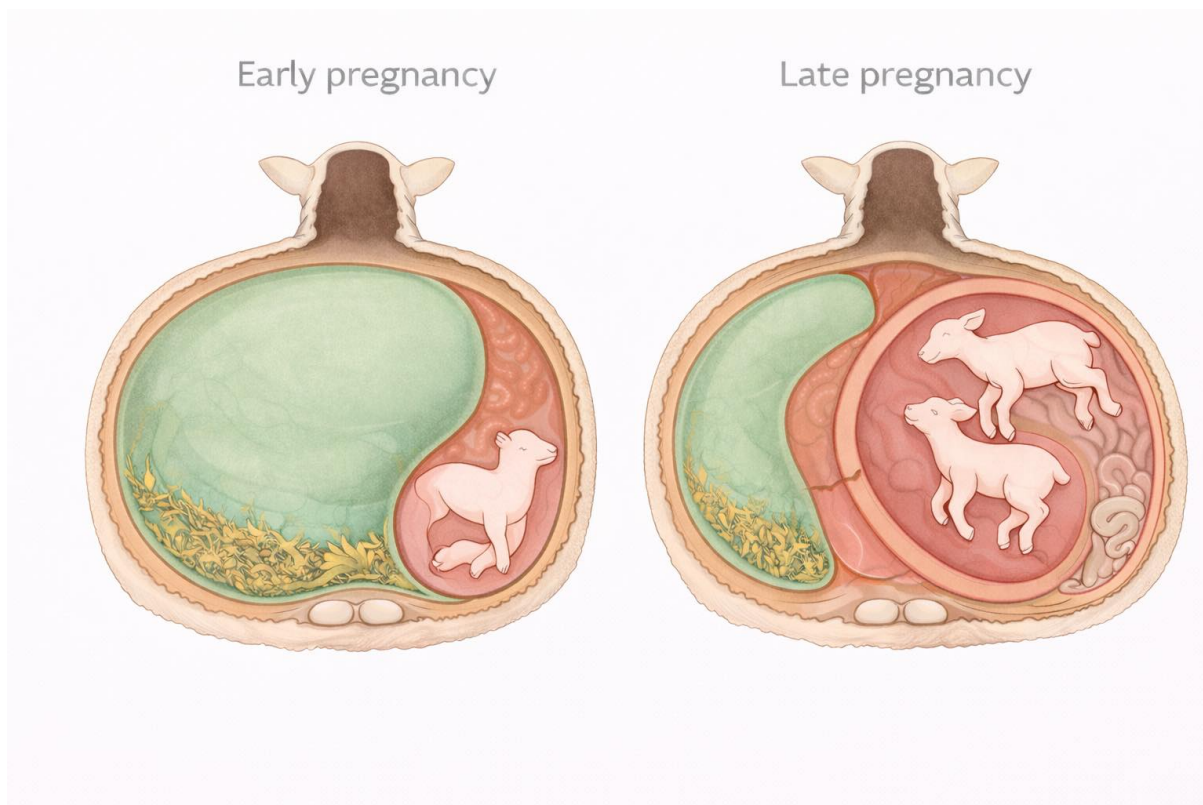


Ketosis / Pregnancy Toxemia in Sheep and Goats

A PRACTICLE GUIDE TO UNDERSTANDING SYSTEMS



Late Gestation in Sheep and Goats – Article 1

When Space Becomes the Problem

Spend enough time around sheep and goats and you'll hear a lot of simple advice about late pregnancy.

“Just feed more protein.”

“Give them more hay.”

“Add some grain the last couple weeks.”

The problem is that biology rarely works in simple one-line rules. Sheep and goats aren't machines where one dial controls everything.

Late gestation is not about one nutrient.

It's about how the entire system changes during the last weeks of pregnancy.

And one of the most important changes has nothing to do with feed ingredients.

It has to do with space.

The Rumen Is Enormous

To understand what happens late in pregnancy, we first need to understand just how big the rumen really is.

