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CHEMICAL COMPOSITION OF MEAT *(M. ADDUCTOR)* AND FATTY ACIDS IN INTRAMUSCULAR FAT OF GOAT KIDS AND RAM LAMBS

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ABSTRACT

In the experiment, goat kids of White Improved breed and ram lambs of the Polish Lowland breed fattened up to 150 days were studied. Results of the study show that lambs were significantly heavier (36.64 kg) and had a higher weight of warm carcass (16.67 kg). Muscles of goat kids were characterized by 3.55 p.u. (percentage units) of palmitic acid ($C_{16:0}$) and 4,33 p.u. of stearinic acid ($C_{18:0}$). This difference is statistically significant. Among the mono-unsaturated acids predominated was oleic acid ($C_{18:1}$) – 54.1 % in goat kid tissue and 47.5 % in ram lambs tissue. In the experiment, favorable proportion of UFA/SFA characterized the goat kids meat (1.69 in comparison with 1.22 in ram lambs). Differences in individual fatty acids contents between studied animals were statistically significant.

Key words: goat kids, ram lambs, fatty acids

INTRODUCTION

In recent times, markets of food products have been adapting to different requirements of contemporary consumer, insisting on lean and easily digestible meat of high quality and good taste. High interest in the animal fat composition is observed, as it has many functions in the diet. Excessive consumption of this kind of products can increase the cholesterol level in blood, leading to closing of blood vessels and infarct (Borys and Boris, 2001; PN 73/A-82110; Santos-Silava et al., 2002). According to Arsenos et al. (2000), the chemical composition and characteristics of fatty acids in the muscular tissue of ruminants depends, among other factors, on the quality, age, location of fatty tissue and the type of feed the animals are fed with.

The main objective of this study was to determine the differences in fatty acids composition in intramuscular fat of goat kid and ram lambs fed with the same feed and kept in the same conditions.

MATERIAL AND METHODS

Male kids of the White Improved breed and ram lambs of the Lowland Polish breed were used as the experimental material. The study was carried out in two turns. After weaning, the animals at the age of about 70 days were fattened with all-mash pelleted feed CJ (produced by Cargill in Poland). The additive containing 6.1 MJ of metabolizable energy and 182 g crude protein per kg, was fattened without any limitation. Meadow hay of average quality was used as additional roughage. The fattening lasted until the age of 150 days.

Slaughtering and evaluation of carcass value were carried out according to methods approved by the Animal Science Institute in Balice, Cracow (Nawara et al., 1963). After 24-hours of cooling at 4˚C, the carcasses were divided into halves. The right halves of the carcasses were dissected into meat, bones and crude fat.

The basic chemical analyses (dry mater, crude protein, fat and ash) were carried out with standard

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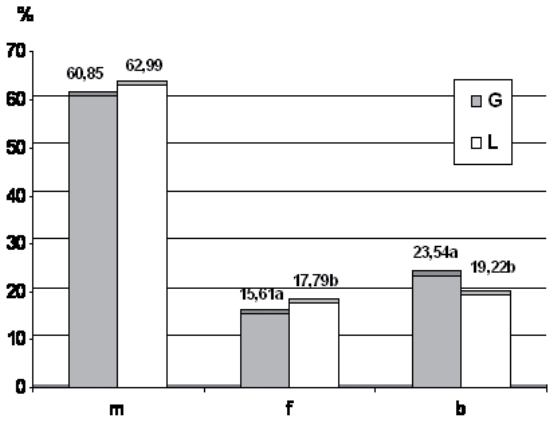
methods (PN 73/A-82110; PN 73/A-82111; PN 75/A-04018) in *m. adductor*.

The fatty acid profile in intramuscular fat extracted from adductor muscle (*m. adductor*) was determined by Soxhlet method (Folch et al., 1957; Ulbert and Reicht, 1992). The determination of fatty acids profile was performed by gas chromatography Chrom-5 device fitted with the fire-ionizing detector, a glass column, a Silar-5CP spiral with a 10-percentual level with inner diameter 4 mm and length 2.5 meters, nitrogen as the transferring gas at float rate 30 ml.min^{-1}, column temperature was maintained at 200˚C and batcher and detector at 250˚C.

