Effect of feeding systems on aromatic characteristics of buffalo mozzarella cheese

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ABSTRACT: Aim of this study was to evaluated the effect of feeding systems (hay vs ray-grass silage) on volatile compounds profiles of mozzarella cheese. Three mozzarella cheese making trials for each experimental group were conducted at our dairy technology laboratory. Mozzarella cheese was manufactured from whole raw water buffalo milk with the addition of natural starter. Volatile compounds were extracted by “purge and trap” system coupled to a gas chromatograph and detected operating with a mass-selective detector (Ciccioli et al., 2004) A total of 84 compounds of the following chemical families were detected: hydrocarbons, fatty acids, esters, alcohols, aldehydes, ketones and terpenes. The data overall indicated difference between the aromatic profiles of mozzarella cheese as consequence of feeding systems. Thus, differences in mozzarella cheese flavour are primarily caused by concentration differences of a common set of flavour compounds, rather than by the occurrence of compounds uniquely associated with a particular feed.

Key words: Mozzarella cheese, Aromatic profile, Volatile organic compounds, Feeding systems.

INTRODUCTION - Water-buffalo mozzarella cheese is a typical cheese, from Campania region and some province of Lazio region, wich have the Protected Denomination of Origin (DOP) status. The quality of cheese depends on chemical, technological and microbiological characteics of the milk, which can be affected by breed, season and diet. The link between diet and milk composition and cheese quality is even more relevant for cheeses originates from appellation of origin areas, since very few or no modification of raw milk are allowed (Stefanon et al., 2004) In the present work, the effect of feeding systems on volatile compounds profiles was studied in water-buffalo mozzarella.

MATERIAL AND METHODS - Three mozzarella cheese making trials for each experimental group were conducted at our dairy technology laboratory. Mozzarella cheese was manufactured from whole raw water buffalo milk with the addition of natural starter. Volatile compounds were extracted by “purge and trap” system coupled to a gas chromatograph and detected operating with a mass-selective detector (Ciccioli et al., 2004). The mass spectrometer scanned from m/z 29 to m/z 400 at 0.5 s cycle time.
by electron impact (70eV). The volatile compounds detected were identified using Wiley MS library. The data were processed by analysis of variance (SAS,1990) with feed as factor; means values were compared by Fisher's LSD test.

**RESULTS AND CONCLUSIONS**. The aromatic profile of mozzarella cheese was affected by type of forage. A total of 84 compounds of the following chemical families were detected: hydrocarbons, fatty acids, esters, alcohols, aldehydes, ketones and terpenes (Table 1).

| Effect of feeding system on aromatic profile of mozzarella cheese (Abundance*10^-6). |
|---|---|---|---|
| H | GS | ES | P |
| Alcohols | 213.60 | 347.51 | 98.2 | 0.01 |
| Aldehydes | 129.98 | 222.26 | 34.78 | NS |
| Ketones | 172.52 | 422.57 | 50.1 | 0.001 |
| Esters | 77.81 | 64.75 | 14.78 | NS |
| Terpenes | 157.88 | 363.46 | 48.79 | 0.01 |
| Hydrocarbons | 176.89 | 341.6 | 73.37 | NS |
| Free fatty acids | 159.00 | 198.76 | 90.74 | NS |

Decanale and nonanale contents were influenced by dietary treatments. Higher contents of decanale (52.36 vs 28.10, P ≤ 0.001) and nonanale (88.63 vs 50.42, P ≤ 0.05) were found in mozzarella cheese made from milk of ray-grass silage (GS) than hay (H). These aldehydes characterized by a typical green grass–like aroma (Moio et al., 1993) could also probably play an important role in water buffalo mozzarella cheese flavour.

2-3 butandione (79.05 vs 27.55 P ≤ 0.05), 6-metil5-epten-2one (31.6 vs 19.99, P ≤ 0.001) and acetoine (321.87 vs 128.64, P ≤ 0.05) were higher in mozzarella cheese made from milk of animals fed with ray-grass silage than hay group. Acetoine (3-hydroxy-2-butanone) represents about of 73 % of the total ketones and is the major constituent of all experimental samples. According to Law (1981) and Moio et al., (1993) acetoine, together with diacetyl, probably plays an important role in aroma of immature soft cheese.

Alcohols varies according to different experimental groups (P ≤ 0.001). The level of 1-octanol was higher (267.89 vs 160.85, P ≤ 0.05) in mozzarella cheese made from milk of buffalos fed with ray-grass silage than H group. The levels of ethyl acetate and ethyl hexanoate was affected by feeding systems (71.22 vs 23.49 and 25.43 vs 6.59; P<0.01 and P<0.05 respectively). A higher contents of fenchyl acetate (7.33 vs 1.94, P<0.001) and isopulegol acetate (12.24 vs 4.65, P<0.001) were found in mozzarella cheese from GS group.

A higher content of terpenes was detected in mozzarella cheese made from milk of buffalos fed with ray-grass silage (GS) than hay (H) group. Dairy product terpenes have recently attracted interest both their possible impact on cheese properties and as potential markers in milk and cheese of the presence of diversified forages in dairy cows’ diet (Rubino et al., 2004). Many authors (Verdier et al., 1995; Bugaud et al., 2001; Cornu et al., 2003; Fedele et al., 2005, Tornambe et al, 2006) reported that the terpene profile are considered as the
forage signature inside animal products. The level of camphene (44.9 vs 13.19, P ≤ 0.001), limonene (45.17 vs 7.05, P ≤ 0.05) and α-pinene (13.38 vs 4.59, P ≤ 0.001) was higher in mozzarella cheese from GS group than other ones.

Our results indicated that the difference observed between the aromatic profiles of mozzarella cheese as consequence of feeding systems. Thus, differences in mozzarella cheese flavour are primarily caused by concentration differences of a common set of flavour compounds, rather than by the occurrence of compounds uniquely associated with a particular feed.

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