Pasture quality and cheese traceability index of Ragusano PDO cheese

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Abstract

In the Iblei plateau (Sicily, Southern Italy) the native dairy cattle breed Modicana during the spring season grazes exclusively on natural pastures for the production of the Ragusano PDO cheese. Along the grazing season, herbage undergoes to changes on protein, fibre and moisture content, affecting quality parameters such as plant carotenoids concentration, involved in the colour and nutritional characteristics of dairy products and potential biomarkers for authenticating fed green pasture-based diets. The aim of this work was to assess whether the cheese traceability index, based on the carotenoids spectra data elaboration, could be related to seasonal variations of floral composition and pasture quality. Four herbage and cheese samples were collected every two weeks in two representative farms of this area, from March to May 2013. Pasture characteristics as pastoral vegetation composition and pastoral value were analysed using the methodology developed for pastoral resources studies. Traceability index showed a significant positive correlation with pasture moisture and crude protein content (r=0.729* and 0.853**, respectively), while it was negatively correlated with fibre content (r=−0.719*).

Introduction

The Iblei plateau (Sicily, Southern Italy) is characterised by an altitude between 120 and 830 m asl, a very shallow calcareous soil and a typical Mediterranean climate with hot-dry summer and rainy autumn-winter period (Gresta et al., 2003). Animal husbandry is widespread within this district area where the autochthonous Modicana dairy cattle is traditionally reared for Ragusano PDO cheese production. Natural pastures in this area are strongly influenced by changes in weather trend with higher yield especially in spring (Cosentino and Litrico, 1992). During this season, animals graze on these pastures characterised by high plant species diversity, including several self-reseeding legumes (Patanè and Bradford, 1993). This traditional feeding system confers a characteristic aroma and colour to dairy products (Nozière et al., 2006), able to transmit biologically active molecules (β-carotene) having beneficial effects on human health due to powerful antioxidants protecting against oxidative stress (Marino et al., 2012).

Throughout the grazing season soil water availability and plant phenological stage influence plant carotenoids concentration, and, in turn, milk and cheese colour (Nozière et al., 2006). As reported by Carpio et al. (2004), cheese yellow index, related to carotenoids content, resulted higher in Ragusano produced from cows fed with natural pasture and total mixed ration (TMR) compared to exclusively TMR-fed ones. In order to trace the type of animal feeding system, Prache and Theriez (1999) developed the traceability index, based on the carotenoids spectra data elaboration. This index allows a complete discrimination between pasture-fed and stall-fed animals (Priolo et al., 2002) and it has been used to trace the changes of feeding systems in ruminant products (Priolo et al., 2003).

The aim of this study was to assess the influence of seasonal changes on pasture quality and how these variations are related with cheese traceability index.

Materials and methods

The study was carried out in two representative dairy farms of the Iblei plateau rearing Modicana breed for PDO Ragusano cheese production (Farm 1: 306 m asl, 36° 52’ 50” N, 14° 33’ 57” E, and Farm 2: 195 m asl, 36° 51’ 36” N, 14° 32’ 49” E).

Pastoral vegetation was characterised before grazing period. In each farm, data were recorded by applying a Point intercept method (Daget and Poissonet, 1969) to three transects 25 m long. Along each transect, 25 measurements were performed and vegetation data were analysed by computing single species contribution to vegetation composition (SCI) (Argenti and Lombardi, 2012) as follows:

\[ SC_i = \frac{SF_i}{\sum SF_i} \times 100 \]  

(1)
Table 2. Herbage botanical composition (mean values±standard error), herbage quality and cheese quality parameters (mean values±standard error) recorded along the grazing season.

