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Technical note

The effect of pregnancy and lactation on diet composition and dietary preference of goats in a desert rangeland

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Abstract

Composition of diets and dietary preference of goats in two physiological states: pregnancy and lactation, were investigated using microhistological analysis of fecal samples. The study was conducted during the growing season in a desert rangeland in northern Mexico. Non-pregnant goat diets contained a larger ($P < 0.01$) proportion of shrubs (70.9. ± 38.9) when compared with pregnant does (43.1 ± 31.2). On the other hand, pregnant goats utilized more ($P < 0.05$) forbs (48.8 ± 18.8) than non-pregnant goats (28.4% ± 12.1). Grasses made up 8% of the pregnant does diet, but this food group was avoided by non-pregnant does. Non-lactating goat diet was dominated by shrubs (71% of the total diet) and forbs (27%), while forbs occurred in greater ($P < 0.05$) amounts in the lactating goat diets. The similarity index for all forage species (where 0 = no dietary overlap and 100 = identical diets) was 80 for the pregnant and non-pregnant does, and 76 for lactating and non-lactating goats. This study demonstrated that both gestation and lactation accounted for some dissimilarities in food selection of goats. Increased nutrients requirements of these animals was associated with a higher utilization of native forbs and grasses, which suggests that, under harsh range conditions, goats adjust their diet selection according to their nutritional needs.

Keywords: Goats; Arid land; Grazing; Foraging strategy; Microhistology

1. Introduction

The internal state of an animal is not static but dynamic. Thus, it is expected that physiological changes as the animal moves through the various phases of its reproductive cycle, will be reflected in changes in diet selection. It is widely recognized that long-term changes in the internal state of the animal, such as pregnancy and lactation, lead to long-term changes in their diet selection or foraging strategies. In lactating females, the rumen expands to increase the exchange rate of metabolites with the blood, resulting in an increased efficiency in nutrient absorption. This physiological change in domestic (Arnold, 1975) and wild (Clutton-Brock et al., 1982; Bunnell and Guillingham, 1985) ungulates allow increased food intake. However, instead of selecting patches of higher biomass, lactating female ungulates tend to select patches of lower

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biomass and graze for longer period of the day when compared with non-lactating animals (Clutton-Brock et al., 1982; Penning et al., 1995). This has been seen as a strategy in which large ungulates increase foraging time and consequently energy intake, to accommodate high energy demands at the expense of the time devoted for other activities (Bergman et al., 2001). Ewes select a diet that meets the physiological needs of advanced pregnancy (Cooper et al., 1994), however, as pregnancy progresses forage intake decreases (Castro et al., 1994). Similarly, sheep can increase their intake to compensate for the extra energy expenditure during lactation (Doney et al., 1983). There is lack of information about how pregnancy and lactation affect foraging strategy of goats in arid ecosystem. Thus, the objective of this study was to investigate the roll of pregnancy and lactation on diet composition of goats grazing in a desert rangeland.

2. Materials and methods

2.1. Study site

This study was conducted in a rural community in northeast Mexico (101°20′W, 25°30′N). This area has been used basically by goats (approximately 800 adult does distributed in 5 flocks) and this rate of stocking has been near constant (1.5 ha per goat) for several decades.

Primary grass species include sideoats grama (*Bouteloua curtipendula* [Michx.] Torr.) and Arizona three-awn (*Aristida arizonica* Vasey). The most commonly encountered shrub species is creosotebush (*Larrea tridentata* [DC.] Cav.), which dominates the range. Other shrubs commonly found are honey mesquite (*Prosopis glandulosa* Torr.), lechuguilla (*Agave lechuguilla* Torr.), pricklypear (*Opuntia rastrera* Weber), huisache (*Acacia farnesiana* (L.) Willd.) and tarbush (*Flourensia cernua* DC.). Globe-mallow (*Sphaeralcea angustifolia* (Cav.) G. Don.) *Sida abutifolia* and silver-leaf nightshade (*Solanum elaeagnifolium* Cav.) comprise the majority of forbs. During the rainy season this plant community normally has 38% total ground cover. Shrubs make up over 75% of the total ground cover and grasses make less than 7% of the total vegetation cover.

Precipitation averages 32.2 cm, with three-fourth of the annual precipitation falling from June to October. July is normally the wettest month with rainfall averaging 5.8 cm. Average maximum daily temperatures range from 28 °C in January to 37.2 °C in July. Average minimum daily temperatures range from −0.7 °C in January to 12.3 °C in July. Elevation varies from 1270 to 1330 m with level or gently rolling hills. Soils of the study area are mainly silty underlain by calcium carbonate hardpan.

2.2. Animals and their management

A commercial flock of goats ($n = 250$) of undefined genotype (mixture of dairy × criollo goats), were used in the present study. Animals were penned near the household at night without access to feed and water. Six lactating (middle of lactation) and 6 non-lactating goats were selected from this flock and were used to collect fecal samples. The goats gave birth in August and were not exposed to bucks throughout their lactation. Criteria to select these animals were similar parity (>3 parturitions) and similar size (mean ± S.D. body weight 42 ± 3.1 kg). The milk production potential of these goats was approximately 80 kg in 6-month lactation.

Also, 6 pregnant (>110 days of pregnancy, based on subsequent kidding dates) and 6 non-gravid adult goats of similar age and size were used to assess the effect of late gestation on dietary preference and composition. Fecal sampling was in October 2001 for lactating animals and pregnant does. Feces of goats (approximately 10 pellets) were obtained directly from the rectum.

The goats were grazed on open range and were driven by a herdsman for 8 h daily (from 1000 to 1800 h). Grazing constraints related to diet selection were considered negligible because goats were taken to different grazing sites every day, and animals walked long distances daily (approximately 3 km from the pen). This pattern of grazing prevented over-utilization of the vegetation and allowed free choice among existing vegetative species.

2.3. Diet analysis

For the assessment of the diet selected, five feces samples were collected from each goat on five successive days. The samples were dried at 50 °C in an oven for 72 h. The feces were then ground in a Willey