

Fattening system influences fatty acid composition in organic Maremmana bullocks

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Abstract

*Organic EU Regulation gives preference to indigenous breeds. Maremmana is a very rustic and long-lived Italian cattle breed. Rearing system, quality of the pasture and possible concentrate integrations can influence the quality of meat and its fatty acid composition. Trials were carried out in an organic farm of Grosseto province. We considered the 3 fattening systems: in the feedlot, on pasture, on pasture integrated with concentrate. After the slaughtering, from a sample of *Musculus longissimus thoracis*, lipids were extracted and acidic composition was determined by chromatography. Results indicated that rustic cattle breeds can be conveniently raised on pasture for the whole fattening period, and demonstrated that grazing can positively influence the quality of the meat fatty acid composition, reducing significantly the Saturated Fatty acids incidence, increasing the Polyunsaturated Fatty acids incidence, and at the same time diminishing the Thrombogenic index and Atherogenic index value.*

Introduction

Organic UE Regulation No 889/2008 states that, in the choice of breeds or strains, account shall be taken of the capacity of animals to adapt to local conditions, their vitality and their resistance to disease. Preference is to be given to indigenous breeds and strains.

Maremmana is a very rustic Italian cattle breed, which seems to be the direct descendant of Italian aurochs (*Bos primigenius*) (Giorgetti et al., 2009) and is part of the group of Grey longhorn cattle, diffused in many EU countries (e.g. Grey Cattle or Hungarian Steppe Cattle).

Selection has always been directed towards disease resistance and adaptation to the harsh environment, where Maremmana cattle live, and generally these cattle never are treated against parasites (Martini, 2001).

Maremmana has a grey coat that is darker in males and lighter-coloured in females, with white apical pigmentation, and it is a long-lived breed that can reach an age of 15-16 years.

Calving is spontaneous and the calves weigh 30-40 kg at birth. They reach a weight of 180-220 kg by the age of six months, thus confirming the cow's milk-producing capacity. Adult females weigh about 600-800 kg, whereas the males reach a weight of 1000-1200 kg.

Maremmana cattle can graze all the year, utilizing, in the summer and winter periods, the Mediterranean scrub as source of food and refuge.

This breed is widespread in the Italian regions of Tuscany and Latium and around 9800 head are enrolled in the official Herd Book (ANABIC, 2013).

EU organic Regulation states also that organic animal farming should be based mainly on grazing in order to assure animal welfare and a proper exploitation of pastures.

In Tuscany, as in the whole Mediterranean area, pastures produce grass only in limited periods (spring and autumn) and traditional beef cattle are traditionally fattened in boxes within stables from the age of 6-8 to 18-20 months. Local farmers are convinced that the grazing negatively influences the quality of the meat. Unfortunately also organic farmers are limited by these climatic and cultural problems, and many researches on this field had to be done to demonstrate the importance of the grazing for the animal welfare and the quality and safety of productions (Martini et al., 2009).

Rearing system, quality of the pasture and possible concentrate integrations can influence the quality of meat and its fatty acid composition.

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The aim of this research is to compare the fatty acid muscle composition of Maremmana bullocks reared in different fattening systems.

Material and methods

The trials were performed at the Filetto organic farm (controlled by ICEA) property of Metallifere Hills Mountain Community (Grosseto province). We utilized analytical laboratory data from Maremmana bullocks fattened from 1996 till 2005, and slaughtered at different ages.

Since, climatic-environmental conditions, organic diets feedstuff and genetic animal lines were all similar, we considered, as variability factors, the 3 fattening systems utilized:

- 1) In the feedlot, with a diet composed by hay (ad libitum) and concentrate (0.8 UFC/kg DM and 150 g CP/kg DM) administered considering the medium animals live weight (FL).
- 2) On pasture, represented by grazing land and mixed forest, with the presence of *Quercus cerris*, *Quercus pubescens*, *Ostrya carpinifolia*, *Fraxinus excelsior* and *Fraxinus ornus* (P).
- 3) On pasture, integrated with concentrate (0.8 UFC/kg DM and 150 g CP/kg DM): 1 kg for 100 kg of animals live weight (P+C).

