Equine Colostrum: *The Elixir of Life for a Newborn Foal*

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What is Colostrum?

Colostrum is the thick, sticky yellowish colored fluid produced by the mammary gland of the mare during the last few weeks of pregnancy. It is comprised of carbohydrates, fats, proteins and electrolytes. Colostrum is rich in antibodies that are critically important for immune protection of the newborn foal. Colostrum is also an important source of nutrients, vitamins, and other factors important in development of the immune system.

The multi-layered placenta of the horse prevents transfer of antibodies from the mare to the fetus across the placenta. Consequently, foals are born without antibody protection and are dependent on antibodies from the mare acquired through ingestion of colostrum for protection against infectious diseases during the early neonatal period. Failure of passive transfer of maternal antibodies significantly increases the risk of life threatening infections. Studies have shown that young foals that develop infections have lower blood levels of antibodies than similar age foals that did not get infected.

Mares produce colostrum only once during the course of a pregnancy. The mammary gland selectively concentrates antibodies from the blood of the mare during the last two to three weeks of pregnancy. Vaccination of the mare 4 to 6 weeks prior to foaling will increase the concentration of immunoglobulins in colostrum. Core vaccines recommended for all broodmares include tetanus, eastern and western equine sleeping sickness (encephalitis), West Nile virus and rabies. Additional vaccines based on risk potential may be advised. Please consult with your equine veterinarian about other vaccines for late-term pregnant mares.

Factors affecting production of colostrum include age, lactation number (i.e. a maiden mare vs. a mare that has lactated previously) and health of the dam. The most common causes of poor quality colostrum at the time of foaling are premature leakage of milk, failure of udder development, fescue toxicity, advanced mare age, maiden mare status, and premature delivery of a foal.

Mares that drip or run milk for several hours prior to giving birth lose colostrum that is vital to the survival of the foal. In that situation, it is recommended that colostrum be stripped or

milked out of the mare and saved for the foal. The colostrum should be strained through a gauze filter into a labeled plastic bottle and either refrigerated or frozen if foaling does not appear to be near.

Newborn foals will usually stand and nurse within 1-2 hours after birth. Specialized cells that line the small intestine engulf droplets of colostrum from the intestinal lumen, transfer the droplets in small vacuoles across the cell and then discharge the contents into lymphatic vessels. The antibodies are subsequently transported via the lymphatic system to the blood stream. The absorption of colostral antibodies is greatest during the first 6-8 hours after birth, and has essentially stopped by 24 hours of age as the specialized cells are lost. To acquire sufficient antibodies to offer reasonable protection against infectious disease, the average foal needs to ingest approximately 2 to 4 liters of good quality colostrum within the first few hours of life.

Concentrations of antibody in the mammary secretions decline rapidly during the first 24 hours after foaling as the foal suckles. This has important ramifications for collection of colostrum for banking. Colostrum should be harvested for frozen storage immediately after the mare foals and prior to nursing.

It is possible to evaluate colostrum quality easily, quickly and accurately within a few minutes after the foal is born. Determination of colostrum quality can provide the basis for important management decisions. If the quality of colostrum is high and the foal nurses adequately, he or she should be protected from infectious disease agents early in life. In addition, if the quality of colostrum is high, 250 to 500 mls can be harvested and frozen for future use. Conversely, if the quality of colostrum is determined to be low, the foal should be supplemented with good quality colostrum from an on-farm colostrum bank. Poor quality colostrum should not be collected and saved in a colostrum bank.

Assessment of Colostrum Quality

Good quality colostrum is thick, yellow in color and sticky in texture. Poor quality colostrum is often watery, white in color and non-viscous in texture. Common techniques used on breeding farms to assess colostrum quality include the colostrometer to determine specific gravity and the Brix refractometer to evaluate optical density. Specific gravity and optical density are both correlated with antibody content of colostrum.

Brix Refractometer. Refractometry measures the concentration of dissolved solids in a solution. In the case of a Brix refractometer, a small amount of colostrum is placed on the prism and the light plate is closed so that colostrum is spread evenly across the prism. The refractometer is then pointed at a light source and the deviation or refraction of light is evaluated as a percentage score.

Figure 1. Refractometer used to evaluate equine colostrum.

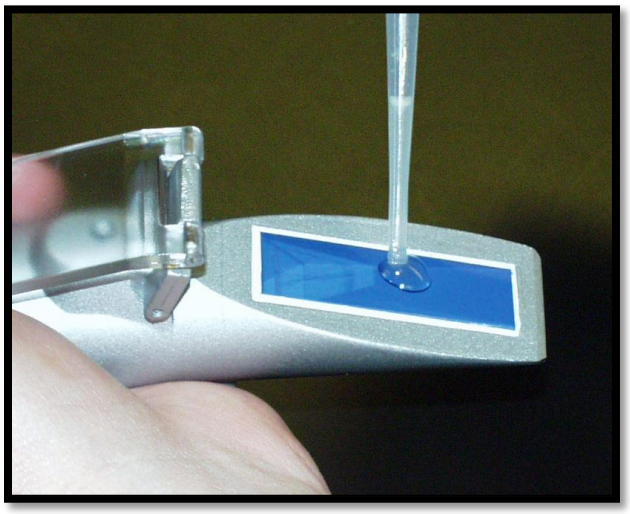

Figure 2. Adding a drop of colostrum to the refractometer prior to evaluation.

