

Lipid content of meat and adipose tissue fatty acid composition in Hybro G+ broilers

Lilic S.¹, Stojanovic Z.², Matekalo-Sverak V.¹, Baltic Z. M.³, Ivanovic S.⁴

¹Institute of meat hygiene and technology, Belgrade 11000, Kacanskog 13, Serbia

²Serbian Environmental Protection Agency, Belgrade 11000, Ruze Jovanovica 27a, Serbia

³Faculty of veterinary medicine, Belgrade 11000, Bulevar oslobodjenja 18, Serbia

⁴Scientific veterinary institute of Serbia, Novi Beograd 11070, Autoput 3, Serbia

Corresponding author: Slobodan Lilic, slobo@inmesbgd.com

ABSTRACT

The objective of this paper was to determine lipid content of meat and fatty acid composition of adipose tissue of broilers Hybro G+ provenience. Broilers were bred under the same conditions and fed a feed mixtures (pre-starter, 1-7th day; starter, 8-14th day; grower, 15-35th day; and finisher, 36-42th day). Breeding and diet were according to the technological normatives for Hybro G+ provenience. Total lipid content was determined by ISO 1443:1992 method. In order to determine the fatty acid composition, lipids were extracted from abdominal adipose tissue by Folch-Lees method. After extraction, lipids were hydrolysed down to fatty acids which were subsequently esterified into methyl esters. Content of fatty acids was determined by gas chromatography (Hewlett Packard type HP680), using the standard of fatty acid methyl esters („Sigma“, USA). Total lipid content was 1.09% in breast meat and 6.40% in thigh and drumstick meat. Total content of saturated fatty acids was 36.03%, monounsaturated fatty acids 57.68% and polyunsaturated fatty acids 3.96%. Content of myristic acid was 1.44%, palmitic acid 26.95% and stearic acid 7.62%. Content of palmitoleic acid was 1.80%, oleic acid 29.50%, linoleic acid 26.38% and linolenic acid 3.96%. Unsaturated to saturated fatty acid ratio was 1.7 : 1.

Keywords: broilers, lipids, fatty acid composition

I. INTRODUCTION

Consumption of poultry meat is permanently increased in the world. It is accepted from each population and does not have any controversy from cultural and religious aspect. Fat in poultry carcass is mainly deposited in abdominal fat and in fewer amounts in muscles [1]. Sensory characteristics of meat influence final decision of consumers, but nowadays, it is very important for them to buy food with less fat content. Lipid content in meat depends on many factors such as provenience, quality of feed mixtures, feeding and

raising conditions. Many authors cite various lipid content in breast meat: 2.91% [2], 1.08% [3], 0.64-0.74% [4] and 1.66-2.39% [5]. Thigh and drumstick lipid content is 8.91% [3], 4.67% [4], 9.24% [6] and 4.46% [7]. Modern man is also considered about unsaturated and saturated fatty acid ratio in the aim to improve the quality of his life. In the human nutrition, polyunsaturated fatty acids have particular role. Two of them are essential: linoleic (C 18:2, n-6) and linolenic (C 18:3, n-3).

Poultry meat is a topic of many investigations about how to change fatty acid composition and improve n-3 and n-6 fatty acid ratio in poultry meat [8]. Even fatty acids from n-3 series have positive impact on meat quality, but they could have negative effect on sensory properties of meat and its oxidative stability [9].

Larger amount of n-6 fatty acids is deposited in drumstick meat, while predominantly fatty acids in breast meat are n-3 fatty acids [10]. Poultry meat contents approximately 34.8% saturated, 27.4% monounsaturated and 12.2% polyunsaturated fatty acids from n-6 series and 20.4% polyunsaturated fatty acids from n-3 series, while abdominal fat contents 31.1% saturated, 33.9% monounsaturated and 12.9% fatty acids from n-6 series and 12.9% unsaturated fatty acids from n-3 series [11].

Use of different fats in feed mixtures impacts on the change of fatty acid composition in meat. For example, adding of α -linoleic acid in feed mixtures influence depositing of n-3 fatty acids in tissues [12].

The aim of this paper was to determine lipid content in breast and thigh and drumstick meat and fatty acid composition of abdominal fat in broilers Hybro G+ provenience.

II. MATERIAL AND METHODS

In this experiment, one-day broilers Hybro G+ provenience was used. They were raised under the same zoohygienic and ambient conditions that meet the technological normative for this provenience [13]. Feeding and watering were *ad libitum*. Structure and chemical composition of feed mixtures are presented in table 1. Chemical composition of feed mixtures was determined according to standard methods [14] and it is shown in tables 3 and 4. Fattening lasted for 42 days and

after that, broilers were slaughtered and carcasses were chilled at the temperature of 3°C. After chilling, samples of thigh and drumstick and breast meat and of abdominal fat were taken. Lipid content in meat was determined by standard method ISO 1443:1992 [15] and by ISO 1444:1998 [16]. Extraction of lipids from abdominal fat was made by modified Folch-Lees method. After extraction, lipids were hydrolyzed up to fatty acids that were esterified into methyl esters. Fatty acid analysis was performed by gas chromatography (Hewlet Packard type HP 6890) using the standards of fatty acid methyl esters („Sigma“, USA).