The results were statistically analyzed by the two-factor analysis of variance followed by Tukey test, and by the SPSS PC (Microsoft Corp., 1985) computer program.

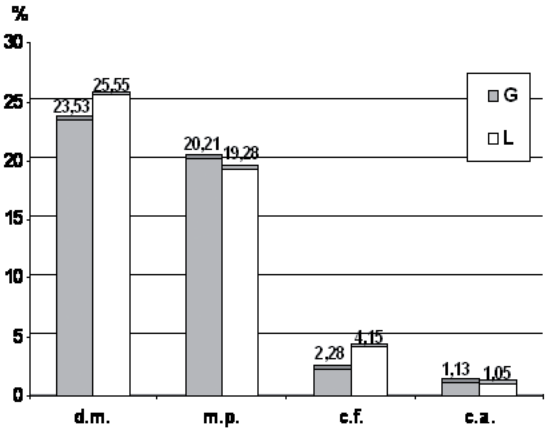
RESULTS AND DISCUSSION

Results of the study showed that lamb kids were significantly heavier (36.64 kg) and had a higher weight of warm carcass (16.67 kg) and higher weight of total fats (8.16 kg) just before slaughter. There were no clear differences in slaughter value and meat content in the goat kid fatness with significantly reduced fat tissue (16.61 and 17.79 %, respectively) (fig. 1). The meat of milk-type lambs was characterized by a significantly lower content of half-carcass fat tissue (12.7 %) as against 15.3 % in heavy lambs (Borys and Borys, 2001).



a, b – columns marked with different letters are significant at the level α = 0.05
m – meat
f – fat
b – bones
G – goat kids
L – ram lambs

Fig. 1: Composition of goat and lamb half-carcass



d.m. – dry mater
c.p. – crude protein
c.f. – crude fat
c.a. – crude ash
G – goat kids
L – ram lambs

Fig. 2: Chemical composition of goat and lamb meat (m. adductor)

The kid meat from the second year experiment showed significantly higher content of protein (20.21 %) and mineral compounds (1.13 %) and lower fat content (2.28 %) (fig. 2).

The effect of animal species and the year of study on body weight before slaughter, right-half carcass weight and fatty acid content in half carcasses were found. The similar results were shown by Sanz-Sampelayo et al. (1993) and Arsenos et al. (2000). Statistically significant differences for chemical composition of muscle tissue with regard to the animal species and the year of study were proved. Protein and mineral proportions were larger, whereas fat proportion was smaller in the muscle tissue of kids. Similar results were proved by Babiker et al. (1990), Pieniak-Lendzion et al. (2000).

Investigation resulted in findings that intramuscular fat of goat kids was characterized by a generally better profile of fatty acids than that of ram lambs (tab. 1). The comparative analysis of results shows 3.55 percentage units (p.u.) lesser content of palmitic and 4.33 p.u. of stearic acid. The difference was statistically significant. Borys & Borys (2001) affirmed the lower level of palmitic acid (22.31 %) and stearinic acid (12.93 %) in lambs fattened to body mass 35–40 kg.

Among fatty acids, which play a special role in human organism, statistically significant differences were found in oleic acid content, in kid and ram meat reaching 54.1 % and 47.5 %, respectively. The mentioned content of fatty acids influenced the total monounsaturated acids.

Table 1: Profile of fatty acids in intramuscular fat of goat kid and ram lambs (%)

Fatty acid		Animals				S
		goat kids (n = 16)		ram lambs (n = 16)		
		x̄	SD	x̄	SD	
myristic	C14:0	1.80	0.12	1.78	0.37	
myristoleic	C14:1	0.22	0.04	0.16	0.02	++
palmitic	C16:0	22.05	0.57	25.60	0.74	++
palmitoleic	C16:1	2.50	0.39	2.27	0.77	
margaric	C17:0	0.88	0.12	0.94	0.28	
margaroleic	C17:1	0.83	0.25	0.61	0.26	+
stearinic	C18:0	12.48	2.13	16.81	1.18	++
oleic	C18:1	54.10	1.91	47.50	1.79	++
linoleic	C18:2	3.46	0.71	3.09	0.85	+
linolenic	C18:3	0.41	0.31	0.17	0.06	+
eicosenoic	C20:1	0.26	0.12	0.23	0.04	+
arachidoleic	C20:4	1.02	0.54	0.85	0.32	+
SFA		37.21	2.85	45.13	0.69	++
UFA		62.80	2.74	54.88	0.66	++
UFA/SFA		1.69	0.45	1.22	0.68	+
MUFA		57.91	1.86	50.77	1.08	++
PUFA		4.89	1.41	4.11	0.65	

