Milk characteristics of grazing sheep fed with different hay/concentrate ratio

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ABSTRACT: Seasonal production of pasture forces in the period of grass shortage to supply the animal feeding with hay and concentrates. The supplies satisfy the animal nutritive needs, but reduce the advantages coming from the grazing on milk quality. The present trial was carried out on Massese breed on a low productive pasture, testing four kinds of feeding supplies with different hay/concentrate ratio. The individual milk productions, the chemical composition so as the acidic milk composition have been controlled for six weeks. Although the four feeding supplies given to the animals had different chemical-nutritional values (diet A 0.84 MFU/kgDM with forage/concentrate ratio 1:1.7; B 0.78 with 1:1; C 0.72 with 1:0.7; D 0.68 with 2:1), they did not influence the milk production which resulted quite low and without significant differences. Results did not show differences in relation to the nutritional characteristics and the acidic milk composition. In the four groups Vaccenic acid and Conjugated linoleic acid (CLA) of milk showed similar and decreasing trends during the trial. These trends were probably due to the progressive grass reduction on the grazing: the effects on the dietetic characteristics of the milk did not depend on the supply but on the quantity of grass intaken during the grazing.

Key words: Sheep milk, Pasture, Fatty acids, Feeding supply.

INTRODUCTION - The sheep breeding based on grazing represents a low cost food resource; it is furthermore positive on the animal welfare and allows to take dietetic and nutritional advantages, since it is the principal source of fatty-acid PUFA n-3 (Cabiddu et al., 2005; Mansbridge and Blake, 1997). In the Mediterranean environments the grazing has a high quasi-qualitative variability related to season productions. When there is a low fodder production, it is often necessary to foresee a feeding supply which can represent an important integration in the animal diet allowing to satisfy animals’ nutritive needs, even if the integration can reduce the positive effects of the natural grazing. The present research aims to compare the effects of four different feeding supplies, on milk yield and dietetic-nutritional characteristics, from Massese sheep breed on a low productive pasture.

MATERIAL AND METHODS – The trial was carried out on four groups (named A,B,C,D) of Massese sheep; each group consists of four ewes which were isoproducive. The trial was carried out for six weeks, from the late Spring to the beginning of Summer, in a period of a low productive grazing. All the ewes were bred on the grazing and each group was given a feeding supply with a different hay/concentrate ratio (1:1.7 in diet A; 1:1 in B; 1:0.7 in C; 2:1 in D). Group A: hay 330 g/h/d; Group B: hay 550 g/h/d; Group C: hay 825 g/h/d; Group D: hay 1100 g/h/d. Each group was supplied with 550 g/h/d of concentrate of maize and soybean extraction meal in different percentages (A12% mais:13% sbm.; B13.5%:11.5%; C15%:10%; D17%:8%). Hay and concentrate samples have been analysed according to Weende and Van Soest method (Martillotti et al., 1987), and the nutritive value in MilkFU was calculated too (INRA, 1988). Individual productions have been daily registered and taken milk samples weekly. The milk analytical verifications regarded principal physical-chemical characteristics according to the ASPA official methods (1996), and the analysis of the fatty acid composition. The total lipids have been extracted according to Folch Method (1951); methyl esters of medium and long-chain fatty acids were prepared by Christie’s alkali catalyzed trans-methylation procedure (1982) with nonadecanoic acid methyl ester (Sigma Chemical Co., St. Louis, MO, USA) as the internal standard. The individuation and quantification of the fatty-acids have been carried out with
gaschromatograph, equipped with a FID and a high polar fused silica capillary column (Chrompack CP-Sil 88 Varian, Middelburg, Netherlands; 100 m x 0.25 mm i.d.; film thickness 0.20 m) (Secchiari et al., 2003). Statistical analysis were carried out by ANOVA using the linear model: \( Y_{ik} = \mu + D_i + e_{ik} \), were \( Y \) is the single observation, \( \mu \) is the general mean, \( D \) is the effect of diet (i=1-4) and \( e \) is the error.

RESULTS AND CONCLUSIONS – The low production of the pasture and its progressive reduction during the trial period strongly affected the results. The four feeding supplies given to the animals, although different in their chemical-nutritional aspects (Tab. 1) did not influence the milk production. In all the four groups the milk production resulted quite low and without significant differences. Milk chemical composition resulted of a good nutritional quality, but did not show significant differences among the groups (Tab. 2).

