PRACTICAL MANAGEMENT OF PREGNANCY TOXEMIA IN SHEEP AND GOATS

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Many goat producers lack a livestock production background and base their herd nutritional program on ingredient availability, Internet resources, local feed store recommendations and traditional feeding practices. Few small-scale producers utilize nutritionists or quantitative analysis of the total ration, and their feeding practices often lead to metabolic imbalances such as pregnancy toxemia, lactational ketosis and hypocalcemia. Fortunately, the majority of these problems can be treated when recognized early in the course of disease and other cases can be prevented through correction of the diet.

NUTRITION THROUGHOUT GESTATION IS THE KEY

Both producers and veterinarians often overlook nutritional management of the late pregnant, non-lactating small ruminant when the focus is directed toward parturition and onset of lactation. Understanding the metabolic demands occurring in the last trimester and the need to provide an increasing plane of nutrition as pregnancy advances are the basis for preventing pregnancy toxemia and hypocalcemia, improving neonatal survival and increasing milk production.

In order to increase ovulation rates and thus number of offspring born, producers are encouraged to provide more energy and protein to small ruminants prior to and during the breeding period. In contrast, the nutritional demand from multiple embryos in early pregnancy is quite low and the diet presented in early gestation should revert to the lower energy and protein levels fed the non-pregnant animal. Glucose is the primary energy source for both the fetuses and the developing mammary gland, while fatty acids and ketones are not well metabolized due to their failure to cross the placenta. Amino acids provide 30 to 40% of the energy requirements of the fetuses as well as the requirements for protein synthesis. At least 50 to 60% of fetal growth occurs in the last 30 days of gestation at the same time the expanding uterus occupies an increasing percentage of abdominal volume. When the gestation diet contains inadequate energy to support fetal and placental growth, the fetus must rely more on amino acids to meet its energy requirements and this increases the protein utilization demand on the dam. If the dam consumes inadequate protein, the mammary gland utilizes fatty acids and ketone bodies for milk and butterfat production but not for milk sugar, which causes decreased milk production postpartum. This demand for pregnant goats to metabolize more fat during periods of inadequate nutrition leads to ketosis and hepatic lipidosis.

Birth weight is the single most important factor affecting neonatal survival and is dependent on the provision of adequate nutrients to the pregnant female throughout gestation. Placental weight is a major factor affecting fetal growth. The number of cotyledons is determined by nutrition during the first trimester while the weight of the cotyledons is affected by second trimester diet. The number of fetuses and placement in the uterine horns also affect birth
weight, while inadequate nutrition in late pregnancy compromises mammary gland development, decreases milk production and alters milk components.

**WHAT IS PREGNANCY TOXEMIA?**

Pregnancy toxemia most commonly occurs in the last two weeks of gestation when the dam cannot consume adequate nutrients to provide for her own maintenance, growth of multiple fetuses and development of the mammary system prior to parturition. Producers often lack the nutritional background necessary to knowledgeably feed young growing yearlings or older thin adults and may underestimate the nutrient density or volume of feed necessary for the number of animals to be fed. Even correctly conditioned females with multiple fetuses need 80% more nutrients for each additional fetus. Severe environmental stress due to transport, unexpected exercise or change in weather or diet may lead to an outbreak of ketosis. Unfortunately, dairies commonly leave pregnant, non-lactating females in pens with lactating females consuming high-energy rations. This practice leads to overly conditioned pregnant females with hepatic lipidosis who are predisposed to ketosis. With grazing animals, individual cases of ketosis may occur when an animal has poor teeth or cannot ambulate to acquire adequate feed such as might occur with lameness or sudden illness unrelated to pregnancy.

**CLINICAL SYMPTOMS**

Early cases of pregnancy toxemia may not be detected due to the subtlety of clinical symptoms such as dullness, decreased appetite, separation from the herd and mild soft tissue swelling above the coronary band. If nutrient intake is not improved, further clinical signs develop including weakness, anorexia, teeth grinding, recumbency, and neurologic symptoms such as stargazing, nystagmus, apparent blindness, ataxia and tremors. If aggressive treatment is not administered, the fetuses die and are followed shortly thereafter by the dam. Diagnosis is based on history, clinical symptoms and examination of urine, plasma or serum for the presence of elevated ketone bodies using ketostix or human hand held meters that measure beta-hydroxybutyrate. Necropsy may reveal dehydration, presence of multiple fetuses in the uterus, poor body condition, an enlarged pale liver that floats when placed in water, and concentrated urine in the bladder that is strongly positive for ketone bodies.

**EARLY TREATMENT INCREASES SUCCESS**

Treatment of pregnancy toxemia is based on the severity of clinical signs. The nutritional plane of animals with mild anorexia and swollen feet should be corrected by increasing the protein and energy content of the diet. Animals in sternal recumbency may benefit from oral administration of two ounces twice daily of propylene glycol or Nutri-Drench to stimulate glucose metabolism and boluses of concentrated rumen flora or transfaunation. Daily administration of 1 gram niacin by mouth or injection stimulates glucose metabolism. Research from commercial dairies in Israel indicates survival rates improve dramatically following daily administration of flunixin meglumine. If the pregnant doe is within seven to ten days of her due date, administration of 10mg prostaglandin F2 alpha may initiate parturition, while 10mg dexamethasone may be administered to induce parturition in sheep. Transabdominal ultrasound may be used to determine if the fetuses are alive, and Caesarian
section is recommended if parturition does not commence within 24 hours after induction. The prognosis for survival of the dam and offspring is guarded once the dam becomes recumbent.

