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Feeding the Orphan Foal

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The nutritional needs of the orphan foal can be met in many different ways. This report will build on what we know about the nutritional needs of the normal foal and describe methods in which we can fulfill these needs through the use of surrogate mares or options in hand-rearing with mare’s milk replacement. The frequency of feeding and the nutritional needs of the orphan change as they mature. Adjustments in the orphan foal’s diet should reflect these changes. Author’s address: Tufts University Cummings School of Veterinary Medicine, 200 Westboro Road, North Grafton, MA 01519; e-mail: maryrose.paradis@tufts.edu. © 2012 AAEP.

1. Introduction

There are many reasons that a foal may become an orphan. Most obvious is that the mare has died. Foal rejection by the mare may also lead to the motherless foal. Agalactia in the mare essentially makes the foal a “food orphan.” No matter what the cause of the lack of a source of milk, the orphan foal will need an alternative nutritional support. In this report, we will review the ways that the orphan foal can be fed, the sources of milk or milk replacers that can be used, and the volume and frequency of feeding need in the orphan foal.

2. Colostrum

If the foal loses it dam at birth, then the nutritional support starts with colostrum. Colostrum is essential for immunologic protection and for a good nutritional start. Finding a source of colostrum may be difficult in a small breeding operation. Larger farms should plan ahead by collecting colostrum from mares that have excellent-quality colostrum. The quality of the colostrum can be measure by 2 different methods—colostrometer or a Brix refractometer. Each of these methods determines the colostrum quality by measuring the specific gravity of the colostrum.\(^1,2\) If a mare has a specific gravity >1.060, using the colostrometer, or 20% to 30% using the Brix refractometer, then 200 to 250 mL of that colostrum can be “stolen” from that mare. Usually this can be obtained either after her own foal has nursed at least once or taken from one teat while the foal is suckling on the other teat. The stolen colostrum can be placed in a zip-lock freezer bag and labeled with the date of collection and the specific gravity. This can be frozen and saved for up to 2 years.\(^3\)

Planning ahead for the foal that needs colostrum is important. When the need arises, the colostrum should be thawed by placing the bag in warm water. Do not microwave the frozen colostrum because it may destroy the important immunoglobulins. The thawed colostrum should be tube fed to the newborn orphan as soon as possible. In general, a foal needs approximately 2 to 3 L of good-quality colostrum to increase its immunoglobulin (IgG) levels to the benchmark of 800 mg/dL. If a mare is to be euthanized at parturition, an attempt should be made to collect colostrum from her before euthanasia. If the mare dies in parturition, you can try to milk out any colostrum that is present in the udder, but suc-
Induction of lactation in barren mares was first re-purpose being to have foster mares for orphan foals. To induce lactation in the barren mare, with the main advantage of fostering human bonding that can occur with raising the sin-

gle orphan. If the mare's natural foal is not by her side, there is a high chance that the mare will “dry up” from the stress of transportation and introduction to a new environment.

The advantages of grafting the foal onto another mare are manifold. After the initial introduction of the foal to the “nurse” mare, the labor of feeding the foal is taken on by the surrogate dam. The foal can nurse at will and should grow and develop as a normal foal. The surrogate mare also provides companionship and normal horse-to-horse bonding, which is so important in social education of the foal.

The disadvantages of the use of a commercial nurse mare include the availability of the mares in certain regions of the country, the cost of leasing the mare, the need to rebreed the mare before returning her, and the worry of farm biosecurity with the introduction of an outside animal to the farm. Another disadvantage is that it creates another orphan from the mare’s natural foal. This disadvantage is offset by the practice of some nurse mare farms of raising their orphans in a “kindergarten” setting, where multiple orphans are raised together. This helps to socialize the foals and prevent excessive human bonding that can occur with raising the single orphan.

