



# COLOSTRUM

BY AMANDA DUCKWORTH  
PHOTOS BY ANNE M. EBERHARDT

**WHEN IT COMES TO EQUINE HEALTH,** many issues and treatment plans come down to the specific individual in question. However, there are a few baseline rules that are generally accepted as gospel. “No hoof, no horse” is hard to argue, and for newborns, the same can be said for “no colostrum, no foal.”



Foal drinks colostrum from an empty soda bottle

Colostrum, which is the first milk a mare delivers, is vital when it comes to having a healthy newborn, and its importance cannot be overstated. As a substance, colostrum is not unique to horses, but rather, it is the first form of milk produced by the mammary glands of mammals, including humans. While it is important for all species, how important it is varies, and the reason comes down to science.

“Foals are born without immunoglobulins in their bloodstream,” said Dr. Kathleen Crandell, the nutritionist for Kentucky Equine Research. “The mare’s immunoglobulins can’t pass through the placenta because they are too large. The

placenta only allows cells of a certain size to pass through. This is not the same as with humans. With humans, we actually can, so colostrum is not as critical in a human baby as it is in a foal.”

### NOT CREATED EQUAL

While colostrum is naturally produced by broodmares, not all mares are equal when it comes to the quality and quantity they produce. Ideal colostrum is yellow, thick, and sticky while a thin, watery-looking substance is cause for concern.

“If it comes out looking more like milk, there’s a chance the mare has already dripped out her good colostrum,” said Crandell. “The color, the texture, and the

viscosity are important, but appearance isn’t the most reliable predictor of immunoglobulin content. That said, if it looks like colostrum, it probably is.”

For those who are familiar with colostrum, the subjective “eye-balling it” method does work. For a more scientific answer to the question of quality, two methods are typically used, the original of which involved a colostrometer.

“You took 15 ml of colostrum in a special glass chamber,” said Crandell. “You would set it into a cylinder with distilled water and measure the specific gravity by seeing how well it floats in water. It sounds pretty crude, but it does correlate.”



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MESSAGE FROM THE GRAYSON-JOCKEY CLUB RESEARCH FOUNDATION

## ENDOCRINE DYSREGULATION IN CRITICALLY ILL FOALS – PROGRESS MADE IN A DECADE

BY DR. RAMIRO TORIBIO



Grayson-Jockey Club  
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**FOR THE EQUINE NEONATE** to survive the new environmental conditions, it must quickly adapt. This requires a rapid and effective response of multiple endocrine systems to overcome adversities. Sepsis, defined as a generalized inflammatory response to microorganisms, is the main cause of mortality in foals, representing major economic losses to the equine industry. Recent studies in septic foals have shown that hormone disorders contribute to disease progression and mortality. Neonatal maladjustment syndrome (dummy foals) also appears to be linked to hormone imbalances. It is reasonable to assume that a better understanding of endocrine disorders in sick foals will improve our ability to increase survival.

**The energy system:** Equine neonates are born with minimal energy reserves. Low blood glucose (hypoglycemia) is common in critically ill foals. To maintain energy supply during illness, there is a regulatory system (brain, pituitary gland, adrenal gland, pancreas, liver, and adipose tissue). Failure at different levels of this system has been identified in premature and septic foals. This information has clinical value.

**The stress system:** The transition from intrauterine to extrauterine life is a major biological challenge that depends on endocrine adaptations. Animals and people have developed a stress response system (hypothalamus, pituitary gland, adrenal gland). During sepsis this system releases hormones to control inflammation, enhance blood pressure, and promote energy delivery. We have identified a failure of this system (adrenal insufficiency) in some foals with severe sepsis that is characterized by a poor production of glucocorticoids. There are therapies based on this information that could be used to assist these foals.

**Progesterones and neurosteroids:** The adrenal gland also pro-

duces progesterones (e.g., progesterone) that are important to maintain the fetus in a quiet state. Progesterones can be metabolized by brain cells into more potent neurosteroids. In the brain, neurosteroids promote neurogenesis, energy conservation, and protect neurons against ischemia. It was recently shown that septic and dummy foals have high levels of neurosteroids. One can speculate that the abnormal behavior observed in some sick foals could be in part due to high neurosteroids.

**Calcium regulation:** Septic foals often develop hypocalcemia (low calcium) that could impair the function of the gastrointestinal tract (colic), heart (arrhythmias), muscle (weakness), and nervous system (seizures). We recently showed that hypocalcemia in sick foals is associated with abnormal concentrations of the hormone (parathyroid hormone) responsible for maintaining calcium levels. These abnormalities were associated with mortality. The use of calcium and magnesium salts to treat these foals has become routine, in part as a result of this research.

