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The fatty acid profile of *M. thoracis* and *M. semitendinosus* intramuscular fat

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ABSTRACT

The experiment was performed on 33 young beef bulls of the following breeds: 16, Limousine (L), 9, Hereford (H), and 8, Charolaise, aged 7 to 14 months. The bulls were fed grass silage, maize silage and a concentrate, according to IZ-INRA standards (2001), assuming body weight gains of 1100-1200 g/d. At the end of the fattening period the bulls were slaughtered and samples of *M. thoracis* (MT) and *M. semitendinosus* (MS) were taken for fatty acid analysis. The intramuscular fat of MS, compared with MT, contained a significantly higher percentage of UFA, especially PUFA with 20 or 22 carbon atoms, and a lower concentration of SFA (P≤0.01). MS contained more n-6 and n-3 PUFA (P≤0.03), and was characterized by a slightly lower n-6/n-3 ratio (P= 0.07).

KEY WORDS: fatty acid, muscles, beef bulls

INTRODUCTION

The fatty acid concentration of subcutaneous fat, kidney fat and intramuscular fat differs (Rule et al., 1994; Stasiniewicz et al., 2000). Luccia et al. (2003) demonstrated that fat of various muscles of buffalos differed in the levels of saturated and unsaturated fatty acids.

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The objective of the present study was to compare the fatty acid composition in the intramuscular fat of *M. thoracis* and *M. semitendinosus* in young beef bulls.

MATERIAL AND METHODS

The experiment was performed on 33 young beef bulls of the following breeds: 16, Limousine (L), 9, Hereford (H), and 8, Charolaise, aged 7 to 14 months. The bulls were fed grass silage, maize silage and a concentrate according to IZ-INRA standards (2001), assuming body weight gains of 1100 - 1200 g/d. At the end of the fattening period the bulls were slaughtered and samples of *M. thoracis* (MT) and *M. semitendinosus* (MS) were taken for fatty acid analysis in extracted fat by gas chromatography on Pye Unicam GC104 equipment using a 30 m long Supelcowax column (f=0.53). Statistical calculations were performed by a one-way analysis of variance applying the GLM procedure of SAS software (1989). The significance of differences between groups was determined by LSM.

RESULTS

Compared with MT, the intramuscular fat of MS, contained a significantly higher percentage of UFA, especially PUFA with 20 or 22 carbon atoms, and a lower concentration of SFA ($P \leq 0.01$). The intramuscular fat of MS contained more n-6 and n-3 PUFA ($P \leq 0.03$) and was characterized by a slightly lower n-6/n-3 ratio (P=0.07). A tendency towards higher levels of linoleic acid (P=0.11), linolenic acid and CLA (P=0.09) in MS, compared with MT, was also found. MT contained more hypercholesterolemic acids, such as C14 (P=0.09) and C16 (P=0.02), as well as C18 (P=0.002), considered neutral regarding its cholesterolemic properties. There were no statistically significant differences in the concentration of MUFA ($P > 0.05$)

DISCUSSION

The significantly higher percentage of UFA than SFA in the intramuscular fat of MS, in comparison with MT, indicates that not only the type of fat (Stasiniewicz et al., 2000) but also muscle structure may affect fatty acid composition. According to Vestergard et al. (2000), the MT and MS muscles differ in muscular fibre type, activity and growth rate. These factors could influence the fatty acid profile in the intramuscular fat of these muscles. The slightly lower n-6/n-3 ratio in

the fat of MS, compared with MT, suggests that MS may be more valuable in human nutrition (Laborde et al., 2001, after Scientific Review Committee). The significantly higher concentration of PUFA with 20 to 22 carbon atoms could result from desaturation and elongation occurring in tissues (Chang et al., 1992). These processes proceeded at a faster rate in MS than in MT.

Table 1. Concentration of fatty acids (FA) in *M. thoracis* (MT) and *M. semitendinosus* (MS)

FA	MT	MS	LSM	SE
C14	1.82	1.64	0.089	0.09
C14:1	0.48	0.50	0.48	0.02
C15	0.55	0.57	0.65	0.015
C16	20.54	19.46	0.025	0.33
C16:1	2.84	2.70	0.14	0.07
C17	1.07	1.02	0.35	0.03
C17:1	0.83	0.89	0.19	0.03
C18	17.59	16.04	0.002	0.33
C18:1n-9	31.37	30.27	0.33	0.78
C18:2n-6	9.95	11.46	0.11	0.66
C18:3n-6	0.09	0.09	0.32	0.005
C18:3n-3	1.13	1.37	0.09	0.10
CLA	0.27	0.33	0.09	0.02
C20	0.18	0.16	0.01	0.006
C20:1n-9	0.20	0.21	0.63	0.008
C20:2n-6	0.24	0.31	0.01	0.02
C20:3n-3	0.70	0.95	0.001	0.05
C20:4n-6	3.41	4.45	0.007	0.26
C20:4n-3	0.09	0.11	0.15	0.006
C20:5n-3	0.56	0.86	0.0003	0.055
C22:4n-6	0.30	0.39	0.004	0.02
C22:5n-3	1.25	1.70	0.001	0.09
C22:6n-3	0.17	0.22	0.004	0.013
Total	95.66	95.71	0.82	0.17
PUFA	17.90	21.93	0.02	1.17
MUFA	36.04	34.56	0.21	0.82
UFA	53.63	56.49	0.0004	0.54
SFA	41.75	38.88	0.0003	0.52
Unidentified	4.34	4.29	0.82	0.17
PUFAn-6	14.68	17.66	0.03	0.97
PUFAn-3	3.21	4.27	0.002	0.23
n-6/n-3	4.72	4.26	0.07	0.18

P>0.05 - statistically non-significant differences

CONCLUSIONS

The hypercholesterolemic and/or atherogenic profile of fatty acids (C14 and C16), and the n-6/n-3 ratio in the intramuscular fat of *M. semitendinosus* suggests that this muscle, as compared with *M. thoracis,* is more valuable in human nutrition.

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STRESZCZENIE

Profil kwasów tłuszczowych w tłuszczu śródmięśniowym *M. thoracis* i *M. semitendinous*

Doświadczenie przeprowadzono na 33 buhajkach ras mięsnych w tym 16 Limousine (L), 9 Hereford (H) i 8 Charolaise w wieku od 7 do 14 miesiąca życia. Buhajki żywiono kiszonką z traw i kukurydzy oraz mieszanką treściwą według norm IZ-INRA (2001), zakładając przyrost 1100-1200 g/d. Na zakończenie opasu buhajki były ubijane i w pobranych próbkach mięśni *M. thoracis* i *M. semitendinosus* oznaczano zawartość kwasów tłuszczowych. W tłuszczu MS w porównaniu z MT stwierdzono istotnie większą procentową zawartość UFA, w tym szczególnie PUFA o 20 lub 22 atomach węgla i mniejszą zawartość SFA ($P \leq 0,01$. MS zawierał więcej PUFA z rodziny n-6 i n-3 ($P \leq 0,03$) stosunek n-6/n-3 ($P = 0,07$) był nieco mniejszy.