30.21±0.4[b]	31.71±0.3[a]	**
Σn3 PUFA	5.12±0.1	6.88±0.20	6.85±0.2	9.91±0.1	12.99±0.3	***
Σn6 PUFA	23.35±0.2[ab]	24.68±0.40[a]	22.38±0.3[c]	20.30±0.5[d]	19.22±0.4[d]	***

*p<0.05; **p<0.01; ***p>0.001; NS: p>0.05; [a-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

whatever diets. The fatty acid composition of abdominal fat and abdominal fat deposition was significantly altered by dietary coriander seed suplementation (Table 3). Abdominal fat percentage was the highest in the control, the 0.5% coriander group, followed by the 1, 4 and 2% coriander groups ($p<0.05$). In coriander treated groups, the percentages of total SFA significantly decreased compared to the control group ($p<0.01$). Diets enriched with the highest dosages of seed (2 and 4%) induced maximal effects on total SFA, palmitic and stearic acid contents ($p<0.01$). MUFA contents were not significantly affected by coriander seed supplementation compared to the control group. Significant changes in PUFA contents were 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%) ($p<0.001$).

DISCUSSION

Supplementation of coriander seed in quail diets abdominal fat deposition was significantly decresed, considerably improwed Ω-3 faty acids ratio in quail abdominal fat compared with the respective data of control group. Furthermore, coriander seed supplementation abdominal fat SFA levels decreased. Body fat deposition depends on the net balance among absorbed fat, endogenous fat syntesis and fat catabolism. Because abdominal fat is positively correleted with total body fat (Becker *et al*., 1979). Low abdominal fat deposition in coriander groups compared with control group can be explained by hypolipidemic and antioxidant properities of corander seed (Chithra and Leelamma, 1999). On the other hand, enhancement of polyunsaturated fatty acids (especially Ω-3 ratio) in abdominal fat pad would result from diminution of fatty acid oxidation in tissue. The n-3 PUFAs are fairly unstable to light and oxygen and go rancid quickly whereas n6 PUFAs are relatively more stable, the anti-oxidative effects of coriander seed on PUFA are particularly interesting. Earlier 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 Morsel, 2004) which act through different mechanisms. Earlier reports suggest that in both birds and mammals, PUFAs reduce lipid synthesis (Wilson *et al*., 1986) and increase fatty acid Oxidation (Sanz *et al*., 2000; Madsen *et al*., 1999). The another study conducted on quail showed that dietary different levels (0.5, 1, 2, 4%) coriander supplemented caused higher levels of PUFA breast muscle in quail (Ertas *et al*., 2005).

CONCLUSION

In this study, because of hypolipidemic and antioxidative properties of coriander, addition of 2-4% of coriander seed into quail diets significantly reduced abdominal fat deposition and increased PUFA in abdominal fatty acids.

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