Italian Journal of Animal Science

ISSN: (Print) 1828-051X (Online) Journal homepage: http://www.tandfonline.com/loi/tjas20

# Milk production and physiological traits of ewes and goats housed indoor or grazing at different daily timing in summer

Antonino Di Grigoli, Massimo Todaro, Giuseppe Di Miceli, Maria Luigia Alicata, Giuseppe Cascone & Adriana Bonanno

**To cite this article:** Antonino Di Grigoli, Massimo Todaro, Giuseppe Di Miceli, Maria Luigia Alicata, Giuseppe Cascone & Adriana Bonanno (2009) Milk production and physiological traits of ewes and goats housed indoor or grazing at different daily timing in summer, Italian Journal of Animal Science, 8:sup2, 616-618, DOI: 10.4081/ijas.2009.s2.616

**To link to this article:** https://doi.org/10.4081/ijas.2009.s2.616

# Milk production and physiological traits of ewes and goats housed indoor or grazing at different daily timing in summer

Antonino Di Grigoli[1], Massimo Todaro[1], Giuseppe Di Miceli[2], Maria Luigia Alicata[1], Giuseppe Cascone[3], Adriana Bonanno[1]

[1]Dipartimento di Scienze Entomologiche, Fitopatologiche, Microbiologiche agrarie e Zootecniche, Università di Palermo, Italy

[2]Dipartimento di Agronomia Ambientale e Territoriale, Università di Palermo, Italy

[3]Istituto Zooprofilattico Sperimentale della Sicilia "A. Mirri", Palermo, Italy

*Corresponding author:* Antonino Di Grigoli. Dipartimento S.En.Fi.Mi.Zo., sezione di Produzioni Animali, Facoltà di Agraria, Università di Palermo. Viale delle Scienze, 90128 Palermo, Italy - Tel. +39 091 7028867 – Fax: +39 091 7028873 – Email: adigrigoli@unipa.it

**ABSTRACT -** During a 6 week trial in summer, 3 homogeneous groups, each consisting of 5 Comisana ewes and 5 Rossa Mediterranea goats, grazed watered forage resources during day (D) or night (N), or were housed indoor and supplied with mowed herbage (H). Maximum THI peaked at 94 at the end of July, and was almost constantly higher of 80. Milk yield was higher in N than in D and H goats, whereas N ewes produced more milk than H group, but their milk yield was higher than D ewes only in the period with the highest THI values. The lower urea in N goat milk, and the higher casein in N ewe milk, seem to indicate a better efficiency in dietary nitrogen utilization of night grazing animals. N ewes showed lower SCC in milk, and higher incidence of clotting milk samples, in comparison to other ewes. N goats and ewes showed lower rectal temperature and pulse rate in the afternoon and, among metabolic parameters, higher hematic level of sodium. Night grazing was confirmed to be a management practice for increasing heat tolerance, to which goats appeared to be more sensitive in terms of milk yield.

*Key words:* Milk production, Dairy ewes, Dairy goats, Heat stress.

**Introduction** - In Sicily, as in other Mediterranean countries, where dairy goats and sheep often coexist in the flock, the rearing system is mainly based on grazing extensive native or cultivated pastures, generally for few hours during the day. Thus, the dairy production of these farming systems, depending on seasonality of herbage availability at pasture, is markedly concentrated within the winter-spring period, whereas milk and cheese production is interrupted in summer. Moreover, the market demand of fresh cheese in some tourist areas of Sicily is making convenient to extend milk production in summer. On the other hand, the environment conditions in the hot season (temperature, relative humidity, solar radiation, wind speed) cause heat stress in dairy animals, because of the overcoming of their termoneutral zone (Finocchiaro *et al*., 2005). Among management practices, the time of grazing affects greatly the performance of animals (Iason *et al*., 1999; Bonanno *et al.*, 2007). In warm areas, nocturnal grazing leads to benefits for animals, improving body condition, reducing heat stress, and increasing forage intake and milk production. In perspective of implementing the summer goat and sheep dairy production, this research was aimed to compare the effects of different modalities of exploitation of a summer watered forage system, by diurnal or nocturnal grazing, or of supplying indoor animals with mowed herbage, on milk yield and composition, and on some physiological and metabolic parameters of both goats and ewes.