**IMPROVE MANAGEMENT TO PREVENT PREGNANCY TOXEMIA**

Pregnancy toxemia is a management problem best prevented through proper nutrition and provision of adequate exercise to stimulate appetite and muscle strength. The producer should body condition score females in advance of breeding season and correct the diet prior to breeding so that the dams are in proper condition before becoming pregnant. The diet should contain adequate nutrients and volume for the type and number of animals present. Growing young stock require a higher plane of nutrition than adults, and pregnant yearlings should be kept separate from the adult females until after their first offspring are weaned. Pregnant non-lactating females should be housed and fed separately from lactating females. Based on research in dairy cattle nutrition, provision of oral niacin in the concentrate ration at the rate of 1 gram per head per day appears to reduce the incidence of pregnancy toxemia in sheep and goats.

**IMPROVE THE GESTATION DIET**

The energy, protein, calcium and phosphorous requirements for late gestation are 1.5 to 2 times that of early gestation and increase dramatically in the last few weeks to support lactation. In order to provide adequate nutrition, the nutrient density must increase during late gestation due to increasing size of the pregnant uterus and lower percentage of abdominal space available for digestive capacity. Late gestation dams should consume 3% of their body weight in feed per day so roughage quality may be a limiting factor for nutrient intake. Inadequate protein and energy intake leads to metabolism of body reserves to meet fetal demands resulting in ketosis, increased susceptibility to disease and decreased milk production postpartum. Sufficient body reserves are necessary to maintain lactation for the first 110 days postpartum because the lactating female cannot consume adequate protein and energy to maintain body weight and produce high levels of milk. Periparturient hypocalcemia can be prevented by providing adequate dietary calcium and phosphorous in a 2:1 Ca:P ratio throughout pregnancy and lactation. Maternal immune function is impacted in late gestation by the level of micro minerals in the diet, while neonatal immune function is dramatically impacted by the level of micro minerals and fat soluble vitamins present in colostrum. Free choice feeding of trace minerals appropriate to the total diet may be the most practical way to insure maternal and neonatal immune function.

**TEACH CLIENTS HOW TO SCORE BODY CONDITION**

Body condition scoring individual animals in the herd on a routine basis helps reveal health and management problems that affect longevity and productivity. Chronic weight loss or persistent poor body condition in spite of good nutrition may indicate onset of subtle insidious diseases such as severe parasitism, caprine arthritis-encephalitis, ovine progressive pneumonia, mycoplasmam, caseous lymphadenitis, Johnes disease or even neoplasia. The scoring system most commonly used in sheep and goats evaluates muscle and fat cover at three locations with a final score assigned ranging from 0 to 5 with 0 being too thin and 5 as
too fat. Scoring is based on manual palpation of the sternum, caudal ribs, and the spinal and transverse vertebral processes of the lumbar spine. Females with a BCS less than 2 and over 4 indicate management problems that should be addressed, and both under nutrition and overfeeding are common in small ruminant herds. Urolithiasis is an important cause of premature death for goat wethers and being overweight is a significant risk factor for development of urinary calculi.

**BODY CONDITION SCORE RESOURCES**

Dr. Terry Gipson from Langston University has an excellent video available online at [www.youtube.com/watch?v=a2ppHAUbLYY](http://www.youtube.com/watch?v=a2ppHAUbLYY) that clearly demonstrates how to body condition score goats while a verbal description of body condition scoring can be found online at [www.luresext.edu/goats/research/bcshowto.html](http://www.luresext.edu/goats/research/bcshowto.html). The Western Australia Department of Agriculture and Food uploaded a video online demonstrating body condition scoring of sheep at [www.youtube.com/watch?v=1F5VGcG1Qk](http://www.youtube.com/watch?v=1F5VGcG1Qk) while the Maryland Small Ruminant Page created by Susan Schoenian includes a verbal description for body condition scoring sheep at [www.sheep101.info/feedingewes.html](http://www.sheep101.info/feedingewes.html).

Pregnancy toxemia in sheep and goats can be prevented through sound nutritional practices, analysis of the total ration including all supplements, recognition of the clinical signs of ketosis early in the course of disease, and good communication between the producer, nutritionist and veterinarian.

**Note of Thanks:**

Dr. Robert Van Saun deserves recognition for the excellent nutritional education he has provided veterinarians and producers over the past several years. Information in this paper regarding nutrient metabolism draws heavily on lectures he presented at the 2010 AVMA Annual Conference in Atlanta, the 2011 ADGA Annual Meeting in Grand Rapids and during the Research Summaries for the 2014 AABP Annual Conference in Albuquerque.