

GOAT NUTRITION



BASICS

OVERVIEW

- Goats should be provided with clean water at all times.
- The cheapest or lowest cost ration is not necessarily the most efficient ration.
- Nutrients of importance are in order: energy, protein, fat, major minerals and trace minerals. Novice goat owners often supplement with trace minerals before considering more important nutrients.
- The social structure of goats is important to the successful feeding program.
- It is extremely important to body condition score the herd on a regular basis.
- Goats consume between 5.5% to 10% of their body weight in dry matter (DM) per day.
- Hay intake approximates 2.5 lb of hay per 100 lb of body weight per day.
- During lactation goats fed high quality alfalfa hay plus concentrates will consume 2.8 to 4.2 Kg DM/100 kg body weight. This range will depend on the stage of lactation (days in milk) and milk production levels. Lactational consumption may reach 3.5% of the live body weight.
- Example diets and ration calculators for goats are available on-line from university extension services (e.g. <http://articles.extension.org/pages/19333/goat-nutrition>)

FEEDING STYLES

- Forest/browse of scrub/brush represent a natural preference for goats, with lower risk of exposure to parasite larvae
- Pasture – must be well managed for parasite control
- Bunk feeders
- Free choice troughs or bins
- Key-hole feeders

OTHER IMPORTANT FACTORS

- Feeding hierarchy/psychology is important in managing herds of goats.
- Bunk space requirements are important.
- Feed use is evident in the selectivity of goats.
- Spoilage/fungus infested feed is generally avoided by goats.
- Plants that can induce disease must be considered (toxicity, urolithiasis)
- Particle size/feed-related issues: goats prefer long-stem browse and reject dietary fines.
- High concentrate low roughage diets can promote rumen acidosis

Feeding Hierarchy

- Feeding social structure is extremely important in the nutrition of goats.

- It is critical to body condition score members of the herd on a regular basis; and all animals with a thick hair coat should be monitored more carefully through visual examination and physical palpation.
- It is very common for subordinate animals low in the social hierarchy to maintain a lower body condition score. Condition scores are commonly misevaluated in Angora goats.
- Adequate feeder space is important. For multiple goats, ideally more than one feeder should be used. Feeder space requirement is 1.4 to 2 linear feet per head. With dry lot confinement there should be 35 to 100 square feet per animal. Decreasing individual animal space increases fighting and aggression.
- Horned goats that are kept with natural polled/disbudded/dehorned goats can keep the latter animals away from feed. Ideally therefore, goats should be grouped as all horned or all non-horned.
- Breed-specific aggression: French Alpine and Toggenburg breeds tend to be more aggressive, while Nubians tend to be shy and submissive.

Sub-clinical Acidosis

- Sub-clinical acidosis is a common problem in goats. Inadequate long-stem roughage is generally problematic in goat diets. Many first-time goat owners feed excessive concentrate levels to animals with insufficient hay/roughage.
- With social eating schemes, alpha animals may gorge on concentrates. This inequity in feed consumption may be due to inadequate feed bunk space.

Acidosis Prevention

- Limit or discontinue concentrate feeding to the herd.
- Buffering agents (baking soda/sodium bicarbonate) may be helpful in the ration.
- Free-choice, high-quality, long-stem hay or grass pasture increases DM consumption.
- Rumen transfaunation
- Probiotics

APPROPRIATE FEEDING

- Feed according to type and need for the given herd.
- Store feed in dry, well ventilated areas. Ensure that all concentrates are stored securely away from goats, ideally behind two distinct barriers.
- Adequate amounts of feed must be available (a minimum approach is 1.5% of body weight on an as-fed basis).
- Adequate feed should be available to all members of the herd through multiple feeders to permit feeding by subordinate animals.
- Proper bunk space requirements per animal unit must be maintained.
- Offering a variety of feeds can increase consumption

NUTRITIONAL ASSESSMENT PROGRAM

- Annual feed analysis by a certified laboratory can be performed on grass, hay, silage, mineral mix, and supplements. Dairy feed analysis laboratories should be consulted.
- Water analysis should be conducted in areas where deficiencies/excesses of minerals occur.
- Liver biopsy, or liver samples from slaughtered animals or goats that die suddenly and blood mineral analysis may be helpful for evaluation in deficient areas.