5. Induction of Lactation in the Barren Mare

In last decade, protocols have been developed to induce lactation in the barren mare, with the main purpose being to have foster mares for orphan foals. Induction of lactation in barren mares was first re-

ported by Chavatte-Palmer in 2002, using vaginal pessaries containing altrenogest and estradiol with subsequent treatment with oxytocin and sulpiride or domperidone, dopamine antagonists known to in-

crease endogenous prolactin. She demonstrated that barren mares could be induced to lactate within 7 to 12 days. Some of the mares did produce a small amount of good-quality colostrums, but this has not been a general observation.4

The criteria suggested for a candidate for lactation induction include a mare that has given birth and successfully raised a foal before, a mare in good health, and a mare that has a gentle calm personality. If the mare has raised several foals, the udder may be more developed. These mares may also have a more predictable mothering behavior.5

Refinement of the original protocols has simplified the process. In the normal cycling mare, it may be possible to induce lactation with sulpiride or domperidone alone. In the anestrous mare, estrogen and progesterone priming is necessary. Daels recommends the following protocol for milk induction in a 500-kg mare (Table 1).5

| Nurse Mares | Options of providing an orphan foal with mare’s milk would include grafting the foal to a “nurse” mare. A nurse mare could be a mare that has recently (within 1 to 2 days) lost her own foal, or it can be a mare that is commercially leased to raise orphans. Commercial nurse mare farms will have mares that are bred for the purpose being available to adopt orphan foals. It is important to ask the foaling date of the mare that you will be using as a surrogate dam and if she still has the foal by her side. If the mare foaled several months ago, her milk may not be sufficient to sustain a newborn orphan. If the mare’s natural foal is not by her side, there is a high chance that the mare will “dry up” from the stress of transportation and introduction to a new environment.

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6. Grafting the Orphan Foal to a Surrogate Dam

In general, the hungry foal is not selective on who or what it nurses on. However, mares can be averse to accepting a foreign foal. Mares rely on their sense of smell at close range and sight at a distance to recognize their natural foal.7 Fostering a strange foal onto a mare requires fooling the mare’s senses. One method used by a nurse mare farm is to place a blanket on the mare’s natural foal and sprinkle it with a distinct scent. The mare and blanketed foal are trailered to the orphan foal farm together. The scented blanket is then placed on the orphan foal and the nurse mare is introduced to the orphan while her natural foal remains in the trailer.

Grafting should take place in a closed stall without neighboring horses. A minimum of two people are needed to introduce the mare and foal— one to control the mare and one to guide the foal to the udder. Safety of the foal and the handlers is of utmost importance for success. Aggression by the mare toward the foal should be disciplined, but an overall quiet calm environment is important. Sedation of the mare may aid in the process.

Several different approaches have been successful. In general, one can start introducing the foal to the mare’s head for sniffing and then gradually move the foal caudally, parallel to the mare’s body, to the flank region. The mare handler should prevent any biting of the foal by the mare, and the foal handler keeps the foal pressed against the mare to prevent her being able to kick the foal. It is best to not feed the foal before introduction, so that it is hungry. The foal should show interest in suckling various parts of the mare. Once the foal is at the level of the flank, the head should be directed under the mare with gentle pressure. Often the foal will suckle a finger coated in the mare’s milk up to the teat. It is important not to force the foal into the udder but allow it to explore the udder. Forcing the foal often results in resistance. Handlers must stay with the mare and foal to observe acceptance of the mare for the foal before safely leaving them alone. This generally takes between 4 and 24 hours.

Other mare restraint methods described include the use of a padded bar at shoulder height on the mare to prevent lateral movement.6 Solid nursing chutes that have an opening around the mare’s flank where the foal can access the udder have also been advocated.8 These methods offer safety to handlers and foals and can reduce labor by reducing the human presence. Hobbles can also be used on the mare to decrease the risk of injury to the foal.

Because it takes several days to induce lactation in the barren mare, it is advocated to house the mare and foal in adjacent stalls during the hormonal stimulation. The mare should be able to see and smell the foal. The mare’s feces can be placed in the foal’s stall. The mare’s behavior can be observed for separation anxiety by removing the foal from her sight. Signs of maternal behavior are good predictors that the mare is ready to adopt the foal.5

Not all foals will graft to a surrogate mare. Foals that have never nursed may not accept the mare. Mares that have had stillborn foals may not accept the foal. Some mares who have never had a foal may present with inappropriate lactation. These mares are not good choices for grafting foals because, although they may have milk, they are not hormonally primed to accept a foal, and forcing the interaction could be dangerous. Although some mares appear willing to accept everyone’s foal, it is unwise to graft an orphan onto a mare that already has a foal by her side.

7. Mare’s Milk Substitutes

If providing a surrogate dam for the foal is not an option, then hand-rearing the foal is necessary. A huge disadvantage to hand-rearing is the human intervention in the foal’s formative months. This is not just because of the increased labor involved but also because of the increased chances of behavioral problems.

