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ScienceDirect
Small Ruminant Research 68 (2007) 35–41
Small Ruminant Research
www.elsevier.com/locate/smallrumres

Potential mineral deficiencies on arid rangelands for small ruminants with special reference to Mexico☆

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Available online 25 October 2006

Abstract

The production of milk from goats managed under extensive range grazing conditions can be affected in quantity and quality by the nutrient and especially by the mineral content of the forages on the rangeland, which in turn reflects soil and precipitation conditions. Mexico with its large dairy dual-purpose goat population and vast expanses of arid rangelands is a good model for many other countries with similar conditions. In several studies on the semiarid rangeland of northeastern Mexico the voluntary selection of brush browse, forbs and grasses by goats, and in comparison by sheep and deer was determined from observations, collections, samples from esophageally fistulated goats and sheep, and microhistological analyses of deer feces monthly for several years. The area had low annual rain precipitation often less than 400 mm and dry season from November to July. Blackbrush (*Acacia* sp.), Mesquite (*Prosopis* sp.), Palo verde (*Cercidium macrum*), Jujube (*Ziziphus* sp.), Hackberry (*Celtis* sp.), Pricklypear (*Opuntia* sp.), Cenizo (*Leucophyllum* sp.), Soapbrush (*Porlieria* sp.) were dominant brush species. Goats selected 81 ± 1.4% brush browse, 12 ± 1.2% forbs, and 7 ± 1.0% grasses throughout the year for their diet, while the botanical composition of the rangeland was 41% brush, 19% forbs, and 40% grasses. Goats preferred *Acacia*, *Cercidium*, *Porlieria*, and *Celtis*. Significant undersupplies of Mg, Cu, Mn, and Zn in the naturally selected diets of goats in relation to requirements in most months was determined. Contrary to the behavior of goats, sheep selected 95–63% grasses, 1–36% browse, and 0.1–2.2% forbs in different months of the year. Sheep had deficient diets in Ca, Mg, K, Cu, and Mn during several months. Deer appeared to select like goats 94% browse, 5% forbs, and 1% grasses. Deer had deficient diets apparently only in Zn during the 6 months of summer and autumn. Several brush browse and grass species with relatively high mineral contents during some seasons were identified as possibly helpful to alleviate mineral deficiencies, such as Hackberry (*Celtis* sp.), Soapbrush (*Porlieria* sp.), Jujube (*Ziziphus* sp.), *Desmanthus* sp., Cenizo (*Leucophyllum* sp.), and Huisache (*Acacia* sp.) brush; Hall's Panicum (*Panicum* sp.), and Buffelgrass (*Cenchrus* sp.).
Published by Elsevier B.V.

Keywords: Goats; Sheep; Deer; Minerals; Rangeland; Browse species; Mexico

1. Introduction

Goats have considerable economic importance in many countries, providing milk, meat, cashmere, mohair, skins, manure, and stand-by cash, especially in the developing world of Asia and Africa (Table 1). Compared to the contributions of other farm animals, the official statistically available percentage (FAO, 2004) from goats may look small, but an estimated recent annual tonnage

☆ This paper is part of the special issue entitled "Goat and Sheep Milk" Guest edited by George Haenlein, Young Park, Ketsia Raynal-Ljutovac and Antonio Pirisi.

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0921-4488/$ – see front matter. Published by Elsevier B.V.
doi:10.1016/j.smallrumres.2006.09.018

Table 1
Proportional importance of goats for milk, meat, and skin production among farm animals worldwide in the year 2003 (FAO, 2004)

Animal species	Milk (million MT)	%	Animal species	Meat (million MT)	%	Hides, skins (million MT)	%
Cows	506,852	84	Beef, veal	58,922	23	8,280	76
Buffaloes	72,682	12	Buffaloes	3,182	1	[a]	
Goats	**11,987**	**2**	**Goats**	**4,199**	**2**	**910**	**8**
Sheep	8,076	3	Sheep, lambs	8,025	1	1,639	15
			Pigs	98,507	39	–	
			Horses	667	–	–	
			Poultry	75,825	30	–	
Total	599,597			253,528		10,829	

–: means <1%. MT: metric tonnes.
[a] Beef and buffalo hides combined.

of more than 12 million in milk, 4 million in meat and 1 million in hides/skins worldwide is no small production, especially in countries with harsh arid and desert climates, and it is providing significant nutrition to people, where often other farm animals cannot survive.

Among the world population of goats, 93% are found in Asia and Africa with 13 countries having more than an estimated 10 million head (Table 2). However, in terms of productivity, the dairy goats of Europe out-produce all others in milk tonnage relative to their population size, and those of North America, New Zealand, Israel, and probably Taiwan (personal communication) have the highest milk production per goat. China has more goats than any other country and leads in tonnage of goat meat and cashmere production (personal communication), while India with the second largest goat population leads in tonnage of goat milk production. All other countries with the world's largest goat populations (Table 2) are located in Asia or Africa, except for Mexico in Central America; all have mainly extensive goat feeding management conditions, depending on grazing rangelands with little supplementary feeding, and thus these goats are producing at low levels.

In Mexico, goat cheese – *queso blanco* – is very popular, as is a sweet dish made from goat milk, called *dulce*. Goat meat – *cabrito* – is also very popular, featured in restaurants as a specialty meal, although it is not as cheap as other meats (personal communication).

Table 2
Importance of goats in numbers, tonnage of meat and milk production worldwide (countries with >10 million head in 2003) (FAO, 2004) (leaders in bold)

Country	Numbers (million)	%	Meat (million MT)	%	Milk (million MT)	%
World	768	100	4199	100	11,987	100
Africa	224	29	825	20	2,793	23
Americas	36	5	138	3	357	3
Asia	**489**	**64**	**3098**	**74**	**6,404**	**53**
Europe	18	2	122	3	2,433	21
Oceania	1	–	17	–	–	
China	**173**	**22**	**1603**	**38**	247	2
India	124	16	473	11	**2,610**	**22**
Pakistan	53	7	373	9	640	5
Sudan	40	5	119	3	1,295	11
Bangladesh	34	4	130	3	1,312	11
Nigeria	27	4	142	3	–	–
Iran	26	3	105	2	360	3
Somalia	13	2	38	1	392	3
Tanzania	12	2	31	1	100	1
Kenya	11	1	31	1	98	1
Mali	11	1	46	1	227	2
Ethiopia	10	1	29	1	17	–
Mexico	10	1	42	1	148	1
Top 13 total	544	71	3162	75	7,446	62

–: means <1%. Oceania: Australia, New Zealand and Pacific Islands. MT: metric tonnes.