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Influence of Age and Sex on Meat Fatty Acid Profiles and Cholesterrol in Various Strains of Japanese Quail Meat

Shashi Kumar M.*, Sudhakara Reddy K. and Kondal Reddy K.
Anurag Chaturvedi and Krishnaih.N

Department of Livestock Products Technology, College of Veterinary Sciences, S V Veterinary University, Rajendranagar, Hyderabad-500 030, India

ABSTRACT

Major fatty acid and Cholesterol content of meat of different strains of Japanese quails were estimated. Palmitolic acid content (per cent) in meat of Japanese quail of black spotted strain (6.62) was significantly higher than those belonging to brown and white strains but the linoleic acid content was higher in brown strain (20.83), when compared to black spotted (19.68) and white (20.04) strains. The palmitolic acid, stearic acid and oleic acid contents (per cent) showed an increase with age while the palmitic acid and linoleic acid content decreased. The linoleic acid content was significantly higher in female birds than males. The total meat unsaturated fatty acid content was significantly higher in brown strain (69.51) than white (68.98) and black spotted (68.78) strains. The meat cholesterol content (mg/100g) in Japanese quail belonging to white strain (75.71) was lower compared to brown (76.75) and black spotted strains (76.31) and was lower in males (74.76) compared to females (76.63).

Key words: *Cholesterol, fatty acids, Japanese quails.*

INTRODUCTION

Quail meat is an ideal food as authenticated in the Holy Bible and the Holy Koran and has no religious taboos (Wahab, 2002). Quail meat has less fat and fewer calories, forming an important food item for health conscious consumers. Quail eggs and meat are renowned for being rich in vitamins (Vitamin B6, niacin, thiamin and riboflavin) and essential amino acids, unsaturated fatty acids and phospholipids (Hamm and Ang, 1982), which are vital for human physical and mental development.

Published work on the chemical composition of quail meat especially that on the fatty acid profiles and cholesterol levels, which the present day consumer is more conscious of, is scanty. Hence, the present study was taken up to study the fatty acid profiles and cholesterol levels in quail meat of different strains and at different ages.

* *Corresponding author, e-mail:mskvph@rediffmail.com*

MATERIALS AND METHODS

Day old chicks of three commercial meat type strains of Japanese quails (Pure White, Black spotted and Brown) of different hatches, reared under deep litter system under identical management conditions were procured from poultry experimental station, department of Poultry Science, College of Veterinary Science, Rajendranagar, Hyderabad and slaughtered at 5, 6, 7 and 8 weeks of age. During each of the five trials conducted, four birds of each strain at each of the four ages with equal distribution of sexes were slaughtered as per the standard procedure and meat samples were collected from the breast muscle for extraction of total lipids (Folch *et al.*,1957).

To study the fatty acid profiles, the total lipids extracted from meat sample were dissolved in 10 ml of heptane. Five ml of heptane solution was taken and 5 ml of 2 N methanolic Potassium hydroxide was added to it. Test tubes were inverted

twice and heated to develop fatty acid methyl esters (FAMES). The supernatant was injected directly into gas chromatograph for separation of the fatty acid methyl esters (FAMES). Thermo Focus Gas Chromatograph fitted with a DB225 polar column (30m, 0.322mm, 0.25ì) and Flame Infrared Detector was used for the analysis of fatty acid composition. The temperature of oven, injector and detector blocks were maintained at 210, 230 and 250ºC respectively. Nitrogen was used as the carrier gas. Peaks were identified by comparison with relative retention times (RT) of the standard FAMES. Concentration of each fatty acid was recorded by normalization of peak areas using GC post run analysis software, manual integration and reported as % of the particular fatty acid. Total cholesterol was estimated by using standard kit method (Qualigens fine chemicals, product no.72181 Mumbai) from the total lipids.

The data obtained in this study were analysed statistically as per the methods outlined by Snedecor and Cochran (1990).