In an adult sheep or goat, the rumen is massive.

In many animals, it can hold roughly the volume of a five-gallon bucket of feed and fluid.

In fact, the rumen alone can account for 60–70% of the entire digestive tract volume.

That large fermentation vat enables sheep and goats to survive on forage. Inside the rumen, billions of microbes break down plant fiber and convert it into usable energy for the animal.

Under normal conditions, this system works extremely well.

But pregnancy changes the physical layout inside the abdomen.

Two Organs Competing for the Same Space

As lambs or kids grow during the final weeks of pregnancy, the uterus expands rapidly.

In sheep and goats, roughly two-thirds of fetal growth occurs during the final four to six weeks of gestation.

That means the uterus is increasing in size very quickly during the same time when the developing lambs or kids are demanding the most nutrients.

But the abdomen is a fixed space.

When the uterus expands, something else must move.

And what gets pushed out of the way is the rumen.

A Simple Way to Picture It

One way to visualize this is to imagine two balloons inside a box.

As one balloon grows larger, the other balloon has less room to expand.

The abdomen works in a similar way. As the uterus enlarges during late pregnancy, the rumen has less room to expand after a meal.

The rumen doesn't disappear.

It simply has less space to work with.

The System Starts to Tighten

As the uterus enlarges, it begins compressing the rumen.

This creates an important shift in the system:

The same animal that needs more nutrients is also losing some of her ability to consume large volumes of feed.

In other words:

- Nutrient demand is rising.
- Feed capacity is shrinking.

Late gestation is where those two curves begin to cross.

Why “Just Feed More Hay” Doesn't Always Work

A common piece of advice is to simply offer more hay during late pregnancy.

While forage remains extremely important, this advice misses a key biological reality.

As abdominal space becomes limited, the animal often cannot physically consume the same large volumes of bulky forage she could earlier in pregnancy.

This is especially true when animals are carrying twins or triplets.

It's not that the animal suddenly refuses to eat.

It's that the system is becoming physically constrained.

Understanding this mechanical pressure is one of the keys to understanding late gestation nutrition.

Bigger Babies Are Not the Goal

Another misconception that sometimes appears in late-gestation discussions is the idea that larger birth weights should always be the goal.

Birth weight can certainly be useful data when tracking flock performance, but it should not be confused with future growth potential.

Just as in humans, a larger newborn does not necessarily mean the animal will become larger later in life.

The goal of late gestation feeding is not to create the biggest possible lambs or kids.

The goal is to maintain metabolic balance in the ewe or doe while supporting healthy fetal development.

Those are not always the same thing.

Why Understanding the System Matters

Many sheep and goat producers do very well with simple feeding systems.

Pasture-based animals may raise healthy lambs every year.

Others feed round bales free choice with few obvious problems.

