Nutritional Management of Late Gestating and Early Lactating Small Ruminants

Introduction

Nutrition serves as a critical component in maintaining proper animal husbandry, breeding efforts and basic herd health. Goats and sheep alike experience the greatest nutritional stress during late gestation and early lactation. These critical periods of production are the most nutritionally demanding due to the final stages of fetal development, milk production and peak lactation. Supporting and supplementing livestock during this period proves essential for both maternal health and recovery and offspring development and performance.

There are several other factors, in addition to physiological status, that affect nutritional requirements. Primary considerations include age, body weight, body condition score, fetal number and current health status. An adequate supply of nutrients such as total digestible nutrients (TDN; a measurement of energy), crude protein (CP), minerals and vitamins is fundamental to the success of any livestock operation. This publication will outline practical considerations and best management strategies highlighting the role of nutrition in supporting fetal development.

Physiological Changes and Nutritional Demand

Approximately two-thirds or more of fetal development and fetus weight is gained during the last six weeks of gestation in sheep and goats. This period is often referred to as late gestation. As a result of a rapidly developing fetus or fetuses, both energy and protein requirements significantly increase compared to open females or those in early gestation.

A few weeks before parturition, colostrum production begins. Colostrum serves as the first milk for newborns and provides an early life immune booster providing them with essential antibodies called immunoglobins. Colostrum is packed with higher concentrations of essential nutrients such as fat, protein, vitamins and minerals. The dam's nutritional management before parturition highly influences the colostrum quality. As milk production rises significantly in the early weeks postpartum, meeting the nutrient demands of lactation, particularly when supporting multiple offspring, requires high levels of energy, protein, calcium, magnesium and water. To sustain consistent growth of lambs or kids, high milk quality and adequate quantity are both essential. If nutritional requirements are not met, both quality and quantity suffer, ultimately limiting offspring performance. **Figure 1 on page 2** demonstrates how subpar nutrition during late gestation can lead to reduced flock productivity.

Recommended Nutritional Requirements

As previously stated, nutrient requirements vary among animals due to a range of factors; however, Tables 1, 2 and 3 provide general nutrient requirements of ewe lambs, mature ewes and does during gestation and early lactation. Optimal nutrition should be evaluated in relation to desired animal performance, including body condition, reproductive success and offspring growth.

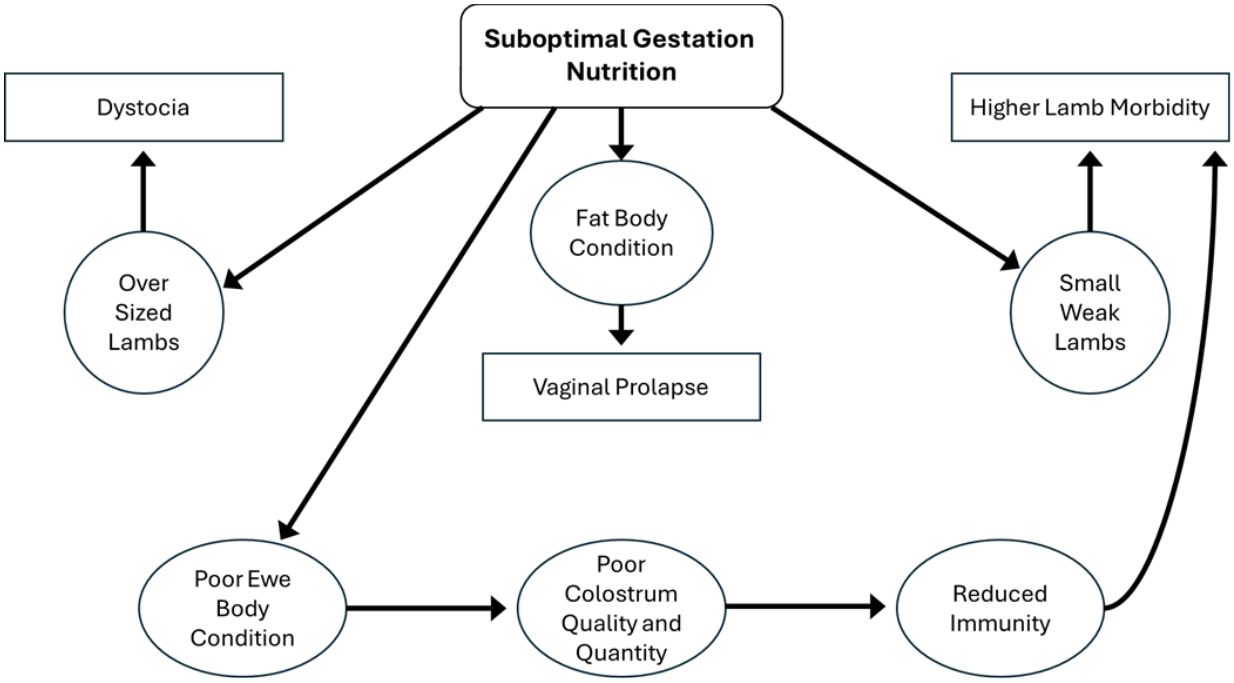

Figure 1. Impacts of inadequate nutrition during late gestation and early lactation.

