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Effect of the inclusion of lemon citrus pulp in the diet of Valle del Belice lactating ewes. Milk production and composition

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Lemon citrus pulp residues from the citrus juice industry; it belongs to the citrus by-product that are more extensively used for livestock feeding. Furthermore, citrus pulp is a source of flavonoids such as hesperidin and naringin, which have antioxidant properties. This study aimed to investigate the effect of fresh lemon citrus pulp (LP) as natural antioxidant, on feeding behavior, milk yield and milk quality of Valle del Belice lactating ewes in the hot summer season in Sicily. A total of 15 second lambing ewes were individually allocated in 3×3 m box and fed with 3 diets in a 3 × 3 Latin square design, with 3 phases composed of 21 days. The diets were: LP0, mixed hay *ad libitum* plus 600 g/d of concentrate; LP1, mixed hay *ad libitum* plus 400 g/d of concentrate and 1 kg/d of LP; LP2, mixed hay *ad libitum* plus 200 g/d of concentrate and 2 kg/d of LP. The samples of offered and refused forage, concentrate and LP were analyzed for the determination of DM, CP, EE, ash, NDF, ADF and ADL. Individual milk samples were analyzed for lactose, fat, protein, casein, urea, SCC, pH, titratable acidity. At the end of the pre-experimental and experimental phases, total polyphenol intake, milk polyphenol content and milk antioxidant capacity were also determined. Statistical analyses were performed using the MIXED model where experimental phase (1, 2, 3) and diet (LP0, LP1, LP2) were fixed factors and the ewe was considered as random factor. On the basis of voluntary feed intake, the ewes of each group ingested the same dry matter, around 2 kg/d/head, but the LP2 group received lower net energy than other groups (1,27 *vs.* 1,33 UFL), in average slightly higher of their nutritional needs. The LP resulted 10% and 20% of the total DM intake, in LP1 and LP2 group respectively. The effect of the high temperatures determined average low milk productions. The LP2 ewes produced significantly lower daily milk yield than the other two groups (322 g/d *vs.* 369 g/d and 355 g/d for LP2, LP0 and LP1 groups respectively), probably due to lower net energy ingested. Milk fat did not differ significantly among groups, while milk protein and casein percentages showed higher values in LP2 than in LP1 group, probably due to higher availability of amino acids for the intestinal absorption. The milk urea content of LP0 resulted significantly lower than other groups. Polyphenol analyses are still under execution.

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Effect of olive pomace and extruded linseed on milk yield and fatty acid composition from dairy ewes

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Use of extruded linseed (EL) in the diet of dairy ewes is an effective strategy to enrich milk with omega-3 polyunsaturated fatty acids (PUFA n-3) and conjugated linoleic acid (CLA). However, since EL is largely biohydrogenated in the rumen, the amount of extruded linseed needed to obtain an effective enrichment of PUFA n-3 in milk fat may often result in an increase of feeding cost. The use of polyphenols in the diet of dairy ruminants has been proposed as strategy to perturb rumen biohydrogenation of dietary PUFA and to increase the passage rate of PUFA omega-3 from the diet to milk. Crude phenolic concentrate (CPC) obtained by membrane filtration of olive vegetation waters to reduce their pollutant charge could be considered a good source of polyphenols, mainly secoridoides derivatives. The aim of this study was to evaluate the effect of the inclusion of linseed and CPC in diets of dairy ewes on milk yield and fatty acid (FA) composition. Twenty pluriparous Comisana ewes were randomly allotted into four groups after a baseline period of three weeks, when the animals received the same dietary regimen based on alfalfa hay and a concentrate feed poor in lipids. Subsequently, the four experimental diets were based on alfalfa hay *ad libitum* administrated and 800 g/head and day of a concentrate feed containing: linseed (L diet) or linseed plus different quantity of CPC to provide 0.4 (L0.4), 0.8 (L0.8) or 1.2 (L1.2) g/kg DM of polyphenols. The trial lasted 5 week, individual milk yield was weekly recorded and analysed for proximate and FA composition. Data were analysed by a repeated measure model. The inclusion of EL and CPC in the diet of dairy ewes did not affect milk yield and proximate composition, however, at the maximum dose, CPC resulted in a significant increase of linoleic and alpha-linolenic acid by 18% and 24%, respectively, if compared to milk fat from ewe fed L diet. At the same time, milk fat from ewe fed L1.2 diet was lower in t11 18:1, CLA content (-38% for both FA) and other intermediates of the biohydrogenation process, probably as a consequence of a perturbing effect of OP on rumen bacteria responsible of the biohydrogenation of dietary PUFA. In conclusion, addition of OP to diet supplemented with EL enhanced the content of PUFA in milk fat from dairy ewes, without affecting productive performance of the animals.

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