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Research Note

Effect of Age on Fatty Acid Composition and Cholesterol Content of Emu (*Dromaius novaehollandiae*) Meat

M. Shasi Kumar*, R. Prasannakumar, M. Muthukumar[1] and G.V. Bhaskar Reddy[2]

Dept. of Livestock Products Technology, College of Veterinary Science, Korutla, Telangana

[1]National Research Centre on Meat, Chengicherala, Hyderabad

[2]College of Veterinary Science, Proddatur, Andhra Pradesh

The fatty acid composition and cholesterol content of meat of different age groups of emu birds (40, 50, 60 and 70 weeks) were estimated. The overall mean values of palmitic, palmitoleic, stearic, oleic and linoleic acid, total unsaturated fatty acids (% of total fatty acids) and cholesterol content (mg/100g) of emu meat were 23.74 ± 0.17, 6.22 ± 0.17, 9.65 ± 0.13, 42.16 ± 0.30, 19.01 ± 0.49, 67.40 ± 0.21 and 52.81 ± 1.70, respectively. The proportion of palmitic acid, oleic acid, palmitoleic, stearic, linoleic acid and cholesterol content was significantly affected by age ($P<0.01$). The palmitoleic and oleic acid content is increased with age, while palmitic, linoleic acids were decreased with age. However, age had no significant ($P>0.01$) effect on the total unsaturated fatty acid content.

Key words : *Emu meat, Age, Cholesterol, Fatty acids*

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The emu birds (*Dromaius novaehollandiae*) are known for high quality leather and fat, which are used for the production of variety of valuable products. Andhra Pradesh is the leading state in India with more than 80% emu birds population and it is estimated that emu population is increasing by 500% per annum. The emu meat is perceived as an excellent healthy alternative to other red meats due to its leanness and low cholesterol content. Though, several studies have been conducted on carcass characteristics, composition, palatability, microbiological and sensory attributes of emu meat, studies on the effect of age, sex, feeding and muscle type on cholesterol content and fatty acid composition of emu meat are scanty (Daniel 1995; Petrosky 1995; Berge *et al*. 1997). The emu meat is similar in taste and texture to lean beef, but lower in cholesterol and has a favorable amino acid profile (Sales and Horbanczuk 1998). Hence, the present work was undertaken to study the fatty acid composition and cholesterol content in meat of emu birds of 40, 50, 60 and 70 weeks of age.

Six emu birds each in age groups of 40, 50, 60 and 70 weeks belonging to M/s Golden Emu Farm, Hyderabad were utilized for the study. Birds were fasted overnight before slaughter and killed by exsanguination. Approximately 8 min were allowed for bleeding. Meat samples from the thigh portion were analysed for the fatty acid composition and cholesterol content. Total lipids were extracted from the thigh muscle samples as per Folch *et al*. (1957).

Preparation of lipid extract: Meat sample (20 g) was finely ground in a pestle and mortar with acid washed sand and transferred into flask with 20 times more volume of solvent mixture (400 ml) comprising of chloroform:methanol (2:1, v/v). The contents were allowed to stand at room temperature with occasional stirring for 4-6 hrs. The extract was filtered through Whatman No.1 filter paper and the residue was re-extracted with 10 times more volume of same solvent mixture for 2 hours and filtered. The filtrate was combined and evaporated to dryness in vacuum at 45^0C in a rotary evaporator.

For breaking the phospholipids, dried lipid residue was dissolved in one tenth volume of original lipid extract (20 ml) in chloroform:methanol:water (64:32:4), (v/v/v) and evaporated to dryness in vacuum at 45^0C. This step was repeated twice and the dried lipid residue was dissolved and filtered into a separating funnel with 100 ml of chloroform:methanol (2:1, v/v). The lipid extract was then washed with 1/5th volume of 0.9% sodium chloride (20 ml) so as to remove non-lipid impurities from lipid sample. It was then allowed to stand overnight at room temperature. The chloroform layer was collected and evaporated to dryness in vacuum at 45^0C and 5 ml of chloroform was added to it. The lipid samples were stored in a stoppered glass test tube and to each tube a drop of 0.5% Butylated Hydroxy Tolune (BHT) in chloroform was added as preservative. These lipid samples were stored at -20^0C till further analysis.

Corresponding author E-mail address: mskvph@rediffmail.com

To study the fatty acid composition, 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 2N methanolic Potassium hydroxide was added to it. Test tubes were inverted twice and heated to develop fatty acid methyl esters (FAME). The supernatant was injected directly into gas chromatograph for separation of fatty acid methyl esters (FAME). Thermo Focus Gas Chromatograph fitted with a DB225 polar column (30 m, 0.322 mm, 0.251) and Flame Infrared Detector was used for the analysis of fatty acid composition. The temperatures of oven, injector and detector blocks were maintained at 210, 230 and 250^{0}C respectively. Nitrogen was used as the carrier gas. Peaks were identified by comparison with relative retention times (RT) of standard FAME. 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, Mumbai # 72181) from the total lipids. The data obtained in this study were analyzed statistically as per the methods outlined by Snedecor and Cochran (1996).

