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Influence of sunflower cake supplementation on Marchigiana carcass and meat quality

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ABSTRACT - The effects of a sunflower cake supplement on the quantity and quality parameters of Marchigiana carcasses and meat were assessed. Live-animal and post-mortem performances were not significantly different in the animals receiving the supplement, whereas significant differences were noted in conformation and fatness. The colour parameters were also influenced by the diet, which resulted in a more brilliant red colour, greatly appreciated by consumers, in the subjects fed sunflower cake.

Key words: Marchigiana beef, Sunflower cake, Meat quality.

Introduction - Sunflower seed is prevalently grown for oil extraction, performed on whole or de-hulled seeds. Different by-products are obtained according to the extraction method: sunflower cake from mechanical oil extraction and sunflower meal from chemical extraction with solvents. In particular, use of sunflower seed as a source of biofuel provides interesting opportunities for farmers, both in terms of oil production and of interesting by-products. Whereas a considerable body of data is available with regard to oilseed meal, information about the use of sunflower cake in feeds is scarce. We investigated the scope for adding a sunflower cake supplement to the fattening ration of Marchigiana beef cattle through the assessment of its effects on the quantity and quality parameters of carcass and meat.

Material and methods - The study involved 24 Marchigiana subjects fattened at two different farms (12+12). At each site 6 subjects were fed a control diet (CD), i.e. the standard feed provided at the farm, and 6 received a sunflower cake supplement (SD). The daily ration supplied ad libitum hay (DM 92.4%; EE 1.1% DM, CP 8.1% DM, CF 33.7% DM), straw (DM 94.2%, EE 1.6% DM, CP 5.3% DM, CF 37.6% DM) and farm-mixed compound feed CD: corn, barley, soybean and vitamin and mineral supplementation; SD: corn, barley, sunflower cake and vitamin and mineral supplementation. The chemical composition of the two rations was as follows: CD= DM 84.3%, EE 3.2% DM, CP 17.2% DM, CF 5.3% DM, and SD= DM 87.3%, EE 3.6% DM, CP 16.5% DM, CF 10.05% DM. Upon reaching the required weight subjects were transported to the slaughterhouse, where data including live weight were recorded. All carcasses were measured for weight and gross yield. Conformation and fatness were evaluated by an authorised operator according to the SEUROP grid (EC Reg. no. 1026/91). pH was measured between the 8th and 9th thoracic rib 45 min (pH1) and 24 h (pH2) post-mortem. After quartering, a steak cut was collected by an incision between the 6th and the 7th vertebra. In the laboratory meat samples were analysed for colour using a Minolta Chroma Meter CR-200 with the CIE L*a*b* system and D65 light. Drip loss was determined on the Longissimus dorsi muscle according to ASPA guidelines (ASPA, 1996). Longissimus dorsi samples were then lyophilised and analysed for water, protein, fat and ash content. After methylation (Rodriguez et al., 1998) the fatty acid composition of intramuscular fat was determined with a Chrompack CP9001 gas chromatographer. Individual methyl...
Esters were identified by their retention time compared with the retention time of standard methyl ester. All data were subjected to statistical analysis with the GLM procedure of the JMP package (SAS, 1995) using farm, diet and their interaction (FmxD) as independent variables, according to the model: 

\[ Y = \mu + \alpha_i + \beta_j + \alpha_i \beta_j + \varepsilon_{ij}. \]

**Results and conclusions** - The farm effect on live-animal and post-mortem performance was significant only for age at slaughter (P<0.001), which in one of the farms was 2 months higher (21 vs. 19); as a consequence, AWG was higher in subjects slaughtered earlier (1.3 kg/d vs. 1.2 kg/d, P<0.05). The mean live-animal and post-mortem performance data according to the diet effect are reported in table 1. Differences were not significant except for pH1, higher in samples from subjects fed the control diet (P<0.05). The mean pH1 values were higher than those reported by Trombetta *et al.* (2007) for Marchigiana beef cattle.

|                          | CD          | SD          | P     |
|--------------------------|-------------|-------------|-------|
| No. of subjects          | 12          | 12          |       |
| Age (months)             | 20.0 ± 0.414| 19.0 ± 0.433| ns    |
| Live weight (kg)         | 767.7 ± 29.111| 748.7 ± 31.3| ns    |
| Carcass weight (kg)      | 496.3 ± 22.25| 480.3 ± 23.9| ns    |
| Gross yield (%)          | 64.5 ± 0.83 | 64.0 ± 0.9  | ns    |
| ADG (kg)                 | 1.2 ± 0.04  | 1.3 ± 0.041 | ns    |
| ADG of carcass (kg)      | 0.8 ± 0.032 | 0.8 ± 0.033 | ns    |
| pH1                      | 6.7 ± 0.121| 6.6 ± 0.101 | 0.05  |
| pH2                      | 5.6 ± 0.073| 5.7 ± 0.08  | ns    |