Adapted from Phillips et al., Sheep health, welfare and production planning 2: Assessing nutrition of the ewe in late pregnancy. In Practice. 2014;36(3):133–143. doi:10.1136/inp.g1564.

Table 1. Required nutrient concentrations of sheep ewe lamb rations (expressed on 100% dry matter basis).

Body Weight (lb.)	Avg. Daily Gain (lb.)	Dry Matter (lb./head)	% Body Weight	Total Protein (lb.)	TDN (lb.)	Calcium (lb.)	Phosphorus (lb.)	Vitamin A (IU)	Vitamin E (IU)
Last 4 Weeks of Gestation (130%–150% Lambing Rate Expected)									
132	0.4	3.7	2.8	10.8	59.5	0.35	0.3	1,378	7
154	0.4	4	2.6	10.5	57.5	0.35	0.3	1,490	7
176	0.4	4.2	2.4	10.5	57.1	0.33	0.31	1,619	7
198	0.4	4.4	2.2	10.7	56.8	0.32	0.32	1,738	7
Last 4 Weeks of Gestation (180%–225% Lambing Rate Expected)									
110	0.5	3.7	3.4	11.6	64.8	0.38	0.19	1,148	7
132	0.5	4	3	11.2	65	0.38	0.2	1,275	7
154	0.5	4.2	2.7	11.2	66.7	0.40	0.24	1,416	7
176	0.5	4.4	2.5	11.1	65.9	0.41	0.3	1,545	7
198	0.5	4.6	2.3	11.1	65.2	0.43	0.3	1,663	7

Table 1. Required nutrient concentrations of sheep ewe lamb rations (expressed on 100% dry matter basis)(cont.).

Body Weight (lb.)	Avg. Daily Gain (lb.)	Dry Matter (lb./head)	% Body Weight	Total Protein (lb.)	TDN (lb.)	Calcium (lb.)	Phosphorus (lb.)	Vitamin A (IU)	Vitamin E (IU)
First 6–8 Weeks of Lactation, Suckling Singles									
110	-0.06	4.6	4.2	14.6	65.2	0.43	0.28	923	7
132	-0.06	5.1	3.8	13.7	64.7	0.39	0.27	1,000	7
154	-0.06	5.5	3.6	13.3	65.5	0.36	0.27	1,082	7
176	-0.06	5.7	3.2	13.3	64.9	0.37	0.28	1,193	7
198	-0.06	5.9	3	13.2	64.4	0.36	0.29	1,296	7
First 6–8 Weeks of Lactation, Suckling Twins									
110	-0.13	5.3	4.8	16.2	64.1	0.43	0.3	943	7
132	-0.13	5.7	4.3	15.6	64.9	0.40	0.3	1,052	7
154	-0.13	6.2	4	14.8	64.5	0.39	0.29	1,129	7
176	-0.13	6.6	3.8	14.5	65.1	0.38	0.29	1,212	7
198	-0.13	7	3.6	14.1	65.7	0.36	0.29	1,285	7

Adapted from Alabama Cooperative Extension System. Nutrient Requirements of Sheep and Goats (ANR-0812), and National Research Council (2007), Nutrient Requirements of Small Ruminants.

Table 2. Required nutrient concentrations of mature sheep ewe rations (expressed on 100% dry matter basis).

Body Weight (lb.)	Avg. Daily Gain (lb.)	Dry Matter (lb./head)	% Body Weight	Total Protein (lb.)	TDN (lb.)	Calcium (lb.)	Phosphorus (lb.)	Vitamin A (IU)	Vitamin E (IU)
Last 4 Weeks of Gestation (130%–150% Lambing Rate Expected)									
110	0.4	3.5	3.2	0.38	2.1	0.013	0.01	4,250	24
132	0.4	3.7	2.8	0.4	2.2	0.013	0.011	5,100	26
154	0.4	4.0	2.6	0.42	2.3	0.014	0.012	5,960	27
176	0.4	4.2	2.4	0.44	2.4	0.014	0.013	6,800	28
198	0.4	4.4	2.2	0.47	2.5	0.014	0.014	7,650	30

Table 2. Required nutrient concentrations of mature sheep ewe rations (expressed on 100% dry matter basis)(cont.).