There are many commercial products available for feeding the orphan foal. Milk replacers come in the powder form that are reconstituted with warm water or in a pelleted form that is generally fed to older foals. Most formulas need frequent changing to avoid spoilage, but some powder formulations are acidified, which allows it to be left out for longer periods of time without a problem.

The milk replacers simulate mare’s milk on the macronutrient level but there are important differences (Table 2).9 It is important to maintain the total solids in the reconstituted formula at 10% to 11%. Often the manufacturers recommend a powder-to-water ratio that results in higher total solid concentration. Higher total solids in the milk will often result in an osmotic diarrhea. To maintain the appropriate concentration based on the total solids, the powder:water ratio should be 1:9 or 10. It is also important to read the labels to determine the

### Table 1. Protocol for Lactation Induction in a Barren Mare

<table>
<thead>
<tr>
<th>Drug</th>
<th>Day 1</th>
<th>Day-2 Adoption</th>
<th>Days 7 to 10 After Adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostaglandin F20</td>
<td>5 mg, IM</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Estradiol benzoate</td>
<td>50 mg, IM</td>
<td>10 mg, IM q 24 h</td>
<td>n/a</td>
</tr>
<tr>
<td>Altrenogest</td>
<td>44 mg, PO q 24 h</td>
<td>44 mg, PO q 24 h</td>
<td>n/a</td>
</tr>
<tr>
<td>Domperidone</td>
<td>1.1 mg/kg, PO q 12 h</td>
<td>1.1 mg/kg, PO q 12 h</td>
<td>1.1 mg/kg, PO q 12 h for 10 to 20 days</td>
</tr>
</tbody>
</table>
source of the energy. Products containing malto-
dextrins, corn syrups, oligosaccharides, and glucose
polymers are not recommended for foals <3 weeks of
age because of the low level of maltase, the enzyme
needed to digest these disaccharides.10

On the micronutrient level, there are also differ-
bences between mare's milk and milk replacement
formulas. One study investigated 8 different foal
milk products compared with mare's milk for con-
centrations of Ca, Cu, K, Mg, Na, P, S, and Zn. Most of the milk substitutes met or exceeded the
mean value for mare's milk elements (one was low in
Fe). All of the milk substitutes exceeded the max-
imum amount of K and Na measured in mare's milk,
and 60% of substitutes exceeded the maximum in Zn
and Mg.11 The healthy foal does not have difficulty
in handling this excess. However, if you are feed-
ing a foal that may have renal compromise, the high
K can become a problem of decreased secretion in
the urine. Dilution of the formulas to half strength
may be helpful.

Because diarrhea can be a result of introducing a
mare's milk replacement formula, it may be wise to
start slowly at 10% of the foal's body weight (recon-
stituted equaling 5 L for a 50-kg foal) or by diluting
the formula to half/three-quarter strength. Re-
member that the normal week-old foal drinks be-
 tween 25% and 35% their body weight daily;
therefore, as the foal tolerates the new food, you
can increase the amount that it is eating by 3% to 5%
each day until you reach the foal's needs.

8. Other Species' Milk

Milk from other species has also been used to feed
the orphan foal. Again, there are differences that
can result in problems (Table 3). Cow's milk is
higher in fat and lower in sugars than mare's milk.
It can be modified by using 2% milk and adding 20 g
dextrose/L.12 Goat's milk is also higher in fat, total
solids, and energy. The fat in goat's milk is a sim-
er fatty acid composition and is digested better
than cow's milk. It can occasionally cause consti-
pation and metabolic acidosis.

9. Methods of Feeding

Obviously, if the orphan foal is being fed by a sur-
grrogate dam, the method of feeding is not a problem.

For the healthy orphan foal that is raised on a milk
substitute, there are 2 methods that are used—bot-
tle feeding and bucket feeding. Bottle feeding is
not recommended because of the excessive foal hu-
man bonding that takes place and the risk of aspi-
ration pneumonia from someone inexperienced in
feeding foals.

Bucket feeding has the advantage of being less
labor-intensive, and it decreases the human bonding
issue. To train a foal to drink from a bucket, one
would begin by placing warm milk formula in a
shallow pan so that the foal is not frightened by
having to place its nose into a deep bucket. The
foal should be positioned into a corner of the stall so
that they cannot back up further. With gentle re-
straint, the pan of milk should be brought up to the
foal's nose, dipping the muzzle into the milk. Dip-
ning your finger into the milk and allowing the foal
to suckle on your finger as you draw it closer to the
milk is also effective. Patience is needed for the
process because forcing the foal will meet with re-
 sistance. Once the foal takes a few sips, they begin
to understand the process. Most foals will learn to
bucket-feed within a day. Be prepared to be cov-
ered in milk by the end of the lesson!