**Material and methods** - The experimental site was the "Don Pietro Canicarao" farm, situated in an area of the province of Ragusa (36°58'N e 14°38'W, 250m a.s.l.) characterized by availability of water for

irrigation purposes. The forage system, exploited for grazing or mowing, was constituted by three adjacent and fenced plots with *Medicago sativa* (1ha), *Cichorium intybus* (1ha) and a mixture of *Lolium perenne*, *Trifolium repens* and *Festuca arundinacea* (0.5ha). Fifteen Comisana ewes and fifteen Rossa Mediterranea goats were homogeneously divided into 3 groups (each comprised of 5 animals *per* species) on the basis of days in milk (goats 241±50d; ewes 138±20d), milk yield (goats 2027±158 g/d; ewes 988±87 g/d) and live weight (goats 48.0±5.2 kg, ewes 60.9±10.7 kg), and assigned to the treatments: day grazing (D), night grazing (N) and indoor housing (H). For 6 weeks from 10 July 2007, the D group grazed during the day, from 7.30 to 18.30 h, while the N group grazed during the night, from 19.30 to 6.30h; the H group was permanently housed indoor into a fold and fed *ad libitum* with the same fresh forage grazed by D and N animals, which was mowed daily at 7.30h. The fold was an adapted old warehouse equipped with mangers and watering tanks. In addition, during the housing period, all animals were offered 800g/day of hay. Animals were hand milked twice in a day (6.30 and 18.30). All animals were weighed at the start and the end of the experimental period. For 4 times, with 10-day intervals, pulse rate (PR), using a stethoscope for 1 min, and rectal temperature (RR), by an electronic thermometer with an accuracy of 0.1°C, were detected in all animals just prior to both morning and afternoon milking; individual and bulk milk yield of each group was measured and sampled. Individual milk samples were analyzed for lactose, fat, protein, casein and somatic cells count (SCC) by infrared method (Combyfoss 6000, Foss), and urea by enzymatic method using difference in pH (CL10 instrument, Eurochem). Bulk milk samples were used to determine pH, titratable acidity and clotting ability by measurements of clotting time (r, min), curd firming time ($k_{20}$, min) and curd firmness ($a_{30}$, mm) (Formagraph, Foss). Blood samples of all animals were taken at 7.00h from jugular veins at days 21 and 43. Samples were centrifuged for 15 min at 3500 rpm, and plasma was stored at -20°C. The following metabolites and enzymes in plasma were determined: bilirubin, magnesium, total cholesterol and total protein by colorimetrical method; alanine amino-transferase, alkaline phosphatase, aspartate amino-transferase, creatinin, gamma-glutamiltransferase, lactate-dehydrogenase and urea by enzymatic methods; chloride, sodium and potassium by potenziometric method. Ambient temperature and relative humidity data were recorded throughout the trials by the meteorological station of the farm. Maximum, minimum and mean temperature-humidity index (THI) were calculated by the formula of Kelly and Bond (1971). Data were statistically analyzed separately for goats and ewes, by MIXED procedure of SAS 9.1.3 (2003), using a mixed model for repeated measures, with treatment, day of trial and their interaction as fixed effects, animal within treatment as repeated subject and the day of trial as repeated measure.

**Results and conclusions** – During the trial, mean THI ranged from 63 to 76, and maximum THI from 77 to 94, with higher values occurring at the end of July. Maximum THI was almost constantly higher of 80, value above of which Sevi *et al.* (2001) observed a milk yield reduction. Peana *et al*. (2007) indicated 72-75 as a threshold value of maximum THI causing discomfort for lactating ewes. The night grazing allowed the goats to increase milk yield in comparison with D and H groups, whereas in ewes milk yield from N animals was higher than H group, but did not differ from D group (Table 1). However, N ewes produced more milk than D ewes (1052 *vs.* 820 g/d; $P<0.05$) in the period when THI reached the highest value. Milk production of housed animals were the lowest for both species, presumably because the fold used for housing animals was not adequate to limit the heat stress, but also because the forage supplied in the morning, just after mowing, was less consumed during the hotter hours, and the forage supplied in the afternoon were less palatable, having lost its initial freshness due to air exposure. With regard to milk composition, milk from N goats was lower in fat than milk from H goats, due to a dilution effect, and lower in urea than the other experimental groups, whereas N ewe milk resulted higher in casein. These results seem to indicate a tendency toward a better efficiency in dietary nitrogen utilization of night grazing animals, favored by mild temperatures, according to Marai *et al.* (2007). Moreover, the heat stress-free N ewes showed lower SCC in milk, in accordance with Peana *et al.* (2007) and Finocchiaro *et al.* (2007), and higher incidence of clotting milk samples, in comparison to other ewes (Table 1). However, clotting parameters of reactive milk did not show marked differences among groups of both species.