GOAT FEEDING HABITS

- Goats have mobile upper lips and a prehensile tongue. They generally are browse and short forage feeders. In a typical diet, browse contributes 50% of the diet consumed.
- Most goat breeds are energetic feeders and they randomly consume feedstuffs in an inquisitive manner. They tend to wander and graze widely in a meticulous manner.
- Goats tend to retain feed for shorter time periods. One study found goats retained feed for 22 hours, whereas sheep retained feed for 32.7 hours.
- In general, goats consume 5.5 to 10% of their body weight in DM per day.
- Goats eat in a wave-like structure: first wave: dominant animals will eat the highest quality feedstuffs; second wave: the middle class group will eat most if not all of the higher quality feedstuffs; third wave: the least aggressive group will eat the “fines” and stem components left in the feed bunk. These animals will be the young, old, infirm, and the more timid stock. Also, males fed with females may keep others away from the feed bunks. Herds must therefore be fed with multiple feed bunks.
- Dietary deficiency/starvation is the leading goat disease worldwide.

FEEDING CHARACTERISTICS

- Water consumption: behaviorally, goats drink 3 to 5 times per day.
- In one study goat water consumption was determined based on ambient temperature: 0 degrees C = 2.3 L per day was consumed per goat; 35° C = 6.6 L consumed; 40° C = 4 L consumed. At 40° there appears to be a failure of the heat regulatory mechanism.
- Unpalatable or extremely cold water sources can precipitate urolithiasis secondary to poor water consumption.
- Chronic low condition scores in animals on an excellent diet should promote assessment for dental/oral disease, parasites, chronic wasting diseases (Johne’s disease, CLA, CAE), blindness, foot and leg problems, and sub-acute acidosis.
- Dry matter intake is the primary nutrient limitation in goats and can be a decisive factor in nutrient absorption.
- Monitor silage if fed; goats are extremely susceptible to *Listeria* spp. infection
- Molasses improves the palatability of processed feeds. Feeding > 5% molasses can adversely affect rumen function, leading to low-level acidosis. Molasses feeding can predispose goats to develop polioencephalomalacia.
- Dry matter intake of hay can be increased with the daily addition of supplemental green forage.
- Goats will waste up to 40 to 50% of hay fed in a manger. As a herd goal try to reduce this wastage to 20% waste e.g. with well-designed feeders. Feed left over stalks or other material to another class of livestock if possible.
- Goats as browsers have an extreme change in rumen function with fine particle, high energy rations. Rumen tone is lost and there is a marked decrease in rumen contractions.
- Goats will refuse dusty or moldy hay.
- Hay intake, as a rough estimate, is 2.5 lb of hay per 100 lb of body weight per/day (maximum DM intake is 5 to 6 kg/100 kg of body weight).
- During lactation goats fed high quality alfalfa hay plus concentrates will consume 2.8 to 4.2 Kg DM/100 kg body weight. This range will depend on the stage of lactation (DIM).
- Lactational consumption may reach 3.5% of the live body weight.
- Early lactation feeding: free choice hay plus 1 lb of concentrate (14 to 18% protein, 75% TDN, low dry matter) for each 2 lb of milk produced daily; the feeding of concentrates depends on milk production.
- DM consumption ranges from 2.2 to 2.8 kg/100 kg of live body weight during the last trimester of pregnancy (dry matter consumption is depressed).

- Hay intake ranges from 1.5 to 2.5 kg/100 kg of body weight during the pregnant dry period or transition doe period.
- When feeding alfalfa hay and concentrates, a 2:1 H:C ratio is a good rule. When feeding poorer quality hay, a 1:1 or 1:2 ratio can be used. It is important to note that as the percentage of concentrates in a lactational diet increases, the percent of butterfat in the milk decreases.
- Early lactation does require 17 to 18% crude protein.
- Mid-lactation does require 13 to 16% crude protein.
- Palatability is extremely important when formulating the ration. Coarse-textured feeds are preferred over those that are finely milled.
- Angora goats have a decidedly higher protein (especially of high sulfur-amino acids) and energy requirement. Critical time periods are early stock growth, reproduction, mid through late gestation, and during lactation.

