Influence of four single fresh forages on volatile organic compound (VOC) content and profile and sensory properties of goat Caciotta cheese

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Abstract – Aim of the trial was to evaluate the effect of fresh single-species herbage on the VOC and sensory properties of cheese, in order to individuate specific descriptors linked to the use of fresh herbage in pureness. Two groups of Siriana housed goats were fed alternately with 2 grasses: Avena sativa (AS) and Lolium perenne (LP) and 2 legumes: Medicago sativa (MS) and Trifolium incarnatum (TI) in pureness. The milk was processed as Caciotta cheese and ripened for 20 days. The VOC analyses (by GC-MS) showed the highest VOC total content in AS cheeses (226.55a.u.), where alcohols was the dominant class; the lowest value (79.96a.u.) was found in TI cheeses, and the dominant class was hydrocarbons. The panel test (for colour, odour, taste and final acceptability) showed that cheeses from grasses’ groups were described with astringent and blue taste, those from legumes with acidic, bitter and light goaty taste. All cheeses showed goaty taste, except LP cheeses. Grasses’ cheeses showed higher final acceptability than those from legumes. The results showed that each meadow’s species, with its specific content of secondary metabolites, at specific phenological stage, was able to characterise the derived cheese products at sensorial level.

Key words: VOC, Goat cheese, Sensory quality, Fresh forage.

Introduction – Several studies (Coulon et al., 2000) have shown a strong relationship between the aromatic quality of milk and dairy products and the diet of lactating animals. In particular, it was demonstrated that some secondary metabolites, responsible for specific organoleptic expressions, may be directly transferred from milk to the forage ingested by the animal (Carpino et al., 2004; Fedele et al., 2005), beside from the microbiological action during the cheese evolution. Thus, they may be considered as bio-indicator or markers of geographical area or specific diet (hay vs. pasture, land vs. mountain pasture) (Martin et al., 2002; Cornu et al., 2002), in a traceability process within a production chain. Aim of this trial, part of a larger project, was to evaluate the effect of single fresh meadow species, 2 grasses and 2 legumes, given in pureness to goats, on the aromatic profile of cheese (VOC and sensory properties), in order to individuate some specific descriptor, linked to the use of specific fresh forages.

Material and methods – The experiment was carried out at the experimental farm of CRA-ZOE in Bella, southern Italy, at 360m a.s.l. Twenty Siriana goats in middle lactation were housed and allotted into two homogenous groups: AS, ad libitum fed with fresh Avena sativa, and LP, ad libitum fed Lolium perenne. Both species were mowed and distributed to animals at spikelet phenological stage. After 8-10 days of adap-
tation and 6 days of experimental period, the AS group was fed with fresh *Medicago sativa* and LP group with fresh *Trifolium incarnatum*, at early flowering. For each group, cumulative milk samples were daily collected in the last 3 days of experimental period, and simultaneously, daily processed for cheese-making. The raw whole milk (about same quantity for each group) was filtered and heated in a stainless vat to 36°C; liquid calf rennet was added in the amount of 36ml/100litres of milk. After 20-25min, at the end of coagulation, the curd was cut with a knife into equal-sized pieces of 10cm; after 5 min of rest, the curd was broken into walnut sized pieces. The curd was placed into plastic cylindrical mould; after dry salting, the cheeses were ripened for 20 days (85% R.H. and temperature 11°C). After this period, the cheeses for chemical analyses were frozen (-20°C), while those for sensory analyses were kept in refrigerator at 1°C in vacuum bag. For the Volatile Organic compounds (VOC) analyses, one sample of 5g of grated cheese for each day of cheesemaking and dietary treatment was used. VOC profile and content in cheese were analysed in duplicate for each whole sample by a multiple dynamic headspace extraction and GC-MS (Ciccioli *et al.*, 2004). The sensory properties of cheese were evaluated by 10 trained panellists (5 males and 5 females). The panel proceeded in open session, by quantitative and qualitative criteria: two samples for each day of cheesemaking for each treatment were evaluated for colour, odour, taste and final acceptability; the first three parameters were expressed both by score (0=blank, 9=very intense) and main descriptor. The values have been assigned after shared discussion among all panellists. As main descriptors, only recurrent adjectives in all samples per treatment have been chosen. The results of VOC content and quantitative sensory data have been statistically processed using SAS 9.1.3 software, by GLM procedure of ANOVA; means differences were tested by Duncan’s multiple range test.

**Results and conclusions** – The treatments generally affected the VOC content, with significant differences for all classes of VOC (P≤0.05), except for esters and hydrocarbons. The highest total VOC content (Figure 1) was found in AS cheeses (226.55a.u.), mostly represented by alcohol (2-butanol) (about 60%), while the lowest in TI cheeses (79.96a.u.).

**Table 1.** Effect of dietary treatment on the quantitative sensory properties of goat Caciotta cheese (mean score).

| Dietary treatment | SEM | Colour | Odour | Taste | Acceptability |
|-------------------|-----|--------|-------|-------|--------------|
| AS                |     | 3.76b  | 5.31a | 6.56a | 6.19a        |
| LP                |     | 4.50a  | 4.87a | 5.50ab| 6.75a        |
| MS                |     | 4.00ab | 3.87b | 5.06b | 5.00b        |
| TI                |     | 3.75ab | 4.81a | 6.25a | 6.37a        |

*P<0.05; **P<0.01; ***P<0.001; means with the same letter are not significantly different.*

[Figure 1. VOC composition of goat cheeses from each diet treatment (mean value in arbitrary units).]
carbons content (about 50% of total VOC), and ketones (24% of total VOC). The dietary treatment significantly affected quantitative sensory properties of cheeses (Table 1) for all parameters (colour, odour, taste and acceptability). Concerning the colour, significant differences (P<0.05) have been observed between AS and LP cheeses. In fact, cheeses from AS were considered more intensively white than LP's ones. About cheeses from legumes groups (MS and TI), the panel did not find any significant difference. As far as the odour is concerned, the sole difference was found in cheeses from goat fed Medicago sativa (3.87 score). The level of acceptability was generally in the middle of score scale (from 5 to 6.75), in the following increasing order: MS, AS, TI and LP, with the sole significant difference for MS cheeses. About colour, during the qualitative test (Table 2), the main descriptor was the ivory white, as expected from ripened goat cheeses. Only cheeses from MS treatment were characterised by straw light yellow colour. AS and LP cheeses shared blue as dominant descriptor, both for odour and taste.

This was probably due to the presence of 2-heptanone, while in MS cheeses, besides higher content of 2-heptanone (7.91 a.u.), the blue note was not perceived by panellists, probably because interfered by other compounds, such as 2-pentanone (29.97 a.u.). AS and LP cheeses showed significantly different odour and taste profiles in comparison to those from legumes. The groups were characterised by some descriptor for taste: cheeses from grasses' treatments with astringent and blue, those from legumes' treatments with acidic, bitter and light goaty taste. All cheeses showed goaty taste, except LP cheeses.

Beyond the effect on the aromatic compounds, the animal nutrition with different meadow's species transmitted to dairy products different characteristics, perceivable at sensorial level.

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