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Urea Concentration in Collared Peccary Milk as an Indicator of Protein Nutritional Status

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ABSTRACT: Milk urea nitrogen (UN) concentration was examined as a possible index to protein-energy intake in female collared peccaries (*Tayassu tajacu*). Captive adults were bred and assigned to one of four experimental diets through gestation and lactation. Females fed a high protein diet produced milk with UN concentrations exceeding those of low-protein-fed females. A low energy intake tended to elevate UN concentrations in milk.

Key words: Collared peccary, condition assessment, milk, nutrition, *Tayassu tajacu,* urea nitrogen.

Recently, physiological adaptations of animals to their environment were examined in detail as potential indicators of habitat condition (Seal, 1979). These indirect approaches to habitat evaluation are attractive because many ungulates are selective feeders, to varying degrees. Essentially, these techniques rely on the animal to serve as a barometer of forage quality in the habitat. A variety of physiological indices of condition have been suggested for assessing the protein-energy intake of collared peccaries (*Tayassu tajacu*), including blood and urine constituents (Corn and Warren, 1985; Lochmiller et al., 1985).

Blood serum urea nitrogen (UN) concentrations were shown to fluctuate with both protein and energy intake in peccaries (Lochmiller et al., 1985). However, the acute handling stress associated with trapping and immobilization of wild peccaries may influence UN concentrations in blood (Lochmiller and Grant, 1984). Refsdal et al. (1985) suggested that milk UN concentration may be an appropriate alternative to blood for indexing protein intake in the lactating cow. The objective of this study was to determine if milk UN offered a suitable method for assessing dietary protein and energy intake in the lactating collared peccary.

Sixteen adult female collared peccaries were captured, housed in a 30 × 30 m outdoor enclosure at Texas A&M University and fed a high quality (16% crude protein and 3,500 kcal digestible energy/kg) commercial swine diet for ≥8 mo before being assigned to experimental diets. Females were mated (January 1983), weighed, placed (paired during gestation, singly during lactation) in 3 × 2 m covered pens, and assigned randomly to one of four experimental diets on day 30 (approximately) of gestation. Females remained on treatment diets through gestation (145 days) to the sixth wk (15 July–4 August) of lactation. Natural vegetation was not available to the peccaries during the experiment.

Experimental diets were formulated, mixed, and pelleted to provide four combinations of dietary regimes in a factorial design with two levels of energy (high energy (HE) = 3,360 kcal digestible energy (DE)/kg; moderate energy (ME) = 2,360 kcal DE/KG) and protein (high protein (HP) = 15.6% crude protein; moderate protein (MP) = 8.4% crude protein). Formulated diets simulated the protein and energy content of diets consumed by peccaries during either good range conditions (Corn and Warren, 1985) or during moderate drought (Gallagher, 1981). Essential mineral and vitamin contents of each diet were made consistent with the National Research Council (1979) recommendations for swine (Lochmiller et al., 1987). Ad libitum food intake was measured daily in the HEHP group, and each of the other diet groups was given weighed quantities of food so their dry matter intake equalled that of the HEHP group on the previous day. Water was provided ad libtum to all females.

Samples of milk were obtained on days one (12 to 24 hr postpartum), 21 and 42 of lactation. Of the original 16 pregnant females, 14 gave birth to live young; a colostrum sample was obtained from each. Before the 21-day sample was obtained, five females were removed from the experiment due to the loss of litters or abandonment. Females were handled after immobilization with ketamine hydrochloride at a dosage of 20 mg/kg administered intramuscularly. Each female was given 20 U.S.P. units of oxytocin (Vedco, Inc., Omaha, Nebraska 68127, USA) intravenously to stimulate milk letdown, and a 15 to 30 ml sample was obtained manually which often required the complete evacuation of milk from the four functional mammary glands. Milk samples were stored frozen at −20 C until analysis. UN concentrations were determined as described by Coulombe and Farreau (1963) on aliquots of protein-precipitated milk (2 ml of 20% trichloroacetic acid added to 2 ml of milk followed by centrifugation).

Differences in milk UN concentrations of female peccaries were analyzed for diet protein (HP, MP), diet energy (HE, ME) and stage of lactation (day-1, day-21, day-42) effects by analysis of variance with repeated measures. Sources of variation in the statistical model were partitioned as described by Hellgren et al. (1985). The General Linear Models procedure of SAS was used for data analysis (Helwig and Council, 1979).

Initial body weight did not differ ($P <$ 0.05) among diet groups and averaged 26.2 ± 0.6 (SE) kg. Weight changes during gestation were related ($P < 0.05$) to protein intake (Lochmiller et al., 1987). Females fed high protein diets gained an average of 0.6 ± 1.6 kg while those females fed low protein diets lost an average of 1.3 ± 0.4 kg in body weight over the period from conception to day one postpartum. There were no differences ($P > 0.05$) among diet groups in the amount of body weight lost during 6 wk of lactation, which averaged 7.7%.

TABLE 1. Urea nitrogen (mg/dl) concentrations in colostrum (day-1) and milk (day-21 and day-42) of collared peccaries as influenced by energy intake during gestation and lactation.

Diet[a]	Day-1	Day-21	Day-42
HEHP[b]	4[c]	2	2
	11.0 ± 0.4[d]	10.5 ± 1.5	11.0 ± 1.0
HEMP	3	2	2
	11.0 ± 1.5	7.5 ± 0.5	6.0 ± 1.0
MEHP	4	2	2
	16.8 ± 2.8	16.5 ± 2.5	12.5 ± 1.5
MEMP	3	3	3
	6.0 ± 0.9	6.0 ± 1.2	5.7 ± 0.3

[a] Significant protein effect ($P < 0.01$) and energy × protein interaction ($P < 0.05$).
[b] High energy (HE) = 3,360 kcal digestible energy (DE)/kg; moderate energy (ME) = 2,360 kcal DE/kg; and high protein (HP) = 15.6% crude protein; moderate protein (MP) = 8.4% crude protein.
[c] Sample size.
[d] $\bar{x}$ ± SE.

Dietary protein levels had a significant ($P < 0.01$) influence on milk UN concentration during lactation (Table 1). Females fed a high protein diet during gestation and lactation produced milk with UN concentrations exceeding those of low protein-fed females. There was also a significant ($P < 0.05$) energy-protein interaction indicating that a negative energy balance tended to elevate UN concentrations in milk as more amino acids were deaminated and used for energy (Woo et al., 1979). This was best represented by the MEHP-fed females which consistently had the highest milk UN concentrations. Stage of lactation had no apparent effect ($P > 0.05$) on milk UN concentration.

Results of this study are consistent with studies on domestic livestock (Oltner and Sjaunja, 1982; Oltner et al., 1983; Refsdal et al., 1985). Refsdal et al. (1985) reported that milk yield had no influence on UN concentration of cow's milk. Similar to this study, UN concentration in cow's milk also is related to the protein/energy ratio of the diet (Refsdal et al., 1985). Urea probably diffuses passivley from blood into milk (Peskette, 1934).

Metabolic costs of lactation are very high in the collared peccary (Gallagher, 1981). Lactating females should be very sensitive to changes in range condition as a result of their high dietary demands for protein and energy. Since milk is obtained easily, and its composition is probably affected less by acute handling stress than blood, it is a suitable index of long-term protein intake in lactating collared peccaries. Responsiveness of milk urea to short-term dietary changes in energy and protein remains to be demonstrated.

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