**Vitamin D:** Vitamin D has a multitude of functions (bone health, calcium and phosphorus regulation, anti-

inflammatory, anti-bacterial, immune modulation). A recent finding by our group is that vitamin D levels in septic foals decrease by half the values of healthy foals and that foals with the lowest levels are more likely to die. We also found low vitamin D levels were associated with hypocalcemia. We can speculate low vitamin D in sick foals leads to a multitude of complications (hypocalcemia, immune suppression, inflammation, bacterial invasion). We can speculate vitamin D therapy could be beneficial to these foals. However, no study on vitamin D therapy in sick foals has been performed.

**Thyroid hormones:** The differentiation and maturation of most organs at the end of pregnancy depend on thyroid hormones. They are important to maintain body temperature and organ function in the neonate. Low thyroid hormones could be devastating to foals. We showed this to be a serious problem in premature and sepsis foals. It is unclear whether replacement therapy could be beneficial to these foals.

It is evident that progress to understand various endocrine systems in healthy and sick foals has been made in recent years. This information has clinical implications. It is important to give credit to organizations such as the Morris Animal Foundation and the Grayson-Jockey Club Research Foundation for supporting this type of research. **BH**

### References:

Toribio RE, 2011; Himler et al. 2012; Madigan et al. 2012; Aleman et al. 2013; Dembek et al. 2017

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## HEALTH ZONE

Foal Health

The newer, and easier, way to test the quality of colostrum is by using a Brix refractometer.

“It is like what wine makers use to check the amount of sugar in the grapes,” said Crandell. “It’s nice because you only need a couple of drops of colostrum. It measures the sugar in the colostrum, and there is a correlation between the amount of sugar and the amount of immunoglobulins. They have made a scale, and you want to see that it has a level of greater than 50mg/ml, which equates to about 22% sugar. That would mean it was good-quality colostrum.”

“I feel like that was a major breakthrough because the colostrometer was a little tedious. This is a handheld thing that is quite portable. It is recommended that immunoglobulins in colostrum be measured from the first colostrum before the foal ever nurses.”

Once a foal is on the ground, the clock starts on its getting an appropriate amount of colostrum. According to the American Association of Equine Practitioners, the best-quality colostrum



A newborn's first meal, colostrum, is vital for a healthy start

is produced in the first eight hours post-foaling, and in an ideal scenario, a foal will get at least two pints of mare's milk within its first 12 hours.

“They receive that initial immunity from their mother,” said Dr. Luke Fallon of Hagyard Equine Medical Institute. “You cannot substitute the quality of maternal antibodies. It’s hard to take the place of Mother Nature when you get down to it. That’s always your best option.”

Much like the reason colostrum is so critical to begin with, the time crunch involved with a foal's receiving it comes down to the science of how the newborn's system works. After the first eight hours a foal's capacity to absorb key antibodies steadily declines until eventually it reaches zero.

“The foal needs to consume colostrum within the first 24 hours of life because at that time, the gut lining has cells that allow larger immunoglobulins to be absorbed directly into the lymphatic system, and the lymphatic system is an integral part of the immune system in the body,” Crandell said. “After that first 24 hours the foal isn't able to absorb these large immunoglobulins, and so it can't receive the passive transfer of immunity.”

Failure of passive transfer, which is referred to as FPT, is estimated to occur in 10-20% of foals. It is considered an FPT case if a foal's immunoglobulin levels are less than 400 mg/dl after the first 24 hours of life. Anything between 400 mg/dl and 800 mg/dl is a partial failure of passive transfer. It is recommended that newborn foals have their blood tested to ascertain whether they have received the necessary amount of immunoglobulins.

### IMPROVED ODDS

Much like with humans, some broodmares are naturally better milk producers than others. When it comes to horses, good milkers tend to be good colostrum producers, but maiden mares and older mares typically don't produce as good a quality colostrum as a mare in her prime.

“Mares are pretty consistent from year to year, but there are

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certain factors that can affect that,” said Crandell. “Age affects the quality of the colostrum, so if you have an older mare, you may seriously think about supplements. There are a couple of supplements that have been looked at in research recently, like omega-3 fatty acids, and more specifically DHA and EPA. Those are found in marine-derived sources like fish oil. They can boost the immune system, which helps boost production of immunoglobulins.

“Vitamin E has also been looked at. The thing about vitamin E is you want to make sure you are giving a natural vitamin E versus a synthetic one. The natural vitamin E is much better absorbed and utilized by the body.”

Other general “good care” considerations can help a mare with the quality and quantity of her colostrum production. Good nutrition throughout her pregnancy and vaccinations four to six weeks prior to foaling are important. Additionally, making sure a mare does not have access to fescue is something to be aware of.

“If you have a mare consuming fescue that is infected with endophytes, it can interfere with prolactin production, and it can make even the best of milkers stop producing,” said Crandell. “That’s something to keep in mind. A way to improve a mare’s colostrum is to get them off fescue at least 60-90 days before they are supposed to foal.”

Furthermore, if a mare routinely has provided good colostrum for her foals each year, that fact becomes moot if for some reason she goes into premature labor.