Figure 3. Evaluation of equine colostrum using a refractometer.

Colostrum with high amounts of dissolved solids (i.e. high antibody levels) will cause a large degree of light scatter and will consequently have a high Brix percentage score. Colostrum with low antibody levels will have less light scatter and a lower Brix percentage score. Brix refractometer evaluation of equine colostrum quality has been shown to be both repeatable and highly correlated with foal plasma antibody levels.

Colostrometer. The colostrometer measures the density or specific gravity of colostrum. A volume of exactly 15 mls of colostrum is added to a specially designed calibrated glass chamber. The colostrum-filled chamber is then carefully placed in a graduated cylinder containing distilled water and allowed to float. The specific gravity of the colostrum is measured by reading the scale on the glass cylinder at the water line. Colostrum with high antibody levels has a greater density and, therefore, specific gravity than colostrum with low antibody levels. However, determination of the specific gravity of equine colostrum with a colostrometer depends on accurate measurement of an exact volume (15 ml) of colostrum; even small errors in volume measurement can lead to significant inaccuracy in specific gravity determination.

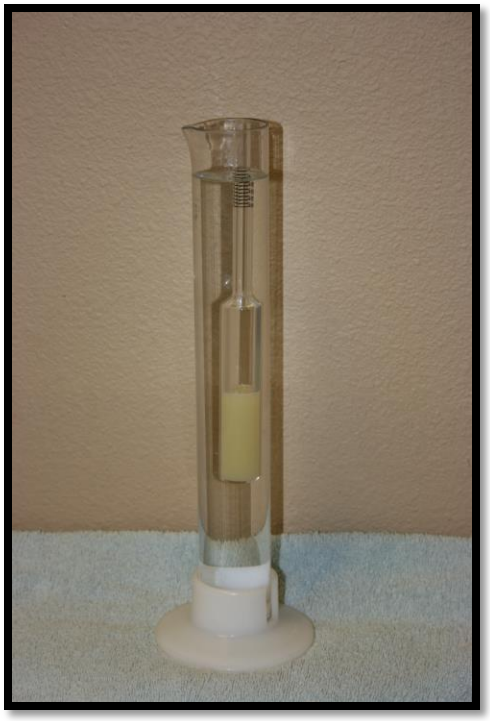

Figure 4. Measuring specific gravity of equine colostrum using a colostrometer.

The relationship between refractometry percentage, specific gravity, IgG content as determined by RID assay and overall colostrum quality assessment is presented in the following table.

Colostrum Quality	Brix (%)	Specific Gravity
Very Good	> 30	≥ 1.10
Good	20 – 30	1.08 – 1.09
Fair	15 – 20	1.06 – 1.07
Poor	< 15	< 1.06

Colostrum Bank and Storage

An owner or farm manager generally does not know in advance if a foal of a late-term pregnant mare will need supplemental colostrum. An on-site supply of frozen colostrum can therefore be critical for the health of a valuable neonate.

The best colostrum donors are mares that have had one or more foals and are 4-15 years of age. Vaccination 4 to 6 weeks prior to foaling will increase antibody content of colostrum and consequently increase the quality of colostrum to be collected for storage. Colostrum volume

and quality are not as good from young maiden mares or older mares. Mares that have dripped milk for several hours prior to foaling may not have a large volume of good quality colostrum remaining in their udder and may not make suitable donors for a colostrum bank. Colostrum should not be saved from a mare with a history of having a foal affected by neonatal isoerythrolysis (NI or Jaundice Foal Syndrome) or that died from unknown causes within the first few days after birth.

Ideally, colostrum to be banked should be tested for quality (antibody content) and only good or very good quality colostrum stored for future use. In addition, blood from a potential colostrum donor should be tested for the presence of anti-RBC antibodies and only colostrum from sero-negative mares banked to prevent the possibility of inducing neonatal isoerythrolysis in a foal receiving stored colostrum.

The technique for harvesting colostrum for banking is relatively simple. The udder of the mare should be washed with warm water and soap to remove debris and bacteria. It is recommended that colostrum be collected from one side of the mammary gland from a donor mare in the first hour after foaling before her foal has nursed. A total of 8 to 16 oz may be safely harvested from the mare without adversely affecting the ability of the newborn foal to acquire sufficient colostrum for adequate passive transfer of antibodies.

