PHYSICO-CHEMICAL CHARACTERISTICS OF RAW AND CANNED OSTRICH MEAT

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Background

Ostrich meat is a relatively new product in the market, and breeding has gained popularity in recent years in many countries. The consumer wants to be aware of their food nutrient composition, since some components may pose a risk factor in coronary heart diseases. Ostrich meat has a relative high pH (5.9) (Sales, 1996) and low intramuscular fat content (1.6%), this fat content was lower compared with beef (4.5%) and turkey (3.8%) (Paleari *et al*., 1998). This interesting characteristic is of particular interest due to the fatty composition of fat. The ostrich meat is low in mono-unsaturated fatty acid but rich in polyunsaturated fatty acids (PUFA) (Paleari *et al*., 1998), confirming the nutritional characteristics of this meat. However, polyunsaturated oils, including the omega 3 fats, are extremely susceptible to damage from heat, light, and oxygen. When exposed to these elements for too long, the fatty acids in the oil become oxidized.

Objectives

The aim of this work was to: (1) prepare a canned product containing ostrich meat; (2) determine food fatty acid composition in raw meat as well as the canned product; and (3) determine the effects of sterilization temperatures on stability of fatty acids in the canned product.

Materials and methods

Vacuum packaged ostrich meat samples from African Black (*Struthio camelus var. domesticus*) corresponding to *M. iliofibularis* and *M. iliotibialis lateralis* were used. The muscles were obtained from a commercial abattoir. Both muscles were cut into about 2.5 cm^3 pieces, mixed together with salt, and precooked in a kettle for 15 min at 60 °C and then for 5 min at 100 °C., when redness disappeared. After preparation, precooked meat was placed in metal containers. In order to measure the temperature TYPE T (copper-constantan) thermocouple was fastened in the geometric center of the container. A Model 692-000 and Design 5-thermocouple-channel data logger (Barnant) were used to collect and record data. The product was sterilizated at 250°F, Z = 18 until reaching a Fo = 9. Sterilization was repeated three times. Nine samples of raw and processed ostrich meat were analyzed in triplicate to measure the following parameters: pH, moisture, ash, protein and fat (AOAC, 2002). Lipid oxidation was determined by measuring thiobarbaturic acid values (TBA) (Pfalzgraf *et al*., 1995) and conjugated dienes (Sirinivasan *et al*., 1996). After extraction of lipids according to Bligh y Dyer (1959), an aliquot of the lipid fraction was transmethylated as described by Park and Goins (1994) using boron-trifluoride in methanol and the produced fatty acid methyl esters were determined on a Hewlett Packard 6890 gas chromatograph equipped with an automatic sample injector and flame ionization detector. Fatty acids were identified by comparing retention times with those of fatty acid methyl ester standards. Results were statistically analyzed by ANOVA test using SPSS for windows version 10.0.6 (1999).

Results and discussion

Means for pH, proximate chemical analysis, TBA, conjugated dienes, and fatty acid composition are presented in Table 1. The pH and proximate composition showed no significant difference ($P< 0.05$) between raw and canned ostrich meat. Values of moisture, fat, protein, and ash are in agreement with those reported by Paleari *et al*. (1998), and Sales (1996), in raw meat. Lipid oxidation indicators (TBA and conjugated dienes) showed that the canning procedure had a significant effect on their values; an increase ($P< 0.05$) in these parameters was observed due to high temperature process. Many factors affect lipid peroxidation, heat

disrupts muscle cell structure, inactivates enzymes and releases oxygen from oxymyoglobin; the release of oxygen from oxymyoglobin produces H_2O_2 and this reaction is increased at 60 °C (Harel and Kanner, 1985). The effect of sterilization on the fatty acids is shown in table 1. Significant differences ($p< 0.05$) were found for saturated and unsaturated fatty acids between raw and canned process. The profile analyzed of fatty acids in this study was similar to that observed by Sales et al (1996) for cooked ostrich meat. Total saturated fatty acids composition was similar in raw and canned meat in this study (32.13 and 32.28%, respectively). According to Armstrong and Bergan (1992) saturated fatty acids are less susceptible to oxidation than unsaturated fatty acids. Total unsaturated fatty acids in canned ostrich meat were also similar than in raw meat. The tendency of temperature influencing some fatty acids was also observed by some researchers like Anderson et al. (1971) and Smith et al. (1989) on beef meat cooked in conventional heating, observed that excessive heating produced cellular tissue break down and permitted lixiviation of hydro soluble nutrients and fatty acids auto oxidation. Unsaturated fatty acids constituted 67.72% of the total fatty acids in the raw and 67.55% canned meat, respectively. Omega-3 fatty acids, especially eicosapentaenoic acid (EPA, 20:5n-3), docosahexanoic acid (DHA, 22:6n-3) and linolenic (18:3n-3) fatty acids had low values in canned meat, mainly linolenic acid. These particular fatty acids (EPA, DHA and linolenic) are of great interest concerning human cardiovascular health.

Conclusions

It can be concluded from this study that canning procedure caused changes in fatty acid composition, principally linolenic (18:3n-3) fatty acid, while the other parameters studied were relatively constant. However, there is evidence that the variation in percentage fatty acids might differ by the diet and the process used.

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Table 1. Average values for pH, proximate analysis, TBA, conjugated dienes and fatty acid composition parameters of raw and canned ostrich meat (Mean ± SD).

Parameters	Raw (n=9)	Canned (n=9)
pH	6.76 ± 0.1	6.72 ± 0.1
Moisture (g/100 g)	75.9 ± 0.3	75.1 ± 1.7
Protein (g/100 g)	21.6 ± 0.7	21.6 ± 1.7
Fat (g/100 g)	1.5 ± 0.1	1.3 ± 0.2
Ash (g/100 g)	1.7 ± 0.2	1.5 ± 0.4
TBA (mg MA/kg)	0.3^{b} ± 0.03	0.7^{a} ± 0.01
Conjugated dienes (µmol/mg)	7.0^{b} ± 2.1	19.9^{a} ± 3.7
Fatty acids (% of total fatty acids)		
C14:0	0.72^{a} ± 0.04	0.66^{b} ± 0.08
C16:0	23.4^{a} ± 0.6	22.7^{b} ± 1.7
C16:1n-7	6.2^{a} ± 0.3	6.0^{b} ± 0.6
C18:0	8.1^{b} ± 0.6	8.9^{a} ± 0.8
C18:1n-9	34.1^{b} ± 0.8	34.7^{a} ± 3.0
C18:2n-6	16.8^{b} ± 1.0	17.4^{a} ± 1.0
C18:3n-6	1.4^{a} ± 0.2	1.1^{b} ± 0.1
C18:3n-3	0.19^{a} ± 0.03	0.04^{b} ± 0.03
C20:1n-9	0.21^{a} ± 0.02	0.13^{b} ± 0.06
C20:4n-6	6.6^{a} ± 1.1	6.2^{b} ± 0.6
C20:5n-3	0.56 ± 0.2	0.55 ± 0.1
C22:4n-6	0.4^{a} ± 0.1	0.3^{b} ± 0.1
C22:6n-3	1.3^{a} ± 0.2	1.1^{b} ± 0.2
Total saturated	32.1	32.3
Total unsaturated	67.7	67.6
Saturated/unsaturated	0.47	0.48

Values in rows with different superscripts differ significantly ($p<0.05$)