

Understanding Neonatal Immunity

By Shari C. Silverman, VMD

After thoughtful selection of bloodlines to suit your breeding program, caring for the dam and providing her with good nutrition, your cria is finally here! But for all your careful planning, one of the single most important factors in your newborn cria's survival is the transfer of passive immunity via colostrum.



What is colostrum?

Mammary development in the camelid accelerates in the last two weeks of gestation. The first milk secreted from the mammary glands is rich in immunoglobulins (antibodies). This colostrum is then replaced with milk with a low level of immunoglobulins after the first 24 hours following parturition. The immunoglobulins are primarily IgG molecules aggregated from the bloodstream during the last 2-3 weeks of pregnancy. In addition to IgG, colostrum contains other protective substances, electrolytes, carbohydrates, fats and proteins.

The amount of colostrum a cria must ingest depends on different factors but should be as much as is needed to raise the cria's plasma IgG to levels reflective of an effective transfer of immunity.

How is colostrum absorbed into the blood stream?

Specialized cells in a neonate's small intestine allow absorption of large molecules. Immunoglobulins, specifically IgG, are such macromolecules. Unfortunately, bacteria tend to also be large molecules and the indiscriminate absorption can also facilitate

bacterial translocation across the gut wall and into the bloodstream. Bacteria can be ingested from the environment and even from the dam's udder during the initial attempts to nurse.

Over the first 24 hours, the specialized cells are replaced by mature cells which lack the ability to absorb large molecules. Absorption declines gradually over the 24 hours following birth with the highest absorption being in the first 6-8 hours. It is believed that the trigger to this "closure" is the ingestion of milk, even if that first milk is not colostrum.

Feeding milk or other substitutes will also precipitate the decline in absorption. Therefore, it may even be harmful to give anything other than colostrum as an initial nutritional stimulus. While feeding substitutes will give the cria nutrition and hydration, it may lead to a full stomach and a delay in attempts to nurse from the dam. This will lead to a delay in IgG ingestion while the gut is already decreasing in absorption capability.

It also seems that the uptake of IgG and nutrition is more effective if

the cria suckles (even a bottle) than if it is fed with a stomach tube.

The amount of IgG absorbed into the bloodstream is dependent on the following factors:

Quality of colostrum produced by the dam

- Health and nutrition of the dam
- Age of the dam - maidens and geriatric females are more likely to have crias with low IgGs
- Premature cria - colostrum is less likely to be "ready"
- Genetics?

Quantity of colostrum produced by the dam

- Health and nutrition of the dam
- Premature cria - dam may have low milk production or no milk production
- Maiden dams may have a lower milk production than dams that have previously had crias
- Previous or current mastitis may lead to decreased milk production
- Genetics?

Amount of colostrum ingested

- Cria's ability to nurse and the dam's ability to produce
- Poor mothering - some dams will not stay put while the cria attempts to nurse
- Poor udder conformation or mastitis - may affect the cria's ability to nurse
- Neonatal vigor - a sick or weak cria may not make frequent enough attempts to nurse
- Health of the dam - a sick dam or orphaned cria may not even have the opportunity to nurse

Absorption of colostrum

- Health of the cria - a healthy cria has the best chance of a good transfer of immunoglobulins; a sick cria not only will likely not nurse often enough or long enough, but will also have a decline in absorption

- Premature cria - may not have developed the ability to absorb macromolecules

- Ambient temperature - a cria that is hypothermic or hyperthermic is less likely to nurse well and will also have a decrease in absorptive capabilities.

What is failure of passive immunity?

Crias are born immunologically naïve - their immune system is still too immature to produce the cells necessary to provide protection from viral or bacterial challenges. In addition, IgG are not absorbed across the placenta from the dam's bloodstream. Therefore, the cria relies almost entirely on the passive transfer of immunoglobulins from the colostrum for the first 6-8 weeks of life. The cria that fails to receive an adequate passive transfer of IgG (Failure of Passive Transfer or FPT) will lack the ability to overcome exposure to bacterial or viral pathogens.

Crias with failure of passive transfer have a significantly higher incidence of illness and death from infectious disease during the first few months of life when compared to crias with successful passive transfer or even partial passive transfer. These crias reach a few months of age, their own immune systems mature and produce their own antibodies and immunoglobulins. The risk of suffering life-threatening problems gradually becomes equal to that of a normal cria with successful passive transfer at birth.

How is passive immunity measured?

Currently, there is no reliable

means of measuring the quality of a dam's colostrum. The physical appearance gives some indication of quality. Thick, sticky off white to yellow colostrum in other species is associated with high quality.