Table 1. Effects of grazing timing and housing on milk yield and composition, pulse rate (PR), rectal temperature (RT) and blood sodium.

| | | GOATS | | | EWES | | |
|---|---|---|---|---|---|---|---|
| | | Night grazing | Day grazing | Indoor housing | Night grazing | Day grazing | Indoor housing |
| Milk | g/d | 1702$^{a}$ | 1439$^{b}$ | 1437$^{b}$ | 908$^{A}$ | 875$^{A}$ | 666$^{B}$ |
| Fat | % | 3.26$^{b}$ | 3.51$^{ab}$ | 3.77$^{a}$ | 6.97 | 6.58 | 6.50 |
| Protein | % | 3.93 | 3.79 | 4.19 | 6.23 | 5.87 | 5.93 |
| Casein | % | 2.86 | 2.72 | 3.05 | 4.94$^{a}$ | 4.61$^{b}$ | 4.61$^{b}$ |
| Urea | mg/dl | 49.2$^{B}$ | 56.0$^{A}$ | 56.2$^{A}$ | 54.4 | 53.8 | 51.6 |
| SCC | log10 | 6.44 | 6.47 | 6.30 | 5.53$^{b}$ | 6.01$^{a}$ | 5.77$^{ab}$ |
| Clotting milk | % | 90 | 85 | 75 | 62.5 | 48.3 | 46.2 |
| PR morning | n/min | 77.1 | 77.6 | 77.3 | 73.6 | 75.3 | 73.3 |
| PR afternoon | n/min | 78.0$^{C}$ | 104.2$^{A}$ | 89.3$^{B}$ | 72.2$^{Bb}$ | 89.1$^{Aa}$ | 80.6$^{ABc}$ |
| RT morning | °C | 39.0$^{Aa}$ | 38.7$^{Bb}$ | 38.8$^{ABc}$ | 39.0 | 38.8 | 38.9 |
| RT afternoon | °C | 39.0$^{C}$ | 39.7$^{A}$ | 39.5$^{B}$ | 39.1$^{B}$ | 39.8$^{A}$ | 39.7$^{A}$ |
| Blood sodium | mmol/l | 145.8$^{A}$ | 143.7$^{B}$ | 142.3$^{B}$ | 144.7$^{a}$ | 143.5$^{b}$ | 143.2$^{b}$ |

*$^{A, B, C}$: P≤0.01, $^{a, b, c}$: P≤0.05.*

Afternoon rectal temperature and pulse rate of both goats and ewes were higher in day grazing and lower with night grazing animals, in accordance to Marai *et al.* (2007) and Sevi *et al.* (2001) who reported an increase of these parameters with a longer exposure of animals to solar radiation. The metabolic parameters did not overcome the threshold values, and did not show precise trends ascribed to heat stress, with the exception of hematic level of sodium, which was lower for goats and ewes of D and H groups. Accordingly, deficiency in plasma sodium was reported to be an indicator of heat-stressed animals (Silanikove, 2000). In conclusion, the results of this investigation confirmed night grazing to be a suitable management practice for limiting the effects of heat stress in warm season. However, goats appeared to be particularly sensitive to high temperatures and solar radiation, since they benefited more than ewes by night grazing in terms of milk yield.

**REFERENCES** - **Bonanno,** A., Di Grigoli, A., Vargetto, D., Tornambè, D., Di Miceli, G., Giambalvo, D., 2007. Grazing sulla and/or ryegrass forage for 8 or 24 hours daily. 1. Effects on ewes feeding behaviour. Proc of the 14th Simp. EGF. Ghent, Belgium, 12:208-211. **Finocchiaro,** R., Van Kaam, J.B.C.H.M., Portolano, B., Misztal, I., 2005. Effect of heat stress on production of Mediterranean dairy sheep. J. Dairy Sci. 88:1855-1864. **Finocchiaro,** R., Van Kaam, J.B.C.H.M., Portolano, B., 2007. Effect of weather conditions on somatic cell score in Sicilian Valle del Belice ewes. Ital. J. Anim. Sci. 6(suppl.1):130-132. **Iason,** G.R., Mantecon, A.R., Sim, D.A., Gonzalez, J., Foreman, E., Bermudez, F.F., Elston, D.A., 1999. Can grazing sheep compensate for a daily foraging time constraint? J. Anim. Ecology 68:87-93. **Kelly,** C.F., Bond, T.E., 1971. Bioclimatic factors and their measurement: a guide to environmental research on animals. National Academy of Sciences, Washington, DC. **Marai,** I.F.M., El-Darawany, A.A., Fadiel, A., Abdel-Hafez, M.A.M., 2007. Physiological traits as affected by heat stress in sheep - A review. Small Rumin. Res. 71:1-12. **Peana,** I., Fois, G., Cannas, A., 2007. Effects of heat stress and diet on milk production and feed and energy intake of Sarda ewes. Ital. J. Anim. Sci. 6(suppl.1):577-579. **SAS**, 2003. SAS/STAT User's guide: Statistics, Version 9.1.3. SAS Institute Inc., Cary, NC, USA. **Sevi,** A., Annichiarico, G., Albenzio, M., Taibi, L., Muscio, A., Dell'Aquila, S., 2001. Effects of solar radiation and feeding time on behavior, immune response and production of lactating ewes under high ambient temperature. J. Dairy Sci. 84:629-640. **Silanikove,** N., 2000. Effects of heat stress on the welfare of exstensively managed domestic ruminants. Livest. Prod. Sci. 67:1-18.