NUTRITION-ASSOCIATED PROBLEMS

- Ketosis (pregnancy toxemia)
- Parturient paresis (milk fever)
- Acidosis/indigestion/lameness
- Enterotoxemia
- Abortion
- Diarrhea/constipation
- Starvation
- Urolithiasis (see below)
- Posthitis (pizzle rot): excess dietary protein fed to males
- Vitamin/mineral imbalances

Urolithiasis

- Urolithiasis is a very common disorder of goats that usually has a dietary basis.
- Urethral obstruction due to stone formation is common in males, and can occur in females; castrated males are at the greatest risk.
- Urolithiasis is a prevalent, expensive and frustrating problem in pet food animal medicine. In production animal medicine the treatment protocol is typically directed at salvage, not long-term survival.
- The composition of uroliths in sheep and goats is primarily dependent on the feeds and soil conditions within a specific location.
- Researchers have found goat uroliths to be of two common types: calcium apatite and phosphatic calculi. Phosphatic calculi can be further classified as calcium hydrogen phosphate dihydrate and magnesium ammonium phosphate. Silicate and calcium carbonate uroliths can also occur, in specific geographic locations.

Phosphatic Uroliths

- Low roughage
- High concentrate
- Low Ca: P ratio; high phosphorus concentration in grains
- Increased magnesium
- Alkaline urine
- Decreased saliva formation - normally phosphorus is excreted predominantly in the feces of goats, but reduced saliva production can increase phosphorus concentration in urine.
- Pygmy goats are much more predisposed to this disease.

Diagnosis of Urolithiasis

- Early signs: hematuria, dysuria, tail flagging, vocalization, depression, anorexia, colic, chewing at tail head, urine dribbling.
- Late signs: recumbency, depression, anorexia, preputial swelling, severe straining, vocalization, abdominal distension.
- Tachycardia, tachypnea, and increased or decreased core body temperature can occur
- Ultrasound and radiographs can help diagnose the condition. Distention of the bladder with or without visible stones is a common finding. Ultrasound of the penis often reveals a distended urethra and may identify stones. Common sites of urethral blockage include the urethral process and the distal sigmoid flexure. Calcium carbonate stones are often readily visualized on radiographs which helps to identify sites of obstruction and to enumerate stones (often multiple remain in the bladder).

Prevention of Urolithiasis

- Do not feed equine diet mixes to goats since they are higher in phosphorus.
- Pet goats should be castrated at an older age (6 to 12 months) to enhance urethral diameter
- Increase water consumption through salt supplementation and the provision of readily available clean water sources.
- Acidification of urine with ammonium chloride at a rate of 0.5 to 1% of the total ration can be helpful but adaptation may occur if treatment is not provided intermittently. Some clinicians suggest the addition of cranberry pulp.
- Show animals and feedlot animals fed high amounts of grain should have dietary salt mixed in at 2 to 5% of the ration to increase water consumption.
- Ca:P ratios should be between 2:1 or 2.5:1.
- Grass hay is lower in Ca and higher in P.
- Calculi in younger goats can occur on less expensive milk replacers and Ca supplementation should be considered.

Treatment of Urolithiasis

- Re-educate owners to improve their dietary program as there is a high incidence of urolith recurrence.
- Prognosis is poor to grave (see urolithiasis chapter).
- Perineal urethrostomy: salvage procedure of feeder animals, poor prognosis for pet animals.
- Urethral translocation
- Ischial urethrostomy
- Tube cystostomy
- Permanent cystostomy

SEE ALSO

- Body Condition Scoring Goats (www.fiveminutevet.com/ruminant)
- Indigestion
- Parturient Paresis (Hypocalcemia)
- Starvation
- Urolithiasis
- Ulcerative Posthitis and Vulvitis

ABBREVIATIONS

- BCS = body condition scoring
- CAE = Caprine Arthritis Encephalitis
- Ca:P = calcium to phosphorus ratio
- CLA = caseous lymphadenitis
- DM = dry matter
- H:C = hay to concentrate ratio
- TDN = total digestible nutrients

Suggested Reading

- Committee on Nutrient Requirements of Small Ruminants, Board on Agriculture and Natural Resources, Division on Earth and Life Studies, The National Research Council Nutrient requirements of small ruminants : sheep, goats, cervids, and New World camelids Washington, D. C. The National Academies Press, 2006
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