The statistics related to the SEUROP grid failed to highlight significant differences due to the farm and diet effects. Based on conformation, 58% of SD carcasses were assigned to class E and 41.7% to class U, whereas 41.7% of CD carcasses were assigned to class E, 50% to class U, and 8.3% to class R (Figure 1). With regard to fatness parameters, the diet effect was significant (P<0.05), with 100% of SD carcasses were assigned to class 2, while 66.7% of CD carcasses were assigned to class 2 and 33.3% to class 3 (Figure 2).
The data regarding the quality parameters of meat in relation to the diet effect are reported in table 2 and 3. The data of the two groups of animals were substantially comparable, the only difference being a slightly higher drip in subjects fed the sunflower cake supplement (SD 1.5 vs. CD 1.3). Their mean values were similar to those reported by Trombetta et al. (2007) for Marchigiana bulls. The mean values reported in table 3 demonstrate a significant effect of the diet on all colour parameters, which were better in samples from subjects fed the SD diet. All colour parameters were significantly (P<0.05, P<0.001) higher in SD than in CD samples. The mean redness value was similar to the one reported by Trombetta et al. (2007) for Marchigiana beef cattle and by Preziuso and Russo (2004) for T. brachii and semitendinosus muscles of Chianina cattle slaughtered at 20-21 months of age. The mean yellowness value of SD samples was similar to that reported by Liotta et al. (2007) for beef cattle with long lairage.

The values of fatty acids considering are influenced of diet effect. Significant differences (P<0.05) were found for mean C18:0, SFA (46.15 vs. 51.9%) and MUFA (41.1 vs. 38.12%). The significantly higher C18:0 content found in SD samples (22.4% vs. 18.2%) may be explained with higher fatty acid biohydrogenation in the rumen, favoured by the large amount of unsaturated fatty acids (C18:1 28.0%, C18:2 60.0%) provided by the SD diet. In fact the levels of C18:1 (34.7 vs. 37.2%) and C18:2 (6.24 vs. 7.6%) were lower in SD than in CD meat. In particular, the means of the latter two fatty acids in CD samples were similar to those obtained in Marchigiana beef cattle fed faba beans and peas (Trombetta et al., 2008). Overall, the data presented above indicate that the carcass and meat of Marchigiana cattle fed a sunflower cake supplement have the same quality characteristics as those from animals receiving a standard feed, with the not negligible advantage of a brighter colour. Although further investigation is required to confirm these findings, we feel that sunflower cake from biodiesel production crops is a useful addition to standard feeds, benefiting both farmer and slaughterer and also the final consumer in terms of better meat quality.

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Table 2. Effect of the diet on the quality parameters of meat (mean±SE).

|         | CD            | SD            | P   |
|---------|---------------|---------------|-----|
| No of samples | 12            | 12            |     |
| Water, % as fed | 73.9 ± 0.383  | 73.3 ± 0.421  | ns  |
| Protein, % as fed | 20.2 ± 0.383  | 20.5 ± 0.422  | ns  |
| Fat, % as fed    | 2.9 ± 0.227   | 2.9 ± 0.249   | ns  |
| Ash, % as fed    | 1.1 ± 0.014   | 1.1 ± 0.016   | ns  |
| Energy, cal/kg   | 4221 ± 10.24  | 4222 ± 11.2   | ns  |
| Drip loss, %     | 1.3 ± 0.160   | 1.5 ± 0.172   | ns  |

Table 3. Effect of the diet on meat colour (mean±SE).

|         | CD            | SD            | P   |
|---------|---------------|---------------|-----|
| No. of samples | 12            | 12            |     |
| L       | 40.6 ± 0.455  | 43.3 ± 0.476  | 0.001|
| a*      | 25.0 ± 0.589  | 27.3 ± 0.616  | 0.05 |
| b*      | 7.0 ± 0.428   | 10.0 ± 0.447  | 0.001|
| Chroma  | 26.0 ± 0.672  | 29.1 ± 0.703  | 0.001|
| Hue     | 15.3 ± 0.608  | 20.0 ± 0.637  | 0.001|