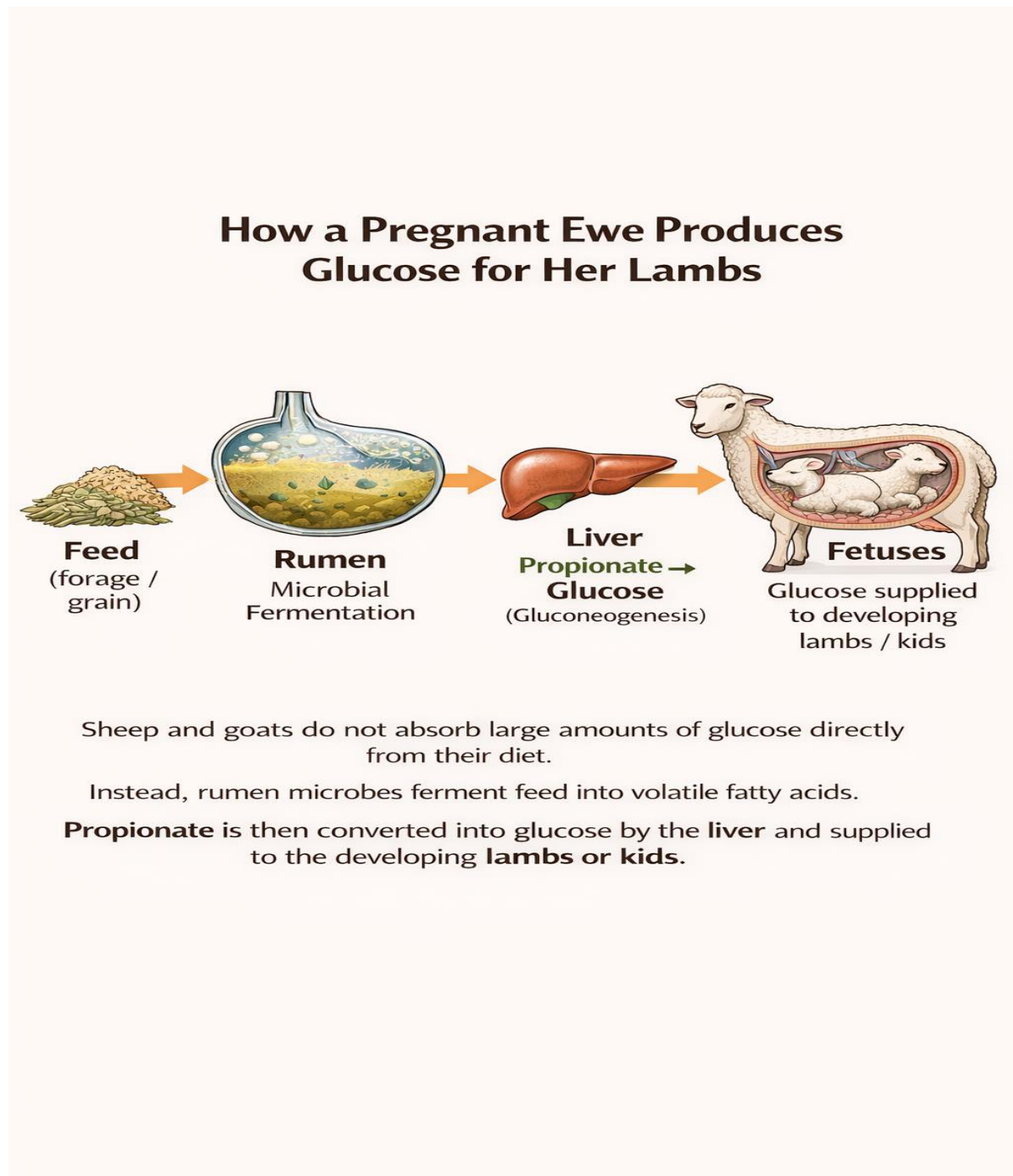
But understanding how the system works allows producers to recognize when things begin to drift out of balance.

Late gestation is a period where several forces are all changing at the same time:

- fetal growth accelerates
- energy demand rises
- rumen capacity decreases

- abdominal pressure increases

When these changes line up poorly, metabolic problems can begin to appear.



Late Gestation in Sheep & Goats – Article 2

The Metabolic Side of the Equation

In the first article, we talked about the space problem. As pregnancy advances, the developing lambs or kids take up more and more room inside the abdomen. That growing uterus gradually crowds the rumen, which means the ewe or doe simply cannot eat the same volume of feed she could earlier in pregnancy. So, intake begins to fall right at the same time fetal demand is rising.

Now we need to look at the metabolic side of that equation

Because once rumen intake begins to fall while fetal demand continues to increase, the ewe or doe must begin drawing energy from somewhere else.

But the real challenge here isn't just space.

The real challenge is glucose.

Developing lambs and kids run almost entirely on glucose supplied by their mother. The placenta depends on a steady supply of it, and fetal growth is largely driven by that constant energy flow.

So, the question becomes:

How does a ruminant produce glucose in the first place?