RESULTS AND DISCUSSION

The mean fatty acid profiles and cholesterol levels obtained in the present study on three strains of Japanese quails at different ages are presented in Table 1 and the analysis of variance for the effects of strain, age and sex is presented in Table 2.

The overall mean per cent palmitic acid content in the meat of Japanese quails belonging to brown, black spotted and white strains was 23.53 and it was significantly influenced by age of the birds. Hamm and Ang (1982) also reported 20.6% of palmitic acid in Japanese quails. Palmitic acid in Japanese quail muscles revealed a significant declining trend with age.

Mean palmitoleic acid percent in the meat of Japanese quails belonging to black spotted strain (6.62) was significantly higher than those belonging to brown (6.37) while that of white (6.57) strain was intermediate. The mean per cent palmitoleic acid content increased with age and it was 6.08, 6.32, 6.66 and 7.01 at 5, 6, 7 and 8 weeks of age, respectively. The decrease of palmitic acid and increase of palmitoleic acid with age may due to conversion of palmitic acid to palmitoleic acid by increased activity of desaturase, and the desaturase activity appears to be more in the black spotted strain

Strain and age of the birds significantly influenced the stearic acid content in the meat of Japanese quails. The overall per cent mean stearic acid content in the meat of Japanese quails belonging to brown strain (6.88) was significantly lower than those belonging to black spotted (7.64) and white (7.73) strains. The mean per cent stearic acid content was 6.62, 7.03, 7.49 and 8.53 at 5, 6, 7 and 8 weeks of age, respectively. The findings revealed a significant increase in stearic acid content with age. Hamm and Ang (1982) reported that Japanese quail meat contained 7.1 % of stearic acid. The increase in the stearic acid content with age may be due to the conversion of palmitic acid to stearic acid by chain elongation.

The overall mean per cent oleic acid content in the meat of Japanese quails belonging to black spotted, white and brown strains was found to be 42.49, 42.38 and 42.31, respectively. Percent oleic acid values were similar to those found by Hamm and Ang (1982) who reported mean oleic acid content of 44.8 in Japanese quails. The mean per cent oleic acid content was 40.95, 42.32, 42.91 and 43.38 at 5, 6, 7 and 8 weeks of age, respectively which revealed a significant increase of oleic acid content as age advanced. There was an increase in oleic acid content with age in all the strains probably to meet the physiological needs of bird (growing cellular mass) as they near maturity.

Strain, sex and age of the bird significantly influenced percent linoleic acid content in the meat of Japanese quails. The overall mean per cent of linoleic acid content in the meat of Japanese quails belonging to brown (20.83) strain was significantly higher than those belonging to white (20.04) and black spotted (19.68) strains. Female birds recorded significantly higher linoleic acid content (20.47) than male birds (19.90). The overall mean

Table 1: Mean meat fatty acid profiles and cholesterol content (mg/100g) in different strains of Japanese quails at different ages.

