Determination of factors affecting milk yield, composition and udder morphometry of Hair and cross-bred dairy goats in a semi-intensive system

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Supplementary File

Supplementary Materials and methods

Animal management and feeding regime

The first (38˚04′N, 32˚23′E), second (38˚06′E, 32˚27′E) and third farms (37˚55′N, 32˚14′E) were located at 1393 and 1527 meters above the sea level. The goats were between the first and fourth parity. Individual milk samples were collected throughout the lactation period during 2014 and 2015.

They grazed the rangelands from early morning until noon before returning to the shaded resting areas in the farms; they resumed grazing the rangelands again after sundown when the temperature cooled down. The daily grazing duration ranged from 6 to 8 h. During snowstorm and very cold weather in the winter months, indoor feeding was performed. In addition to pasture, they were fed 700-800 g d^{-1} a mix of dry alfalfa hay and wheat straw in winter periods. A 200 g d^{-1} supplemental concentrate was offered to goats in the midst of pregnancy, and this was gradually increased to 500-600 g d^{-1} in the last 45 days of pregnancy based on the body conditions of the goats (Supplementary Table S1). Mineral supplements in the form of mineral blocks were used on flocks as to improve production and animal health (NRC, 2007) in lactation and non-lactation periods. The annual DM production of rangelands in the region produces about 500 kg of DM ha^{-1} y^{-1} with the main productive period being May to July (Mülayim & Ozköse, 2013).

The goats were grazed with vertical and horizontal movement on natural vegetation. The mountain grazing system was carried out common from lowland valleys (spring and autumn) to upland pastures (about 1900 m) in summer. The goats were set to graze at two different times of the lactation period; intensely, plant vegetation was grazed from May to July, and then the goats were grazed with woody vegetation until the end of lactation period.

Milking, milk samples and udder measurements

Milk production of the goats was measured until their daily production level dropped below 100 g d^{-1}. The lactation period was defined from kidding to drying. Udder teat length **(UTL)**, distance between udder teats **(DBUT)**, front udder depth **(FUD)** and rear udder depth **(RUD)**

were measured with calliper. Udder teat circumference **(UTC)** and udder circumference **(UC)** were measured with measurement tape.

Statistical analysis

The statistical significance level was set at 5%, and the JMP 11 computer-based program was used for all statistical computations.

$y_{ijklm} = \mu + a_i + b_j + c_k + d_l + e_{ijklm}$

where y_{ijklm} is the observation, μ the overall mean, a_i the flock effect (i=1, 2, 3), b_j the lactation number effect (j=1, 2, 3, 4), c_k the genotype effect (k=Hair, AHF_1, SHF_1), d_l the year effect (l=1, 2), e_{ijklm} the random error.

References

Mülayim M & Ozköse A 2013 Livestock production of the Konya, roughage requirement and production, production problems and solutions In Proceedings of the 10th National Field Crops Congress pp. 201-209.

NRC 2007 *Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids. Washington, DC: The National Academies Press.* Washington, DC. USA:

Supplementary Table S1.

Concentrate and forage calculated nutrient composition of the ration (%)

	Concentrate feed		Forage	
Traits	Lactation period	Winter period	Alfalfa hay	Wheat straw
Dry matter	89.6	88.5	89.4	91.4
Crude protein	16.05	14.29	14.56	3.78
Metabolic energy (Mcal/kg)	2.50	2.46	2.14	1.52
Crude cellulose	7.41	6.24	28.27	40.53
NDF			44.8	77.5
ADF			33.4	50.0
Lignin			7.6	7.2
Calcium	1.13	1.02	1.57	0.48
Phosphorus	0.52	0.49	0.26	0.07

Supplementary Table S2.

The botanical composition of pastures (%)

Plants	%	Woody and shrubs	%
Aegilops markgrafii	10.6	Amygdalus orientalis	6.9
Aegilops triuncialis	3.4	Berberis integerrima	9.7
Aegilops umbellulata	5.3	Cerasus avium	4.8
Artemisia splendens	3.3	Cornus sanguinea	2.8
Astragalus andrachneifolius	5.2	Cotoneaster integerrimus	2.2
Crepis armena	4.0	Crataegus aronia	5.8
Euphorbia anacampseros	9.5	Juniperus communis	8.6
Festuca arundinacea	3.7	Juniperus oxycedrus	6.4
Festuca callieri	5.1	Pistacia atlantica	2.4
Festuca ovina	10.4	Pistacia terebinthus	5.4
Genus of bromus	10.9	Quercus cerris	27.6
Medicago sativa sp.	6.8	Rosa canina	3.3
Verbascum cheiranthifolium	7.1	Other woody and shrubs sp.	14.1
Other plant sp.	11.7		
Total	100	Total	100

Supplementary Table S3.

Means and standard error of means (SEM) of udder traits for genotype groups and udder shape

Traits[2]	Genotype[1]			Udder shape				SEM
	Hair	AHF_1	SHF_1	Asymmetric	Too flat	Halving	Broken	
n	216	232	167	118	144	225	128	
UTL (cm)	3.2 [c]	3.7 [b]	3.9 [a]	3.6	3.7	3.6	3.5	0.04
UTC (cm)	5.4 [c]	5.9 [b]	6.1 [a]	5.8	5.8	5.8	5.7	0.04
UC (cm)	26.2 [b]	27.7 [a]	28.1 [a]	27	27.6	27.5	27.1	0.11
DBUT (cm)	8.1 [b]	8.7 [a]	8.8 [a]	8.5	8.6	8.5	8.5	0.06
RUD (cm)	12.0 [b]	12.7 [a]	12.8 [a]	12.5	12.6	12.6	12.3	0.06
FUD (cm)	6.2 [b]	6.4 [b]	6.7 [a]	6.3	6.5	6.5	6.3	0.05
UV (ml)	324.8 [c]	376.7 [b]	396.1 [a]	360.1	374.4	370.2	358.7	3.58
Udder shape (%)				19.2	23.4	36.6	20.8	

[1] Value of factors within a row with different superscripts letters (a,b,c) differ significant ($P < 0.01$).

[2] Abbreviations are: UTL, udder teat length; UTC, udder teat circumference; UC, udder circumference; DBUT, distance between udder teats; RUD, rear udder depth; FUD, front udder depth; UV, udder volume.