Unlike humans, sheep and goats absorb very little glucose directly from their diet.

Instead, almost all the carbohydrates they eat are first fermented by microbes in the rumen. Those microbes break down feed into compounds called volatile fatty acids (VFAs).

The three major VFAs produced in the rumen

- Acetate – primarily used for fat metabolism and milk fat production
- Propionate – the main precursor for glucose production
- Butyrate – largely used by rumen tissue and as an energy source

Of these, propionate becomes especially important during pregnancy.

Propionate is absorbed from the rumen and transported to the liver, where it is converted into glucose through a process called gluconeogenesis.

In other words, when we feed sheep and goats, we are not feeding the animal directly.

For the most part, we are feeding the rumen microbes first.

Those microbes convert feed into fermentation products, and the animal's metabolism is built around using those products.

Even feeds that people often think of as "sugar sources," such as molasses, still go through this fermentation process. The microbes consume the carbohydrates and convert them into VFAs before the animal can use them.

So, the pathway really looks like this:

Feed → Rumen microbes → Propionate → Liver → Glucose → Developing lambs/kids

As long as rumen intake stays adequate, this system works remarkably well. The microbes continue producing propionate, the liver continues producing glucose, and the developing fetuses receive the steady energy supply they require.

Remember the problem we discussed in Article 1

As late gestation progresses, rumen capacity begins to shrink.

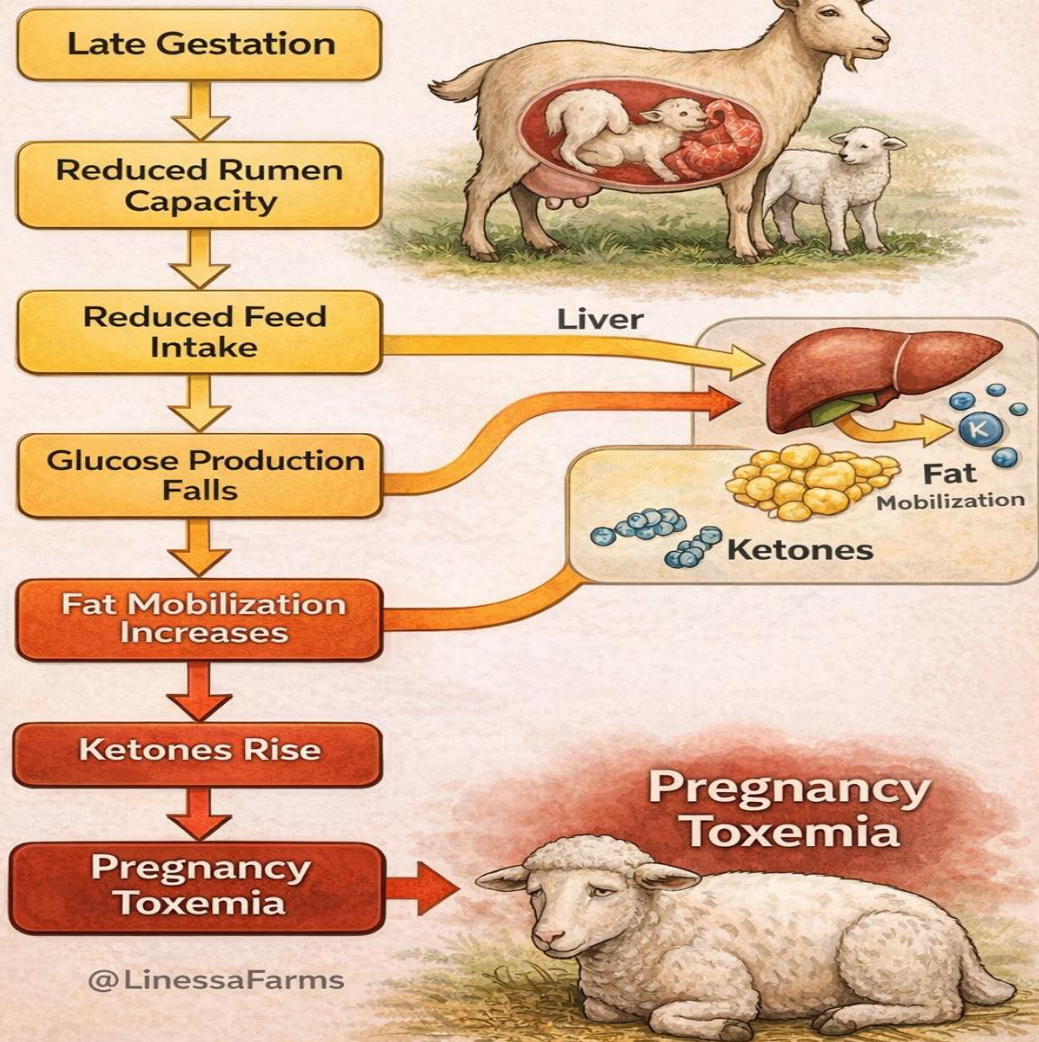
When rumen intake drops far enough, propionate production begins to fall.