Table 1. % composition, chemical characteristics and nutritive value of feed supply.

| Diet | Alfalfa hay | Corn grain | Soybean E. M. | CP%   | NDF%   | MFU/kg DM |
|------|-------------|------------|---------------|-------|--------|-----------|
| A    | 37.5        | 30.0       | 32.5          | 23.56 | 32.42  | 0.84      |
| B    | 50.0        | 27.0       | 23.0          | 21.32 | 36.90  | 0.78      |
| C    | 60.0        | 24.0       | 16.0          | 19.74 | 40.53  | 0.72      |
| D    | 66.7        | 22.7       | 10.6          | 18.43 | 42.91  | 0.68      |

Table 2. Milk production and chemical analysis.

|                | Diet A | Diet B | Diet C | Diet D | SE    | P      |
|----------------|--------|--------|--------|--------|-------|--------|
| Production g/head/d | 676    | 668    | 649    | 675    | 75.50 | 0.99   |
| Total solid %     | 17.68  | 18.98  | 18.38  | 18.20  | 0.91  | 0.77   |
| Protein           | 5.82   | 6.44   | 6.04   | 6.08   | 0.38  | 0.71   |
| Fat               | 6.34   | 6.78   | 6.89   | 6.40   | 0.64  | 0.83   |
| Lactose           | 4.43   | 4.68   | 4.41   | 4.61   | 0.14  | 0.47   |
| Casein            | 4.73   | 5.70   | 5.30   | 5.01   | 0.36  | 0.30   |
| pH               | 6.84   | 6.70   | 6.70   | 6.77   | 0.07  | 0.59   |
| TA °SH/50ml       | 4.65   | 4.98   | 5.36   | 4.66   | 0.39  | 0.51   |

\( a, b: P<0.05. \)

Figure 1. Trend of the Vaccenic acid (VA) and CLA content in milk during the trial.

The trend of the Vaccenic Acid and of the CLA resulted of some interest. In the milk produced by the four experimental groups it has been observed that the CLA and the Vaccenic acid (CLA precursor) showed similar decreasing trends: in the first two weeks they quickly decreased, in the last four weeks they had a slower decreasing trend.
(Figure 1). This is probably due to the fact that the grazing is satisfactory only at the begin of the trial; later, the slow grass growth, didn’t allow the animal to intake the right quantity of green forage. This confirms the effectiveness of green forage to increase the milk content of CLA and VA. Table 3 shows that the diet wasn’t a significant variation factor for any fatty acid of sheep milk. This trial pointed out that the dietetic-nutritional advantages of the milk produced by grazing animals depend on the quantity of intaken grass but they realized only when the green forage is prevalent in the animal ration. In the case of grazing shortage, the different kind of supply (forage/concentrate ratio and kind of concentrate), seems to have limited effects on the milk acidic composition.

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| Table 3. Milk fatty acid composition. |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                         | A            | B            | C            | D            | SE          | P           |
| C10:06                  | 6.004        | 5.810        | 5.689        | 5.660        | 0.476       | 0.815       |
| C12:03                  | 3.455        | 3.348        | 3.267        | 3.345        | 0.244       | 0.866       |
| C14:08                  | 8.783        | 8.569        | 8.738        | 8.749        | 0.416       | 0.716       |
| C14:10                  | 0.120        | 0.122        | 0.150        | 0.140        | 0.023       | 0.746       |
| C16:0                   | 20.365       | 19.125       | 19.440       | 19.377       | 0.444       | 0.197       |
| C16:1 n-7               | 0.514        | 0.571        | 0.669        | 0.668        | 0.061       | 0.235       |
| C18:0                   | 9.827        | 8.867        | 8.957        | 9.433        | 0.850       | 0.810       |
| C18:1 trans11           | 1.736        | 1.659        | 1.470        | 1.607        | 0.142       | 0.296       |
| TotalC18:1trans         | 2.510        | 2.558        | 2.194        | 2.543        | 0.384       | 1.152       |
| C18:1 cis9              | 15.847       | 16.524       | 16.926       | 16.544       | 0.814       | 0.822       |
| Total C18:1 cis         | 16.800       | 17.850       | 17.932       | 17.761       | 0.964       | 2.416       |
| C18:2 n-6 cis           | 1.927        | 2.057        | 1.892        | 1.931        | 0.118       | 0.735       |
| C18:3 n-3               | 0.801        | 0.865        | 0.747        | 0.751        | 0.049       | 0.308       |
| Total CLA               | 0.953        | 0.927        | 0.869        | 0.931        | 0.061       | 0.568       |
| C20:5 n-3               | 0.104        | 0.128        | 0.126        | 0.120        | 0.015       | 0.660       |
| C22:6 n-3               | 0.081        | 0.072        | 0.086        | 0.078        | 0.010       | 0.768       |
| SFA                     | 50.422       | 47.549       | 47.942       | 48.430       | 1.554       | 0.453       |
| UFA                     | 24.259       | 25.636       | 25.117       | 25.376       | 0.865       | 0.681       |
| PUFA                    | 3.131        | 3.382        | 3.080        | 3.121        | 0.182       | 0.608       |
| MUFA                    | 20.175       | 21.326       | 21.167       | 21.325       | 0.788       | 0.680       |
| SAT/UNSAT               | 1.598        | 1.393        | 1.433        | 1.430        | 0.088       | 0.342       |
| n6                      | 1.989        | 2.142        | 1.967        | 2.026        | 0.132       | 0.734       |
| n3                      | 1.126        | 1.199        | 1.188        | 1.086        | 0.065       | 0.930       |
| n3/n6                   | 0.573        | 0.579        | 0.568        | 0.543        | 0.029       | 0.637       |

a, b: P<0.05.