Once the foal is trained to bucket-feed, food can be
left for it on a time schedule. Buckets should be
cleaned between feedings and fresh milk supplied.

Some foals that have experienced nursing from
their dams before becoming an orphan will have
difficulty adapting to bucket feeding. In these
foals, one can resort to feeding milk pellets or to
making a mash out of the milk pellets and teaching
the foal to eat a solid food by placing the pellets/

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**Table 2. Comparison of Nutrients Found in Mare's Milk to Three Leading Equine Milk Replacement Formulas**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Mare's Milk</th>
<th>Replacement A</th>
<th>Replacement B</th>
<th>Replacement C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total solids, DM%</td>
<td>10.7</td>
<td>11–13</td>
<td>16</td>
<td>12.5</td>
</tr>
<tr>
<td>Crude protein %</td>
<td>25</td>
<td>24</td>
<td>Min 19.5</td>
<td>Min 21</td>
</tr>
<tr>
<td>Crude fat %</td>
<td>17</td>
<td>16</td>
<td>Min 14</td>
<td>Min 14</td>
</tr>
<tr>
<td>Crude fiber %</td>
<td>0</td>
<td>0.15</td>
<td>Max 0.1</td>
<td>Max 0.15</td>
</tr>
<tr>
<td>Energy, kcal/L</td>
<td>580</td>
<td>Not listed</td>
<td>438</td>
<td>439</td>
</tr>
</tbody>
</table>

**Table 3. Comparison of Nutrient Components Between Mare's, Cow's, and Goat's Milk**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Mare's Milk</th>
<th>Cow's Milk</th>
<th>Goat's Milk</th>
</tr>
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<tbody>
<tr>
<td>Total solids, DM%</td>
<td>10.7</td>
<td>12.5</td>
<td>13.5</td>
</tr>
<tr>
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<td>25</td>
<td>27</td>
<td>25</td>
</tr>
<tr>
<td>Crude fat %</td>
<td>17</td>
<td>38</td>
<td>31</td>
</tr>
<tr>
<td>Energy, kcal/L</td>
<td>580</td>
<td>600</td>
<td>690</td>
</tr>
</tbody>
</table>

The nutrients are listed as a percentage of milk when reconsti-
tuted to the manufacturer's specifications.9
mash in its mouth repeatedly. It can be very frustrating, working with the foal that refuses the alternative to mare’s milk. Foals may also have taste preferences. Trying different brands of milk replacers may be helpful in finding the most palatable to the foal.

10. Frequency of Feeding
Remember that normally the week-old foal will nurse approximately 5 to 8 times per hour, depending on its age. It is impossible to mimic this feeding pattern in the orphan without a nurse mare. Naylor suggested the foals that are 1 day of age should be fed every 1.5 hours, with the number of feedings per day going from 16 on day 1 of age to 5 by day 15. During this time frame, the volume of the meals increases from 300 mL to 3 L, with the total daily volume increasing from 5 to 15 L per day.

Normal foals that are with their dams will investigate water, hay, and grain as early as the first days of life. It is important to familiarize the foal with these components early in life, even though they will not be able to gain nutrition from hay or grains until the large colon matures.

11. Weaning
In natural herds, foals may be still nursing once per hour at 6 months of age but get most of their nutrients from other sources. Some mares will nurse their foals up until the next foal is born. This is not practical for the orphan foal. Weaning can begin as early as 2 months, but is better if delayed until 3 to 4 months. The decision to wean should be based on the amount of nonmilk components of feed that the foal is ingesting. A slow reduction in the mixing rate of milk replacement and milk pellets as you add other grains and forage is the best way to proceed.

12. Outcome
Raising an orphan foal without a mare is a tremendous amount of work. Nutritionally, the orphan foal can thrive and prosper. The behavioral problems that can develop with the orphan foal are the most problematic, and owners must be reminded multiple times to find a nonhuman companion for their foals.

References and Footnotes

*Mare’s Match® Land O’Lakes, Arden Hill, MN 55126.
*Foal-Lac® Pet-Ag, Inc., Hampshire, IL 60140.
*Mare’s Milk Plus® Buckeye Nutrition, Dalton, OH 44618.