When propionate production falls, glucose production begins to fall.

And when the ewe or doe cannot maintain adequate blood glucose levels to support both herself and the developing fetuses, the body begins turning to emergency energy pathways.

That metabolic shift is where some of the most serious late-gestation problems begin.

Pregnancy Toxemia in Sheep & Goats



Late Gestation in Sheep & Goats – Article 3

When the System Breaks: Pregnancy Toxemia and Ketosis

In the previous article we looked at how a ewe or doe produces glucose for her developing lambs or kids.

Unlike humans, sheep and goats do not absorb large amounts of glucose directly from their diet. Instead, rumen microbes ferment feed into volatile fatty acids, and the liver converts propionate into glucose.

Under normal conditions this system works remarkably well.

But late in pregnancy two things are happening at the same time:

- Feed intake often begins to decrease because the growing fetuses occupy more and more space in the abdomen.
- Glucose demand is rapidly increasing as the lambs or kids grow during the final weeks of gestation.

When those two forces begin to move in opposite directions, the ewe or doe can slip into an energy deficit.

The Body's Backup Plan

Animals have a natural backup system when glucose supply begins to fall.

When energy intake is insufficient, the body begins breaking down stored fat to provide fuel. This process is normal and happens in many animals, including humans.

As fat is mobilized and processed by the liver, compounds called ketones are produced.

In small amounts, ketones can serve as an alternate energy source for the body. But when fat mobilization accelerates and ketone production becomes excessive, those ketones begin to accumulate in the bloodstream.

This condition is known as ketosis.

Why Pregnancy Makes It Worse

Late gestation creates a unique metabolic challenge.

The ewe or doe may already be struggling to consume enough feed because the expanding uterus reduces rumen capacity. At the same time, the developing lambs or kids are drawing increasing amounts of glucose from the mother's bloodstream.

If intake falls too low, the body responds by mobilizing more and more fat in an attempt to keep up.

Eventually, the system becomes overwhelmed.

Ketone levels rise, appetite decreases even further, and the ewe or doe may begin showing symptoms such as:

- reduced appetite / off feed completely
- lethargy
- separation from the group
- neurological signs in advanced cases

This condition is commonly referred to as pregnancy toxemia.

Why Both Thin and Fat Animals Can Be at Risk

It is often assumed that pregnancy toxemia only occurs in overly fat animals, but the reality is more complicated.

Very thin animals may simply lack the energy reserves needed to support late gestation when feed intake falls.

Over conditioned animals, however, can also be vulnerable. Excess body fat can reduce abdominal space and limit rumen expansion, which may decrease feed intake when energy demand is highest.

In addition, when intake drops, heavily conditioned animals can mobilize fat very rapidly.

This sudden increase in fat metabolism can accelerate ketone production and overwhelm the liver.