|                  | 21/03/2013 Farm 1 | 21/03/2013 Farm 2 | 04/04/2013 Farm 1 | 04/04/2013 Farm 2 | 18/04/2013 Farm 1 | 18/04/2013 Farm 2 | 02/05/2013 Farm 1 | 02/05/2013 Farm 2 |
|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Herbage composition (%) |                   |                   |                   |                   |                   |                   |                   |                   |
| Poaceae          | 8.6±0.6           | 45.4±13.4         | 16.7±13.5         | 25.0±6.5          | 2.0±0.3           | 28.5±12.9         | 25.9±12.7         | 35.8±18.1         |
| Fabaceae         | 45.5±4.3          | 38.8±15.2         | 70.9±10.6         | 64.5±5.5          | 57.1±9.9          | 56.4±9.1          | 64.2±9.4          | 60.3±19.3         |
| Others           |                   |                   |                   |                   |                   |                   |                   |                   |
| Herbage ground cover (%) | 90               | 90               |                   |                   |                   |                   |                   |                   |
| Traceability index |                   |                   |                   |                   |                   |                   |                   |                   |
| Yellow index (b*) | 20.9±0.1          | 21.4±0.3          | 22.6±0.5          | 21.0±0.2          | 19.1±0.1          | 19.2±0.3          | 17.4±0.3          | 18.7±1.0          |
| Traceability index | 975.6±0.1        | 1102.1±14.5       | 1106.1±26.1       | 951.1±30.4        | 846.3±0.9         | 924.2±12.7        | 865.0±30.5        | 861.5±95.2        |

Mean values within date followed by different letters are significantly different at P≤0.05. NDF: neutral detergent fibre; b*, yellowness.
intercept method allowed to record 21 species. In Farm 1 pasture facies showed four species reaching 54.0% of SCI (Lotus ornithopodioides L., Bromus madritensis L., Lolium rigidum Gaud. and Asphodelus fistulosus L.); while, in Farm 2 facies included three species: Hordeum murinum L. subsp. leporinus (Link) Arcang., Bromus madritensis L. and Urospernum dalechampii (L.) Schmidt, reaching 56.5% of SCI. PV was equal to 52/100 in Farm 1 and 56/100 in Farm 2 (Table 1).

Herbage composition showed a prevalence of other families (more than 50%) versus Poaceae and Fabaceae. However, on the average of sampling dates, Poaceae and Fabaceae weighted differently: 13% and 27% in Farm 1 and 33% and 11% in Farm 2, respectively (Table 2). Herbage moisture content showed a progressive decrease from 84.8% to 31.4% in Farm 1 and from 77.8% to 39.4% in Farm 2 over time. CP decreased from the first sampling (13.5% and 15.6%, respectively, in Farm 1 and 2) to the last one (8.5% and 7.6% in the same order), while fibre content (NDF) showed an opposite trend, ranging from 49.3% and 52.4% (first sampling) to 69.0% and 67.4% (last sampling), respectively in Farm 1 and Farm 2. Same results were obtained by Cosentino and Litrico (1992) in the same environment and grazing period.

Cheese yellow index (b*) showed an average value of 20.0, higher than the average value of 11.5 observed by Carpino et al. (2004) in Ragusano cheese produced by cattle fed on TMR plus pasture. Yellow index showed a decrease along grazing season ranging from 21.1 to 18.1 as average value of the two farms. Same trend was observed for traceability index that ranged from 1038.9 to 863.3 in the average of the two farms. This index showed a positive significant correlation with herbage CP (r=0.853**) and moisture content (r=0.729*), while a negative significant correlation was observed with fibre content (NDF) (r=-0.719*) (Figure 1).

Results are in accordance with Nozière et al. (2006) that showed a higher milk α-carotene levels in spring grazing compared to summer one and with Marino et al. (2012) that observed same trend in Modicana cattle reared in the South of Sicily.

Conclusions

This research shows that during spring grazing season, pasture of the Iblei plateau undergoes a typical Mediterranean spring herbaceous flush that is followed by a fast worsening of pasture quality due to changes in herbage moisture, protein and fibre content (NDF). These variations have been resulted significantly correlated with cheese traceability index. When animals graze a good quality pasture (high protein and moisture content), cheese will present higher traceability index values compared to cows grazing the same pasture later in the season.

This preliminary study indicate traceability index as a speedy and efficient tool to get more information about the observance of PDO rules regarding feeding system and cheese production to satisfy consumers interest about a clear food chain.

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