	Weeks	Overall	Strain			Sex	
			Pure White	Black Spotted	Brown	Male	Female
Palmitic acid	5	24.45^{c} ± 0.14	24.19 ± 0.23	24.53 ± 0.36	24.64 ± 0.06	24.49 ± 0.23	24.41 ± 0.17
	6	23.97^{c} ± 0.16	23.56 ± 0.23	23.91 ± 0.37	24.43 ± 0.12	23.82 ± 0.25	24.11 ± 0.19
	7	23.16^{b}± 0.18	22.95 ± 0.43	23.24 ± 0.32	23.28 ± 0.05	23.20 ± 0.17	23.11 ± 0.31
	8	22.55^{a} ± 0.22	22.40 ± 0.44	22.62 ± 0.52	22.63 ± 0.07	22.59 ± 0.25	22.50 ± 0.38
	Overall	23.53 ± 0.10	23.27 ± 0.19	23.57 ± 0.21	23.74 ± 0.10	23.53 ± 0.13	23.53 ± 0.15
Palmitoleic acid	5	6.08^{a} ± 0.08	6.08 ± 0.05	6.30 ± 0.23	5.88 ± 0.04	6.09 ± 0.15	6.07 ± 0.06
	6	6.32^{a} ± 0.07	6.43 ± 0.15	6.32 ± 0.14	6.22 ± 0.06	6.37 ± 0.09	6.26 ± 0.11
	7	6.66^{b} ± 0.10	6.77 ± 0.25	6.65 ± 0.18	6.58 ± 0.06	6.839 ± 0.16	6.50 ± 0.13
	8	7.01^{c} ± 0.10	7.00 ± 0.20	7.22 ± 0.20	6.82 ± 0.06	7.06 ± 0.14	6.96 ± 0.13
	Overall	6.52 ± 0.05	6.57^{xy} ± 0.10	6.62^{y} ± 0.10	6.37^{x} ± 0.05	6.59 ± 0.08	6.45 ± 0.06
Stearic acid	5	6.62 ± 0.08 ^{a}	6.94 ± 0.08	6.72 ± 0.20	6.21 ± 0.06	6.72 ± 0.14	6.52 ± 0.09
	6	7.03^{b} ± 0.12	7.40 ± 0.14	7.15 ± 0.29	6.54 ± 0.05	7.13 ± 0.18	6.92 ± 0.15
	7	7.49^{c} ± 0.09	7.83 ± 0.16	7.71 ± 0.15	6.92 ± 0.06	7.56 ± 0.15	7.41 ± 0.11
	8	8.53^{d} ± 0.18	8.76 ± 0.41	9.00 ± 0.30	7.84 ± 0.06	8.67 ± 0.29	8.40 ± 0.22
	Overall	7.42 ± 0.08	7.73^{yz} ± 0.14	7.64^{y} ± 0.15	6.88^{x} ± 0.07	7.52 ± 0.12	7.31 ± 0.10
Oleic acid	5	40.95^{a} ± 0.19	40.95 ± 0.31	41.03 ± 0.49	40.88 ± 0.07	40.98 ± 0.18	40.92 ± 0.34
	6	42.32^{b} ± 0.15	42.29 ± 0.25	42.46 ± 0.37	42.22 ± 0.06	42.35 ± 0.24	42.30 ± 0.17
	7	42.91^{c} ± 0.15	42.89 ± 0.36	43.01± 0.29	42.83 ± 0.05	43.02 ± 0.18	42.80 ± 0.25
	8	43.38^{c} ± 0.20	43.39 ± 0.49	43.47 ± 0.34	43.29 ± 0.09	43.48 ± 0.29	43.28 ± 0.27
	Overall	42.39 ± 0.10	42.38 ± 0.21	42.49 ± 0.21	42.31 ± 0.11	42.46 ± 0.14	42.32 ± 0.15
Linoleic acid	5	21.89^{d} ± 0.15	21.85 ± 0.19	21.44 ± 0.38	22.40 ± 0.07	21.71 ± 0.20	22.08 ± 0.22
	6	20.51^{c} ± 0.16	20.28 ± 0.43	20.16 ± 0.17	21.11 ± 0.06	20.27 ± 0.27	20.75 ± 0.17
	7	19.79^{b} ± 0.23	19.57 ± 0.59	19.40 ± 0.35	20.39 ± 0.08	19.40 ± 0.31	20.17 ± 0.33
	8	18.53^{a} ± 0.23	18.45 ± 0.48	17.72 ± 0.40	19.43 ± 0.06	18.20 ± 0.36	18.86 ± 0.27
	Overall	20.18 ± 0.12	20.04^{x} ± 0.26	19.68^{x} ± 0.22	20.83^{y} ± 0.13	19.90^{p} ± 0.19	20.47^{q} ± 0.16
Total Unsaturated Fatty acids	5	68.93 ± 0.20	68.87 ± 0.42	68.76 ± 0.40	69.16 ± 0.12	68.78 ± 0.19	69.08 ± 0.34
	6	69.16 ± 0.17	68.99 ± 0.32	68.93 ± 0.38	69.55 ± 0.11	69.00 ± 0.29	69.31 ± 0.19
	7	69.36 ± 0.20	69.23 ± 0.48	69.05 ± 0.36	69.80 ± 0.08	69.24 ± 0.28	69.47 ± 0.29
	8	68.92 ± 0.30	68.84 ± 0.72	68.40 ± 0.49	69.54 ± 0.14	68.74 ±0.40	69.10 ± 0.44
	Overall	69.09 ± 0.11	68.98^{xy} ± 0.25	68.78^{x}± 0.20	69.51^{y} ± 0.06	68.94 ± 0.15	69.24 ± 0.16
Cholesterol	5	65.99^{a} ± 0.43	64.27 ±0.41	66.80 ±1.12	66.89 ± 0.22	64.61 ± 0.58	67.36 ± 0.53
	6	70.82^{b} ± 0.44	69.28 ± 0.43	71.54 ±1.21	71.64 ± 0.11	69.86 ± 0.81	71.77 ± 0.30
	7	81.39^{c} ± 0.94	79.72 ± 2.54	82.07 ± 1.22	82.40 ±0.11	80.48 ±1.35	82.31 ± 1.30
	8	84.64^{d} ± 0.90	83.04 ±1.87	84.83 ±1.96	86.07 ± 0.07	84.20 ± 1.02	85.09 ± 1.50