The real issue is not simply body condition.

The real issue is energy balance.

When a ewe or doe cannot consume enough energy to meet the glucose demands of late pregnancy, the body is forced to rely heavily on fat mobilization, and ketosis can develop.

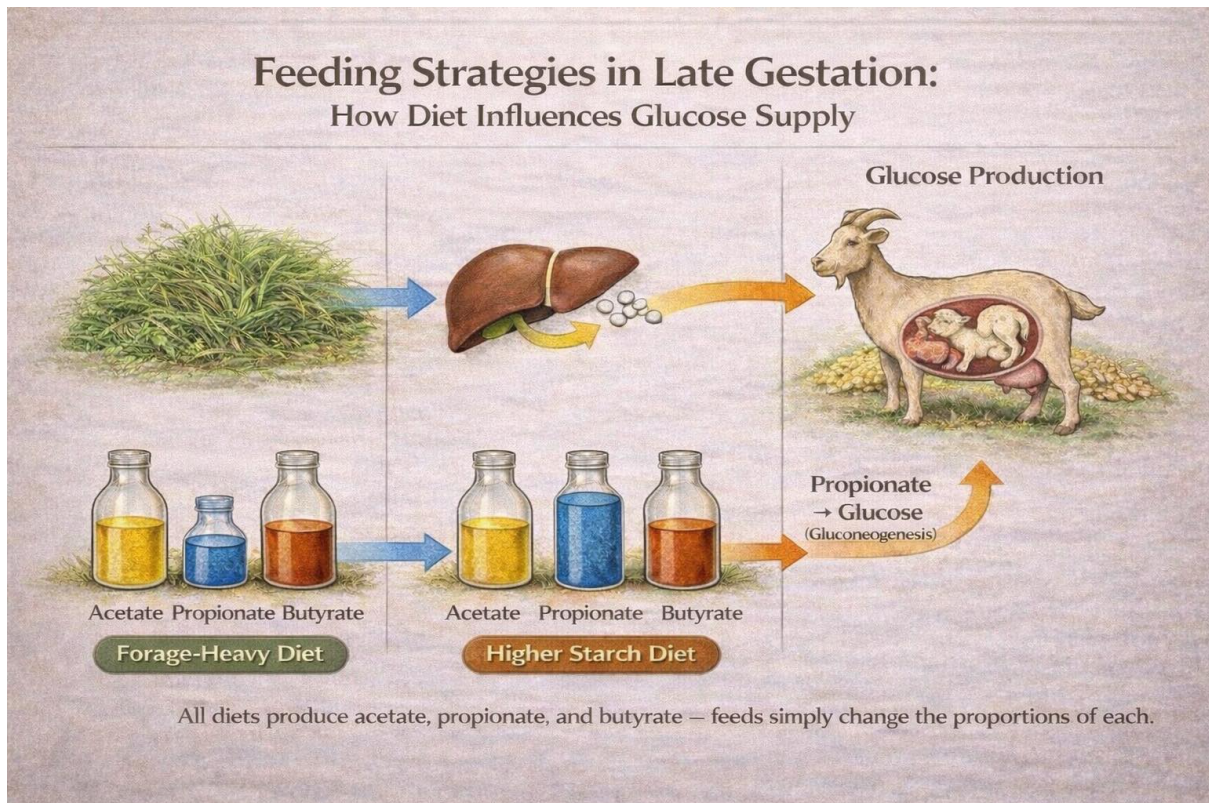
Why Early Recognition Matters

Pregnancy toxemia is much easier to manage early than late.

Once a ewe or doe stops eating entirely and ketone levels become very high, recovery becomes much more difficult.

Producers sometimes use products such as propylene glycol because the liver can convert them into glucose precursors. This provides temporary metabolic support while we work to restore normal feed intake.

These treatments help buy time, but the underlying goal is always the same: restoring the animal's ability to meet her energy needs through normal feeding and rumen fermentation.