+S<0.05 ++S<0.01

n – number of animals in a group; x̄ – arithmetic mean; SD – standard deviation; SFA – saturated fatty acids (f.a.); UFA – unsaturated f.a. MUFA – mono-unsaturated f.a.; PUFA – poly-unsaturated f.a.; S – difference between groups significant at the level $\alpha = 0.05$ or $\alpha = 0.01$

Furthermore, significant differences in the content of polyunsaturated fatty acids such as linoleic, linolenic and arachidoleic acid were noticed. The studied muscles of goat kids contained more fatty acids than the analogous tissue of ram lambs. The animal species significantly influenced the proportions of majority of the fatty acids.

The intramuscular fat of goat kids was characterized by a significantly lower proportion of saturated fatty acids by 7.91 p.u. and a higher content of unsaturated ones by 7.91 p.u., and among them, monounsaturated acids by 7.14 p.u. in comparison to ram lambs. Statistical differences in content of polyunsaturated fatty acids were not found. Gruszecki et al (1999) decected higher level of saturated acids too, about 2.09 % and lower level of unsaturated acids, about 2.1 % from ram lambs in comparison to intense bitterness in kept goat kids.

The comparison of fatty acids in analyzed muscles, depending on the kind of animal during the two years period showed statistically significant differences between years of investigations. However, no differences in proportions of: margaroleic, stearic, oleic, and linoleic acids were ascertained.

Statistically significant interactions (species x years of experiment) in the content of fatty acids studied were caused by a sallier proportion of acids in the intramuscular fat of both goat kids and ram lambs. It was demonstrated that habitat factor, the experimental years and animal species had significant effects on contents of linolenic, eicosenoic and arachidoleic acids. In case of myristic, palmitoleic and margaroleic acids differences between particular animals was not always significant. Borys & Borys (2001) affirmed statistical differences in level of fatty acids comparing milk-type and heavy lambs.

Proportion of unsaturated to saturated acids is a significant indicator of fat quality. In human diet the proportion should be equal to 2 (Gruszecki et al., 1999; Nestel, 1987; Pieniak-Lendzion et al., 2000). Compared to heavy lambs, the muscular tissue of milk-type lambs was characterized by a generally more beneficial fatty acid profile, mainly due to more favourable UFA/SFA ratios, 1.42 and 1.41, respectively (Borys, 2001). In the experiment, advantageous proportion of UFA/SFA was characteristic of goat kids (1.69) in comparison to ram lambs (1.22). The differences between animal species were statistically significant.

The results of the study showed that goat meat has better quality than lamb. It was also confirmed by earlier data obtained by Banskalieva et al. (2000), Gruszecki et al. (1999), Pieniak-Lendzion et al. (2000) and Velasco et al. (2004).

The results obtained lead us to suggest that compared to goat kids, light ram lambs are characterized by generally better slaughter value and meat quality resulting from the lower fatness of half-carcass and meat and higher content of functional components.

CONCLUSION

1. Goat kid meat showed significantly higher content of protein (20.21 %) and mineral compounds (1.13 %) and lower fat content (2.28 %).
2. Significant differences in fatty acid composition in intramuscular fat, depending on animal species, were shown.
3. The most beneficial, from dietary point of view, composition of fatty acids (i.e. the highest content of unsaturated ones and the lowest content of saturated acids) was characteristic of the intramuscular fat of goat kids.
4. The analyzed intramuscular fat of goat kids was characterized by a more beneficial proportion of monounsaturated and polyunsaturated acids than the ram lambs.
5. The results obtained lead us to suggest that compared to goat kids, light ram lambs are generally characterized by better slaughter value and meat quality resulting from the lower fatness of half-carcass and meat and higher content of functional components.

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