The fatty acid composition and cholesterol content of meat samples of emu birds of different ages (40, 50, 60 and 70 weeks) are presented in Table 1. Age of slaughter had significant ($P<0.01$) effect on palmitic acid, oleic acid, palmitoleic, stearic, linoleic acid and cholesterol content. However, age had no significant ($P>0.01$) effect on the total unsaturated fatty acid content of emu meat. There was a significant increase in the palmitoleic acid and decrease in palmitic acid with advancement in age of the bird. This could be due to conversion of palmitic acid to palmitoleic acid by increased activity of desaturase. This is in accordance with Polawska *et al.* (2013) who has reported significant influence of age on the fatty acid composition especially palmitoleic and palmitic acid contents of ostrich.

Table 1: Fatty acid composition (%) and cholesterol content (mg/100g) in meat emu birds at different ages

Age (weeks)	Palmitic	Palmitoleic	Stearic	Oleic	Linoleic	Total unsaturated fatty acids	Cholesterol
	$24.23^{b} \pm 0.04$	$5.88^{a} \pm 0.02$	$9.09^{a} \pm 0.02$	$40.65^{a} \pm 0.19$	$20.76^{a} \pm 0.02$	67.29 ± 0.19	$42.84^{a} \pm 0.01$
	$24.51^{b} \pm 0.30$	$6.07^{a} \pm 0.19$	$10.01^{b} \pm 0.22$	$43.43^{b} \pm 0.37$	$17.08^{a} \pm 1.04$	66.57 ± 0.76	$47.68^{b} \pm 0.26$
	$22.89^{a} \pm 0.12$	$5.85^{a} \pm 0.44$	$9.98^{b} \pm 0.13$	$42.11^{b} \pm 0.67$	$20.18^{bc} \pm 1.08$	68.14 ± 0.21	$59.97^{c} \pm 0.59$
	$23.33^{a} \pm 0.31$	$7.09^{b} \pm 0.30$	$9.50^{ab} \pm 0.34$	$42.46^{b} \pm 0.51$	$18.03^{ab} \pm 0.62$	67.59 ± 0.21	$60.74^{c} \pm 2.14$
Overall mean	23.74 ± 0.17	6.22 ± 0.17	9.65 ± 0.13	42.16 ± 0.30	19.01 ± 0.49	67.40 ± 0.21	52.81 ± 1.70

Means with same superscripts do not differ significantly ($P > 0.05$)

The increase in oleic acid content with age may be to meet the physiological needs of bird (growing cellular mass) as they near maturity. The overall mean proportion of linoleic acid decreased significantly with age. Similarly, Shahryar and Alireza (2012) reported that two saturated fatty acids (C14:0 and C16:0) in 11 months old ostrich oil are less than ostrich oils obtained from 14 months old ostrich, where C16:0 is considerably higher than those of reported for 60 months old ostrich's oil. Mono unsaturated fatty acids (C14:1n5, C16:1n7, C18:1n9 or C18:1n7) for 11 months old was more than those of reported for 14 months old ostrich's oil, whereas poly unsaturated fatty acids with exception to C18:2n6 was lower than 14- and 60-months old ostrich's oil. The n-6 fatty acids concentration of 11 months old ostrich's oil is more than those obtained from 14 or 60 months aged bird.

A non-significant increase in the proportion of unsaturated fatty acid content in the meat of emu was noticed with advancement in the bird age. Among unsaturated fatty acids, the percent of mono unsaturated fatty acid *.i.e.* oleic acidcontent is more and it is increased up to 60 weeks of age, but the poly unsaturated fatty acid. *i.e.* linoleic acid decreased as age of birds increased. However, Beckerbauer *et al.* (2001) observe no significant effects of gender or source of dietary fat on the fatty acid composition of the fan filet of emu meat. They found that the fan cut had 30% saturated fatty acids and 70% unsaturated fatty acids, with 64% of the unsaturated fatty acids being monounsaturated fatty acids and 36% being PUFA.

Cholesterol: The overall mean cholesterol content (mg/100g) of meat of emu bird at 40, 50, 60 and 70 weeks of age was 42.84,

47.68, 59.97 and 60.74, respectively and exhibited significant increase in cholesterol content at 60 and 70 weeks of age as compared to 40 and 50 weeks of age. This might be due to overall increase in fat content of muscles as the birds aged. Beckerbauer *et al.* (2001) observed no effect of gender and type of meat cuts on cholesterol concentration of emu meat. Generally, the meat from soybean oil-fed emus contained slightly more cholesterol than did that from beef tallow fed emus; this difference, however, was significant ($P < 0.05$) only for the flat filet and the inside drum. Of all the cuts, the fan filet had the highest concentration of cholesterol ($P < 0.05$). The inside and outside drums had the least cholesterol, although not significantly less ($P > 0.05$). Sales and Horbanczuk (1998), reported that the average cholesterol concentration was 32.2 mg/100 g of meat.

Based on the above results, it is concluded that all the major fatty acids (palmitic, palmitoleic, stearic, oleic and linoleic acid) were significantly influenced by age. The palmitoleic acid, stearic acid and oleic acid content (per cent) showed an increase with age while the palmitic acid and linoleic acid content decreased. The proportionate increase in unsaturated fatty acid was noticed in the meat of emu with the advancement in the age. Though, the age of the birds does not significantly influenced the cholesterol content, it increased as age advanced. The major fatty acid found in emu oil is oleic acid, which comprises over 40% of total fatty acids.

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