Body Weight (lb.)	Avg. Daily Gain (lb.)	Dry Matter (lb./head)	% Body Weight	Total Protein (lb.)	TDN (lb.)	Calcium (lb.)	Phosphorus (lb.)	Vitamin A (IU)	Vitamin E (IU)
Last 4 Weeks of Gestation (180%–225% Lambing Rate Expected)									
110	0.5	3.7	3.4	0.43	2.4	0.014	0.007	4,250	26
132	0.5	4	3.0	0.45	2.6	0.015	0.008	5,100	27
154	0.5	4.2	2.7	0.47	2.8	0.017	0.01	5,950	28
176	0.5	4.4	2.5	0.49	2.9	0.018	0.013	6,800	30
198	0.5	4.6	2.3	0.51	3	0.02	0.014	7,650	32
First 6–8 Weeks of Lactation, Suckling Singles									
110	-0.06	4.6	4.2	0.67	3	0.02	0.013	4,250	32
132	-0.06	5.1	3.9	0.7	3.3	0.02	0.014	5,100	34
154	-0.06	5.5	3.6	0.73	3.6	0.02	0.015	5,950	38
176	-0.06	5.7	3.2	0.76	3.7	0.021	0.016	6,800	39
198	-0.06	5.9	3.0	0.78	3.8	0.021	0.017	7,650	40
First 6–8 Weeks of Lactation, Suckling Twins									
110	-0.13	5.3	4.8	0.86	3.4	0.023	0.016	5,000	36
132	-0.13	5.7	4.3	0.89	3.7	0.023	0.017	6,000	39
154	-0.13	6.2	4.0	0.92	4	0.024	0.018	7,000	42
176	-0.13	6.6	3.8	0.96	4.3	0.025	0.019	8,000	45
198	-0.13	7	3.6	0.99	4.6	0.025	0.02	9,000	48

Adapted from Alabama Cooperative Extension System. Nutrient Requirements of Sheep and Goats (ANR-0812), and National Research Council (2007), Nutrient Requirements of Small Ruminants.

Table 3. Required nutrient concentrations of mature goat doe rations and daily nutrient density (expressed on 100% dry matter basis).

Body Weight (lb.)	Avg. Daily Gain (lb.)	Dry Matter (lb./head)	TDN (lb.)	CP (oz.)	TDN (% DM)	CP (% DM)	Ca (g)	P (g)
Late Gestation (Last 4 Weeks) Mature Doe, Carrying Twins								
110	0.28	2.9	2.0	6.4	69.0	13.8	5.9	3.3
130	0.31	3.3	2.2	7.1	66.7	13.4	6.0	3.4
155	0.35	3.7	2.5	8.0	67.6	13.5	6.3	3.7
175	0.39	5.1	2.7	9.3	52.9	11.4	7.2	4.6
200	0.43	5.6	3.0	10.2	53.6	11.4	7.6	4.9
Early Lactation (4-6 Weeks) Mature Doe, Suckling Twins								
110	-0.11	3.4	1.8	7.1	52.9	13.1	8.9	5.3
130	-0.12	3.8	2.0	7.2	52.6	11.8	9.1	5.5
155	-0.13	4.3	2.3	8.8	53.5	12.8	9.5	5.8
175	-0.14	4.6	2.5	9.5	54.3	12.9	9.6	6.1
200	-0.15	5.1	2.7	10.3	52.9	12.6	10.0	6.4

Adapted from Alabama Cooperative Extension System. Nutrient Requirements of Sheep and Goats (ANR-0812), and National Research Council (2007), Nutrient Requirements of Small Ruminants.

Common Challenges - Metabolic Disorders

Metabolic disorders or diseases occur when there is an imbalance between the rates of nutritional inputs and production level.

Pregnancy Toxemia

Due to the high energy demand of late pregnancy, meeting nutritional requirements can be difficult, particularly for females carrying two or more fetuses. Feed intake is frequently depressed in late gestation when multiple fetuses are present, largely due to physical limitations and increased metabolic demands. The nutritional requirements of a large litter are substantial, and these needs are further challenged by reduced rumen capacity as fetuses occupy a greater proportion of the abdominal cavity. Often known as pregnancy ketosis or pregnancy toxemia, this can be challenging to manage for producers. During late pregnancy, it's important that diets are easily digestible and nutrient dense due to limitations on feed intake.