After the slaughtering, from a sample of *Musculus longissimus thoracis*, lipids were extracted following the Folch et al. (1957) method, and acidic composition of total lipids was determined by methyl esters chromatography.

The following acidic fractions and ratios were considered: Saturated Fatty acids (SFA), Monounsaturated Fatty acids (MUFA), Polyunsaturated Fatty acids (PUFA), Polyunsaturated Fatty acids n3 (PUFA n3), Polyunsaturated Fatty acids n6 (PUFA n6), Myristic acid + Palmitic acid (14:0+16:0), MUFA/SFA, PUFA/SFA, PUFA n6/PUFA n3, PUFA n3/PUFA n6, Linoleic acid/a-Linolenic acid (18:2n6/18:3n3). Besides, Thrombogenic index (TI) and Atherogenic index (AI) were determined following Ulbricht and Southgate (1991) method.

Analytical data were subjected to ANOVA, considering the fattening system as fixed factor. Means were compared by Tukey test.

Results

Fattening system strongly influenced the acidic composition of *Musculus longissimus thoracis* fat (Table 1).

Maremmana bullocks on pasture, without concentrate integration (P), showed the best fatty acid composition for the human health: significant smaller SFA incidence, and TI and AI ratio; at the same time, greater PUFA, PUFA n6 incidence and MUFA/SFA, PUFA/SFA and 18:2n6/18:3n3 ratio.

Pasture with concentrate integration (P+C) determined greater SFA, MUFA, MUFA/SFA incidence, and TI and AI ratio; at the same time smaller PUFA, PUFA n3, PUFA n6 incidence and PUFA/SFA and 18:2n6/18:3n3 ratio.

Bullocks in the feedlot (FL) showed greater SFA incidence and TI ratio like group P+C, but also greater PUFA, PUFA n3, PUFA n6 incidence like group P.

Discussion

Results indicated that rustic breeds, like Maremmana, may be conveniently raised on pasture for the whole fattening period, and demonstrated that grazing can positively influence the quality of the meat fatty acid composition, reducing significantly the SFA incidence, increasing the PUFA incidence, and at the same time diminishing the TI and AI value.

Table 1: Muscle fatty acids and health indices

| | Fattening system | | | Sign. |
|--|------------------|-------------|---|-------|
| | Feedlot (FL) | Pasture (P) | Pasture integrated with concentrate (P+C) | |
| Samples n. | 23 | 14 | 25 | - |
| Saturated Fatty acids (SFA) % | 42.92 a | 39.41 b | 43.24 a | *** |
| Monounsaturated Fatty acids (MUFA) % | 30.42 b | 31.66 ab | 35.21 a | *** |
| Polyunsaturated Fatty acids (PUFA)% | 26.68 a | 28.92 a | 21.56 b | *** |
| Polyunsaturated Fatty acids n3 (PUFA n3) % | 4.13 a | 4.03 ab | 3.03 b | ** |
| Polyunsaturated Fatty acids n 6 (PUFA n6) % | 22.55 a | 24.88 a | 18.53 b | *** |
| Myristic acid + Palmitic acid (14:0+16:0) | 23.04 | 23.22 | 22.63 | n.s. |
| MUFA/SFA | 0.71 b | 0.80 a | 0.81 a | *** |
| PUFA/SFA | 0.63 ab | 0.75 a | 0.51 b | *** |
| PUFA n6/ PUFA n3 | 5.72 | 6.55 | 6.50 | n.s. |
| PUFA n3/ PUFA n6 | 0.18 | 0.16 | 0.16 | n.s. |
| Linoleic acid/a-Linolenic acid (18:2n6/18:3n3) | 10.48 b | 15.81 a | 10.39 b | *** |
| Thrombogenic index (TI) | 0.77 a | 0.66 b | 0.80 a | *** |
| Atherogenic index (AI) | 0.49 ab | 0.45 b | 0.54 a | *** |

** significant at $P < 0.01$; *** significant at $P < 0.001$

Different letters indicate significant difference among means in the same row ($P < 0.05$) (Tukey test).

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