“If something affects the mare, and she has a premature delivery of the foal, that changes things,” said Crandell. “She may have been a good colostrum producer in the past, but if the foal is coming early, it is not the same. About two weeks before foaling, the mare starts building up the immunoglobulins in her udder, so if the foal is premature, that would interfere with that.”

## ALTERNATIVE OPTIONS

While Mother Nature takes care of things most of the time, as always, sometimes the situation goes wrong. If the foal is too weak to nurse or the mare does not produce enough colostrum, there are alternatives, although the most common one goes right back to the source.

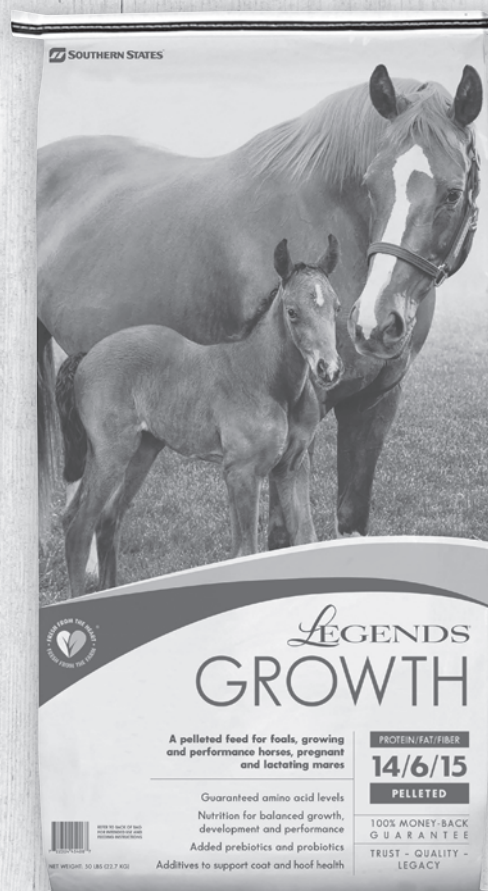
“Banked colostrum is the best you can do,” said Dr. Fallon. “It’s the gold standard. There is really nothing that can replace colostrum, and you really do need to get it on board within the first 18 hours of life, ideally.”

In addition to private stores of colostrum on individual farms, broodmares can donate to colostrum banks much like humans donate to blood banks. The Kentucky Thoroughbred Farm Managers’ Club partners with Hagyard to operate a colostrum bank in the Bluegrass.

Through the bank, the colostrum—which is donated by farms, tested, and then frozen and stored until needed—is available to anyone who has a foal in need. Members of the KTFMC may contribute to the bank and then withdraw from the bank as needed.

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Colostrum can be 'banked' and kept frozen for up to a year...

Non-members can purchase colostrum or they can donate colostrum and receive a credit in case they need colostrum later that foaling season. A pint of colostrum costs \$130, and the proceeds are donated to Central Kentucky Riding for Hope.

According to a paper published by the AAEP, colostrum can be collected and stored in any freezer reliably for about a year. The frozen immunoglobulins are stable for longer than that, but the overall quality of colostrum deteriorates over

time. An ideal scenario takes place when the colostrum is collected after the foal has nursed for the first time.

"It is preferable to collect colostrum shortly after the healthy foal has nursed the mare for the first time because over time the concentration of immunoglobulins will be diluted by increasing milk production," explained Dr. Fairfield Bain in the paper. "After the foal has nursed, approximately one pint can be obtained safely from the mare without



...but it must be thawed gradually or run the risk of rendering it useless

risking any colostrum deficiency to her foal. Only eight to 10 ounces of colostrum should be collected—one time—from each mare per foaling so as not to deprive the foal."

Bain also noted it is important to test banked colostrum before it is frozen for the presence of specific antibodies that include equine red blood cell types Aa and Qa, as they are the most common blood types that result in a colostrum cross-match abnormality known as neonatal isoerythrolysis (NI or jaundiced foal).

In addition to banking colostrum from healthy mares who are good producers, it is also possible to milk mares who deliver dead foals or whose foals die shortly after birth.

When it is time to use the frozen colostrum, a key step is to thaw it gradually, or there is a risk of rendering it useless.

"It is important to thaw it without putting it into a microwave and destroying those immunoglobulins," said Crandell. "Immunoglobulins are proteins, and a microwave will destroy those proteins, so just thaw it gently."

There are other alternatives, but nothing can completely replace naturally produced colostrum.

"There are commercial oral immunoglobulin products that you can buy to give to the foal," said Crandell. "The only thing is that while that product has the immunoglobulins, it doesn't have all the other components found in colostrum, which also may have more immune-boosting effects. We aren't quite sure exactly what those immune boosters are."

Plasma is another alternative for those needing to boost the immunoglobulins in a newborn, but it also is not a perfect solution.

"We do supplement the foals, and some of them just routinely get plasma," said Fallon. "We can boost them with hyper-immunized plasma, but it will never take the place of colostrum." **BH**

*Amanda Duckworth is a freelance writer based in Lexington.*