Cholesterol units are (mg/100g). Fatty acid values are per cent of total fatty acids
Means with same superscripts do not differ significantly (P<0.01)

per cent linoleic acid decreased significantly with age. Hamm and Ang (1982) reported 22.97 per cent of linoleic acid in the muscles of Japanese quails.

Per cent unsaturated fatty acids **:** The overall per cent mean unsaturated fatty acid content in the meat of Japanese quails belonging to brown

(69.51) strain was significantly lower than those belonging to black spotted (68.78) and white (68.98) strains. Dengawy and Nassar (2001) reported that the mean total unsaturated fatty acids represented 60.2 to 73.9% of the total fatty acids. Brown strain showed more unsaturated fatty acids. Among unsaturated fatty acids the linoleic acid is more in brown strain when compared to other strains. The unsaturated fatty acids are physiologically important to the birds in their early growth. As the birds grow, their requirements will be less and as the birds reach their maturity their requirement and synthesis becomes static in all strains.

***Meat cholesterol* :** The overall meat cholesterol (mg/100g) content of Japanese quails belonging to brown (76.75) and black spotted (76.31) strains was significantly higher over white (74.07) strain. Female birds recorded significantly higher meat cholesterol content (76.63) than male birds (74.79). The overall mean meat cholesterol content (mg/100g) was 65.99, 70.82, 81.39 and 84.64 at 5, 6, 7 and 8 weeks of age, respectively and exhibited significant increase as age advanced. This might be due to the overall increase in the fat content of the muscles as the birds aged. Vadivukkarasi *et al*. (2007) found the meat cholesterol in Japanese quails at 5 weeks of age to be ranging from 54.7 to 63.4 mg/100g. In early ages protein synthesis takes precedence over fat. As age advances, fat synthesis increases and cholesterol synthesis will be more to meet the physiological needs of sex hormone production, especially during early maturity. This is more evident in females due to their physiological needs.

CONCLUSIONS:

Major fatty acid and cholesterol content of meat of different strains of Japanese quails was estimated. All the major fatty acids (Palmitic, Palmitoleic, Stearic, Oleic, Linoleic acid) studied in meat fat were significantly influenced by age.

Palmitolic acid content in meat of Japanese quail belonging to black spotted strain was higher than those belonging to brown and white, but the linoleic acid content was higher in brown strain compared to black spotted and white strains. The palmitolic acid, stearic acid and oleic acid content (per cent) showed an increase with age while the palmitic acid and linoleic acid content decreased. The linoleic acid content was higher in female birds than males. The overall mean per cent of total unsaturated fatty acid contents in the meat of Japanese quails belonging to brown strain was higher than those belonging to black spotted and white strains. Strain, sex and age influenced the cholesterol content.

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