Table 1 Structure and chemical composition of feed mixtures

	Pre-starter 1-7. day	Starter 8-14. day	Grower 15-35. day	Finisher 36-42. day
Maiz, %	54.45	50.79	53.84	54.20
Wheat meal, %	2.00	2.50	1.00	4.00
Soybean meal, %	25.00	25.00	23.50	23.00
Sunflower meal, %	5.00	5.00	6.00	5.00
Yeast, %	3.00	3.00	3.00	3.00
Fish meal, %	5.00	4.00	3.00	-
Dehydrated alfalfa meal, %	-	2.00	2.00	2.00
Soybean oil, %	3.00	5.00	4.50	5.50
Dicalcium phosphate, %	1.00	1.20	1.30	1.10
Limestone, %	-	-	0.20	0.40
Salt, %	0.20	0.20	0.30	0.30
Lysine, %	0.10	0.06	0.11	0.25
Methionine, %	0.25	0.25	0.25	0.25
Premix, %	1.00	1.00	1.00	1.00
Moisture, %	11.03	10.72	10.79	20.85
Ash, %	5.61	5.79	5.96	5.44
Crude protein, %	22.73	22.23	21.34	19.48
Crude fat, %	5.93	7.76	7.28	8.16
Crude cellulose, %	3.94	4.37	4.51	4.37
BEM, %	50.76	49.12	50.12	51.69
Ca, %	0.95	0.97	0.99	0.81
P, %	0.86	0.85	0.85	0.71
ME, MJ/kg	12.92	13.23	13.12	13.43
Lysine, %	1.36	1.30	1.26	1.20
Methionine + cystine, %	0.97	0.95	0.92	0.84
Triptophane, %	0.31	0.31	0.29	0.27

III. RESULTS

Lipid content of meat is shown in table 2. Content of total lipids in breast meat was in the range 0.41-2.00 %, average $1.09 \pm 0.41\%$ and content of free lipids was in the range 0.35-1.82%, average $1.00 \pm 0.38\%$.

Table 2 Lipid content of meat, %

	\bar{X}	Range
Breast meat		
Total lipids	1.09 ± 0.41	0.41-2.00
Free lipids	1.00 ± 0.38	0.35-1.82
Thigh and drumstick meat		
Total lipids	6.40 ± 0.81	5.12-7.88
Free lipids	6.19 ± 0.77	5.03-7.45

Fatty acid composition is presented in Table 6. Average content of myristic acid was $1.44 \pm 0.04\%$ (1.40-1.52%), palmitic acid $26.97 \pm 0.74\%$ (25.26-28.02%) and stearic acid $7.62 \pm 0.47\%$ (6.89-8.29%), respectively. Content of unsaturated fatty acids was: palmitoleic acid $1.80 \pm 0.09\%$ (1.63-1.92%), oleic acid $29.50 \pm 1.85\%$ (26.92-33.57%), linoleic acid $26.38 \pm 1.47\%$ (24.18-29.21%) and linolenic acid $3.96 \pm 0.86\%$ (1.85-4.97%), respectively. Total saturated fatty acids content was 36.03% monounsaturated 57.68% and polyunsaturated fatty acids 3.96%.

Tabela 6 Fatty acid composition of abdominal fat, %

	\bar{X}	Range
C 14:0	1.44 ± 0.04	1.40-1.52
C 16:0	26.97 ± 0.74	25.26-28.02
C 18:0	7.62 ± 0.47	6.89-8.29
C 16:1	1.80 ± 0.09	1.63-1.92
C 18:1	29.50 ± 1.85	26.92-33.57
C 18:2	26.38 ± 1.47	24.18-29.21
C 18:3	3.96 ± 0.86	1.85-4.97
Saturated fatty acids		36.03
Monounsaturated fatty acids		31.30
Polyunsaturated fatty acids		30.34

IV. DISCUSSION

Obtained results are in accordance with results of Lonergan et al. [3] which cite lipid content of 1.08% in breast meat and Ristic [4] which cites lipid content of 0.90%. Lipid content of thigh and drumstick meat obtained in this trial is larger than 4.67% that found out by Ristic [4] and less than 9.24% that is cited by Djordjevic [6].

Data about fatty acid composition are very different. Djordjevic [6] found out in abdominal fat 0.48% of myristic acid, 2.81% myristoleic acid, 12.70% palmitic acid, 15.98% palmitoleic acid, 2.99% stearic acid, 23.05% oleic and 19.53% of linoleic acid. Sirry et al. [17] cite 0.38% myristic acid, 17.08% palmitic, 4.26% stearic, 3.22% palmitoleic, 27.77% oleic, 28.25% linoleic and 2.25% linolenic acid.

Abdominal fat of broilers fed the feed mixtures with 3% soybean oil found out 0.4% myristic acid, 22.5% palmitic, 5.9% stearic, 5.9% palmitoleic, 40.6% oleic, 23.8% linoleic and 2.1% linolenic acid [18]. Also Waldroup et Waldroup [19] investigated adding of soybean oil in feed mixtures and found out that abdominal fat contents 0.5% myristic acid, 18.1% palmitic, 2.8% palmitoleic, 5.9% stearic, 30.2% oleic, 37.5% linoleic and 3.5% linolenic acid.

Human needs in nutrition are 9-18 g linoleic and 2-9 g α -linolenic acid with them ratio of 1:3 up to 1:5 [20, 21].

V. CONCLUSIONS

Content of total lipids was in the range 0.41-2.00% in breast meat, in average $1.09 \pm 0.41\%$ and in thigh and drumstick meat in the range 5.12-7.88%, in average $6.40 \pm 0.81\%$.

Free lipids content was in the range 0.35-1.82% in breast meat, in average $1.00 \pm 0.38\%$; and in thigh and drumstick meat in the range 5.03-7.45%, in average $6.19 \pm 0.77\%$.

Total saturated fatty acids in abdominal fat was 36.03%, total monounsaturated 31.30% and polyunsaturated fatty acids 30.34%. Unsaturated to saturated ratio was 1.7.

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