Most cases of pregnancy toxemia develop one to three weeks before parturition. If onset of the disorder sets in before day 140 of the pregnancy, these are classified as severe and have an increased risk of death. In both ewes and does alike, pregnancy toxemia should be suspected when late-pregnant animals show signs of significant weakness, reduced drive to eat, feed selectivity, inability to walk or stand

and muscle twitching. Veterinarians can treat the disorder if detected early on. However, if the disease progresses, death can occur in just days. After treatment and pregnancy, animals tend to make a quick recovery as feed intake and subsequently glucose production returns to normal.

Hypocalcemia (Milk Fever)

Similarly, hypocalcemia or milk fever is often seen in late gestation in small ruminants or one to four weeks after parturition in high milk producing dairy goats. This metabolic disorder is due to low serum calcium concentration. Milk fever can develop more easily in animals already experiencing pregnancy toxemia, as their feed intake is significantly reduced. When both conditions occur together, the risk of more severe and prolonged complications increases.

In animals suffering from milk fever, symptoms such as incoordination, muscle tremors, or inability to stand and overall weakness are often seen. Once the disorder is determined, treatment by an animal health professional should begin immediately via calcium supplementation. This can be done orally through paste and boluses or often seen as an injectable or IV drip. While treating intravenously is the fastest way to alleviate symptoms, it's important to do slowly to not initiate shock. Often, average- to poor-quality grass hay or pasture is moderately low in calcium. Animals relying primarily on forage-based diets may struggle to meet their calcium needs, especially during late gestation and early lactation. Prevention comes in the form of dietary modification by increasing the calcium: phosphorus ratio as well as vitamin D.

Acidosis

While ruminants can often meet nutrient requirements through a high-quality forage, occasionally those forages fall short or animal intake is limited. Specifically, during late gestation and peak lactation when nutritional requirements are heightened grain, supplementation is a common practice. Ruminal acidosis results from the consumption of a surplus of highly fermentable, starchy carbohydrates without appropriate fiber intake or from abrupt diet changes from forage based to grain based. The sharp increase in fermentable carbohydrates causes the rumen to decrease in pH to acidic levels. This change in the rumen environment causes disruptions and changes to the rumen microbiome allowing lactic acid producing bacteria to become the dominant bacteria species. Sustained periods of this can damage rumen walls or cause dehydration or renal failure. If left untreated, this can cause death.

Symptoms can vary depending on severity and status of the disorder. Most commonly seen is bloat, fever, loss of appetite, diarrhea and lethargy. If you suspect an animal is suffering from acidosis, it's important to seek veterinarian treatment quickly. Treatment options vary according to severity as well. Resolving bloat and dehydration, if present, is usually the first step. Rebalancing the rumen pH by removing the causing feedstuff and administrating corrective agents like sodium bicarbonate is common.

To avoid acidosis, prevention measures should be taken into consideration. While additional supplementation might be necessary, it's important to gradually introduce the unaccustomed diet slowly allowing for proper rumen response rather than drastically.

Best Management Practices

Body Condition Management

Body condition scoring (BCS) is a subjective parameter and evaluation of an animal's body fat and muscle and its impact on performance. The BCS scale for both sheep and goats ranges from 1 (emaciated) to 5 (obese). Body condition scoring of a flock or herd should be evaluated at critical points throughout the calendar year such as weaning, breeding, mid gestation, late gestation and shortly after lambing. On average, improving body condition by one score requires six to eight weeks of proper supplemental

feeding. This emphasizes the need for early planning and timely supplementation before the animal reaches a point where recovery is difficult and animal performance is affected. Prior to lambing or kidding, ewes and does should have a BCS between 3 and 4 depending on number of fetuses.

Animal Grouping

As discussed earlier, various factors can alter nutritional requirements. Strategically grouping animals based on age, BCS and overall health allows producers to better target supplementation, ensuring animals are properly supported without unnecessarily feeding those that do not require additional supplementation. Additionally, identifying females carrying multiples, either through separating or detailed recordkeeping, allows for better monitoring of pregnancy toxemia or additional nutritional needs. Overall, animal grouping can help stretch high-quality hay, if limited, and can improve cost effectiveness of concentrate use.

Conclusion

The nutritional management of small ruminants during late gestation and early lactation is critical for both the female and their offspring. Proper nutrition of pregnant animals significantly affects the growth, health and reproductive performance of their offspring throughout their life. Furthermore, inadequate nutrition of the pregnant animal can negatively impact their health and immune function, delay recovery after parturition and contribute to lower reproductive performance in the following breeding season. Strategic planning and implementation of supplementation during these periods is key to long-term health, welfare and performance.

Reach out to your local extension agent and specialist for assistance in determining nutritional requirements and developing nutritional programs for late gestation and early lactation small ruminant animals.

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