The quality of the colostrum and the ability of the cria to absorb the IgG molecule decreases dramatically after 24 hours. To allow for maximum absorption, a blood sample taken from the cria after this 24-hour period may be used to measure the absorption of IgG. Special formulated kits are available and calibrated specifically to measure camelid IgG. A level greater than 1200 mg/dL is ideal and should provide a cria with protection until its own immune system kicks in. A level of 800 to 1200 mg/dL is acceptable but does not leave much reserve if the cria is exposed to any pathogens. A level of 400 to 800 is considered a partial failure of passive transfer. If the level of IgG is less than 400, failure of passive transfer has occurred.

Because the maternal antibodies have a limited life span, the IgG level will slowly decline over the first few months of a cria's life. Their own immune system will eventually take over and begin to produce antibody. However, until that occurs there may be a period where the level of protection dips below ideal. If a cria starts out with an IgG above 1200, it has more reserves and that period between losing maternal protection and having a sufficiently effective immune system is more likely to be brief if it occurs at all. A cria that starts out with a lower IgG has far less reserves and may have an extended period around 2-3 months of age without sufficient immune protection. A cria that has failure of passive transfer is not protected until its own antibodies are produced. Until that time, the cria is at risk of suffering serious, even life-threatening, problems.

Keep in mind that in the face of serious deadly pathogens, antibodies will be consumed rapidly in an attempt to ward off infection. In certain circumstances, even the cria with a high IgG may succumb to illness. Likewise, a cria with an IgG slightly lower than ideal may remain healthy if it is not exposed to any pathogens. The environment the cria is exposed to is an important risk factor. If the farm has many transient animals in and out for breeding, auction or show, the risk to the cria of contracting a disease will be much higher than the risk found on a small backyard farm with a "closed" herd.

How can FPT be treated?

Depending on the level of the IgG, the value of the cria and the risk factors of the farm, a plasma transfusion may be considered. A conservative approach may be taken with partial failure of passive transfer in an otherwise healthy cria kept in a low risk environment. The animal should be kept away from any transient animals and monitored for any early sign of disease. Your veterinarian should be consulted to help determine the risks involved and may decide to put the cria on antibiotics.



A cria with complete failure of passive transfer or a cria with partial failure of passive transfer that is ill, weak, and/or is in a high-risk environment should have a plasma transfusion.

How can FPT be prevented?

Ideally, the dam produces and the cria consumes an adequate amount of colostrum with high amounts of IgG within the first 6-8 hrs. If the cria is not nursing within 2-3 hours or there is other reason to suspect poor colostrum intake, then colostrum should be fed to the neonate. This will provide energy and thus increase vigor.

If possible, the colostrum should be milked from the dam. The next best option would be fresh or chilled colostrum from a donor camelid. Colostrum may be stored frozen but some denaturing of factors in the colostrum may occur. Colostrum stored frozen should be gently thawed. Do not boil or microwave as this will destroy the antibodies.

Cross species donors have been used (goats or cows). However, with the rising concern over BVD, cows are less desirable as donors. There are also diseases carried by goats which may be passed in milk. Try to determine the health status of the donor herd and then discuss your options with your veterinarian. The significance of the antibodies from cross species donors is also questionable.

Powdered or paste colostrum substitutes are often made with bovine colostrum. Most carry a disclaimer on the label indicating that while these products may contain nutrition, they are not a source of antibodies. The process of preparing these products and storage destroys the antibodies that were present in the original colostrum. In addition, they lack many of the other important ingredients found in fresh colostrum. Many farms will automatically give one of these products to crias at birth. This



practice may be unwise as any ingested item may precipitate the decrease in gut absorption. If another hour or more passes before the cria nurses, the absorption of the fresh colostrum will have already begun to decline.

There are many factors affecting the cria's ability to receive sufficient colostrum and absorb a high enough level of IgG to have successful passive transfer. One often overlooked factor is genetics. While selecting breeding stock, both male and female, a breeder should look at the individual's past history as well as familial history. If a female has had crias in the past, you should find out what were their IgG scores. You should also find out if the offspring needed any supplementation (this may reflect on milk production) or if the female has had any milking problems (i.e., mastitis). For both males and females, you should find out what were their IgGs and try to find out the history of their dams. Keeping in mind milk and even colostrum production in bloodline

selection may not only save you time and money but also lead to better quality animals for the industry as a whole.

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Good health management and a need for compassionate care for small ruminants, camelids, and horses are what prompted Dr. Shari Silverman to establish Abbey Rose Veterinary Services. Serving clients and patients throughout New Jersey and Eastern Pennsylvania, the practice provides wellness programs, educational seminars and programs, as well as emergency services 24 hours a day, 7 days a week.

In her spare time, Dr Silverman flies planes, kayaks and plays on her farm where she lives with her husband and many different animal friends.