Figure 5. Washing the udder of a post-partum mare prior to collection of colostrum.

Options for collecting colostrum include hand milking, using an inverted syringe, or using a commercial milking device. Stripping or milking colostrum by hand directly into a clean glass or plastic measuring cup 16 to 32 oz in capacity will make it easy to evaluate the volume that has been collected. Alternatively, colostrum can be harvested using an inverted 60 ml syringe as a simple milking device. To make the unit, cut the tip off of a 60 ml plastic syringe. Reverse the syringe plunger (i.e. insert the plunger into the end the tip was removed from) and place the flared end of the syringe over the mare's teat snug against the udder. A gentle pull on the plunger will create suction and draw colostrum down into the syringe. The colostrum in the syringe is then transferred into a larger measuring cup and the process repeated until the desired volume is obtained.

Figure 6. Handing milking a mare to obtain colostrum.

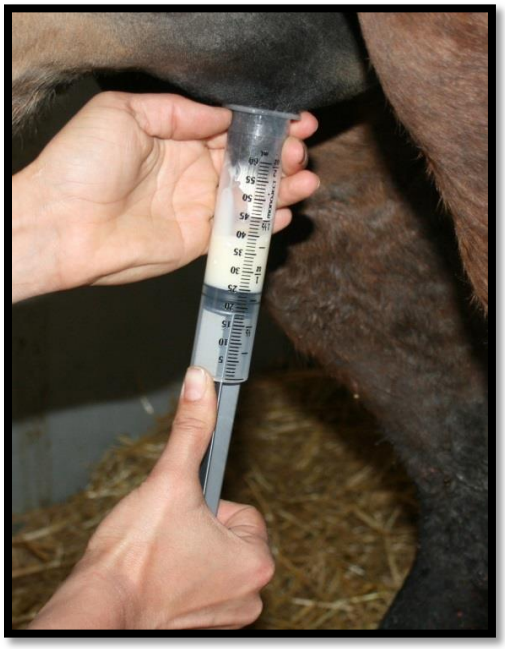

Figure 7. Use of an inverted syringe to collect colostrum from a post-partum mare.

A commercial hand-held trigger-operated pump (‘Udderly EZ Milker’; Manufacturer, City, State) has been developed to assist with collection of colostrum and milk from mares. The device is attached to a plastic bottle into which the colostrum is collected.

Figure 8. Use of the Udderly EZ Milker to collect milk from a mare.

Harvested colostrum should be passed through a gauze filter or new cheesecloth into a storage container. Colostrum should be stored in 8 to 16 oz plastic bottles labeled with the donor mare's name, collection date and colostrum quality. Glass bottles or plastic freezer bags are not recommended for storage of frozen colostrum. Frozen equine colostrum can be safely stored for 1 to 2 years in a standard –20^{o} C freezer. Colostrum should be harvested each breeding season to replenish the colostrum bank with a fresh supply. Colostrum that is more than 1 year old can be used to supplement at-risk foals on the farm.

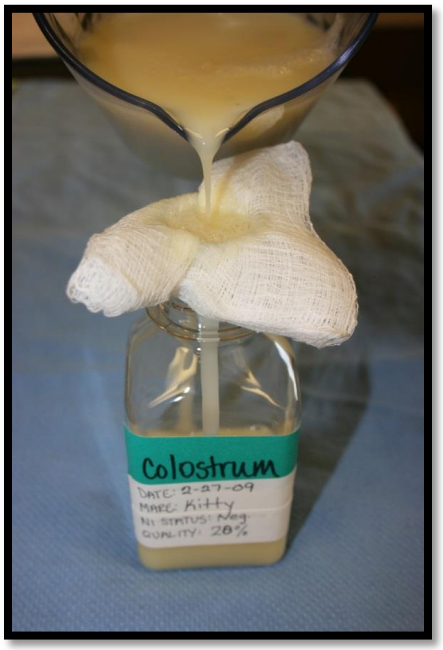

Figure 9. Filtering harvested colostrum through gauze prior to banking.

Frozen colostrum should be thawed in a water bath at room temperature. Thawing in hot water or in a microwave will destroy the antibodies and render the colostrum useless. It is recommended that colostrum be administered immediately after thawing.

Summary

Appropriate and timely development of the mammary gland, colostrum production, and subsequent lactation play key roles in the survival and health of a neonatal foal. The mammary gland is responsible for providing the neonate with immunoglobulins critical to survival and supplies nutrition to the foal during the first few months of life. Measurement of the IgG concentration of colostrum immediately after foaling is valuable for the prevention of failure of passive transfer. A Brix or sugar refractometer is a rapid, repeatable and inexpensive method to estimate IgG content of equine colostrum. Good quality colostrum can be harvested and banked for later use. If a mare has poor quality colostrum, the newborn foal can be supplemented with frozen-thawed colostrum or IgG from another source.