Late Gestation in Sheep & Goats – Article 4

Feeding Strategies in Late Gestation: Understanding the System

By now you've probably noticed something interesting in the comments throughout this series.

People will argue about what to feed.

Some swear by pasture.

Some swear by hay.

Some swear by grain.

The goal of this article is not to tell you what to feed. It's to help you understand how different feeds influence rumen fermentation and glucose supply during late gestation.

Once you understand the biology, the feeding decisions start to make a lot more sense.

All Ruminant Diets Produce the Same Three Energy Sources

No matter what sheep or goats eat, the rumen microbes convert that feed into three main volatile fatty acids:

-Acetate

-Propionate

-Butyrate

Every diet produces all three.

The feeds themselves aren't magic. They simply change the proportions.

This matters because propionate is the primary source of glucose production in ruminants.

During late gestation, glucose demand rises quickly as fetuses grow. Supporting that glucose supply is one of the key metabolic challenges the ewe or doe faces in the final weeks of pregnancy.

How Feed Type Changes Fermentation

Different feeds push rumen fermentation in slightly different directions.

Forage-heavy diets generally produce:

- Higher acetate
- Moderate butyrate
- Lower propionate

Diets containing more starch tend to shift fermentation toward:

- Higher propionate
- Moderate acetate
- Lower butyrate

That increase in propionate can support greater glucose production in the liver.

But this does not mean one feeding system is automatically better than another.

Many forage-based systems work extremely well.

Many systems that include grain work extremely well.

What matters most is that the animal continues to consume enough energy to meet demand.

Intake Still Matters Most

Late gestation creates a physical limitation.

As fetuses grow, they take up space in the abdomen and reduce rumen capacity. This means the animal often cannot eat as much volume as she did earlier in pregnancy.

Different farms manage this challenge in different ways.

Some increase energy density with grain.

Some rely on excellent forage quality and strong intake behavior.

Some use a combination of both.

All these approaches can work if the animals maintain adequate intake and energy balance.

Why Giving Sugar Isn't the Same as in Humans

One important difference between ruminants and humans is how carbohydrates are handled.

In humans and other monogastric animals, sugars can be absorbed directly from the digestive tract as glucose.

Ruminants work differently.

Most carbohydrates that enter the rumen are first fermented by microbes before the animal ever absorbs them. That fermentation produces volatile fatty acids rather than direct glucose absorption.

Because of this, simply giving sugar or molasses does not behave the same way as giving glucose to a human patient.

Those sugars largely feed rumen microbes and are converted into fermentation products.

Why Propylene Glycol Is Commonly Used

When a ewe or doe begins to fall behind metabolically, many veterinarians and producers reach for propylene glycol.

Propylene glycol works because the liver can convert it into glucose precursors. In other words, it supports the same metabolic pathway discussed earlier: producing glucose when demand is high.

It does not fix the underlying situation by itself, but it can provide temporary metabolic support while we work to restore normal feed intake.

That's why it has become one of the most common tools used when early signs of pregnancy toxemia appear.

What Is Typically Done When Ketosis Appears

When pregnancy toxemia is suspected, most veterinarians and producers focus on three basic goals:

- Providing a quick glucose precursor such as propylene glycol
- Encouraging the animal to resume normal feed intake
- Reducing stress or competition so she can eat comfortably

These steps help stabilize the animal metabolically while the underlying energy balance is restored.

There Is No Universal Feeding Rule

If there was a single feeding rule that worked for every sheep and goat, every farm would either see zero cases of pregnancy toxemia or problems in every animal.

That's not what we see in the real world.

Different farms manage their animals differently and still do very well. Genetics, forage quality, litter size, body condition, management style, and experience all play a role in how a system performs.

This series wasn't written to promote one feeding program. It was written so people can understand how the system works.

Once you understand the system, you can evaluate your own animals and your own farm and make better decisions.

Every farm is different.

Thanks to everyone for checking out our articles and thanks to those of you who helped put these together.