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Teaching Basic Equine Nutrition

Part 1: Making the Equine Digestive Tract Model

Introduction

Understanding the basic concepts of how to feed horses properly is important to ensure optimal health and performance in the horse. One of the most fundamental aspects of understanding equine nutrition is learning how the digestive anatomy and physiology of the horse influences what and how we feed horses to meet their nutritional needs.

Teaching Basic Equine Nutrition is a two-part series of publications that educators can use to help foster a fun and easy learning environment when teaching equine nutrition. This publication details how to assemble a model equine digestive tract that is easy to make, store, use, and transport for equine nutrition presentations to people of all ages (Hoffman, 2003). The model equine digestive tract is best used along with the second part of this series, "Teaching Basic Equine Nutrition, Part II: Digestive Anatomy and Physiology," which instructs educators about the physiology of the digestive tract and how it relates to good feeding management practices.

Characteristics of the Equine Digestive Tract

For the purpose of developing a model, the equine digestive tract can be divided into eight main parts: mouth, esophagus, stomach, small intestine, cecum, large colon, small colon, and rectum. There are also accessory organs such as the liver and pancreas that aid in digestion and can be incorporated into the model if desired; however they lie outside of the digestive tract and are not discussed in this publication. Each part of the digestive tract performs an important function and each part has one or more unique aspects about its anatomy or function that relates to proper feeding management of horses. The size and capacity, characteristics of each part and some recommendations for model parts for the model equine digestive system are shown in Table 1. A photo of a completed model equine digestive tract is included to serve as a guide during the assembly process (Figure 1). The total tract is roughly 100 feet in length.

Figure 1. Completed model equine digestive tract.

Making the Trip to the Store

In order to construct the model equine digestive tract, you will need to purchase all of the items needed. Depending on your location and the type of materials selected, the cost of the model equine digestive tract may vary. Table 2 provides a list of supplies and estimated costs and can be used as a list to take to stores. Most home improvement or hardware stores will have the items you will need to construct the model equine digestive tract. You may need to go to more than one store to collect all of the items. Also, think creatively to set your model tract apart from everyone else's!

Putting It All Together

Now that all of the items have been purchased, it is time to assemble the model. Directions for assembling the model equine digestive tract are below. Plan to spend about an hour assembling the model.

1. Lay out the 100-foot garden hose on a large flat dry surface. The garden hose will serve as the core of the entire model digestive tract that will hold it all together.
2. Starting at one end of the hose, use a permanent marker and measuring tape to mark a line on the hose where each organ will come to rest along the 100 feet of tract at the following locations:
    a.) 4 ft—end of esophagus/start of stomach
    b.) 5 ft—end of stomach/start of small intestine
    c.) 80 ft—end of small intestine/location of tee junction, cecum, and large colon
    d.) 90 ft—end of large colon
3. Examine your fuel storage container to see if it has two holes that can be used to slide the hose in and out of. Most containers only have one. Therefore, you will need to use scissors or another suitable cutting device to cut a hole at the other end of the handle opposite the existing hole so that the hole is large enough to feed the hose through.
4. Slide the fuel container into its position along the garden hose so that it rests 5 feet from the start of the hose.
5. Use duct tape or electrical tape to secure the garden hose to the fuel container at both ends. The fuel container will serve as the stomach (Figure 2)

Figure 2. A close up of the stomach.

6. Slide the tee junction into place from the end of the hose so that it rests about 80 feet from the beginning of the hose.
7. Secure the tee junction to the hose with duct tape allowing for the one side of the junction to remain open.
8. Slide the dryer hose up the garden hose to the site where the tee junction is located. You will need to cut a line about 3 inches in length at the end of the dryer hose closest to the tee junction to be able to reduce the diameter of the dryer hose. After it is cut, wrap the dryer hose securely around the tee junction and secure it with tape.
9. Lengthen out the dryer hose along the garden hose so that it stretches out its full 10 feet. If you have purchased a longer dryer hose, cut it down to 10 feet in length using scissors and/or wire cutters.
10. The next step involves making three curvatures in the dryer hose so that the audience can visualize how the colon folds on itself in order to fit snugly into the abdomen. The curvatures should be constructed approximately 2.5, 5, and 7.5 feet from the start of the dryer hose, so that they are evenly spaced. At each of those locations, bend the dryer hose so that it folds back on itself to make a curvature. In order to secure the curvature in place, take the scissors and poke one hole on each fold of the dryer hose, at the base of the curvature, so that the two holes are across from each other. Insert the electrical tie in one hole of one fold and out the other hole in the other fold, and then secure the electrical tie. Cut off any excess of the electrical tie. Repeat this step two more times at the distance mentioned above until the three curvatures have been formed.
11. Using scissors, cut a line about 3 inches in length at the end of the dryer hose closest to the remaining garden hose so that the dryer hose can be wrapped around the garden hose and secured with tape. The dryer hose will serve as the large colon (Figure 3).

Figure 3. The junction between the small intestine, cecum, and colon.

12. The rest of the garden hose will serve as the small colon (~ 10 ft) and rectum (1 ft). To make the small colon, pull a 2-3 ft piece of pantyhose over the hose and secure one end with duct tape. After cutting out the centers of 5 foam balls, slide them on over the hose and underneath the pantyhose. Secure the end of the pantyhose to the hose (Figure 4).

Figure 4. Small colon with noticeable fecal ball formation.

13. To make the cecum, take the clear plastic bag and fill it with about ½ flake of hay. Arrange the filled bag such that it is 4 feet in length and about 10 inches in diameter. Have fun with this and add plastic bugs to simulate the gut microflora. Use the duct tape to secure the garbage bag into the proper size. Then use the duct tape to secure the clear bag filled with hay and bugs onto the tee junction where the open hole has been left. Make sure to not overfill the cecum or else it will become too heavy to hold up during lectures and may break the garbage bag.
14. Use the plastic garbage can as a storage container. Place the model digestive tract gently into the garbage can in reverse order of how it will be used (i.e., rectum, colon, cecum, small intestines, stomach, and then esophagus). If you have a hat or picture to use to discuss the mouth and teeth, place this on the top.

15. Add the horse head to one side of your garbage can by cutting a hole with sturdy scissors. Cut another hole in your garbage can on the other side to insert the tail. Either tie a large knot on the inside of the tail to keep it from pulling through or use duct tape to secure it (Figure 5).

Figure 5. Garbage can holding model decorated with horse head and tail.

Table 1. Characteristics of the Equine Digestive Tract

Part	Average Size/Capacity	Characteristics	Model Ideas
Mouth	1-2 ft long	36-40 teeth	Photo, horse head hat, equine skull
Esophagus	4 ft long	Long cylinder	Garden hose
Stomach	2-4 gal capacity	Shaped like a kidney bean, distinct line called the *margo plicatus* separates the upper (non-glandular) and lower (glandular) portions	2 or 4 gallon fuel storage container
Small Intestine	70 ft long 3-4 inches in diameter 10-12 gal capacity	Long, narrow tube looped back and forth to fit in the abdomen	Garden hose
Cecum	4 ft long 25-30 cm in diameter 7-8 gal capacity	Shaped like a comma	Thick clear plastic bag taped to diameter of cecum, and filled with hay and bugs. Tee junction acts as valves
Large Colon	10-12 ft long 8-10 inches in diameter 30-35 cm right ventral 10 cm short transverse 15-23 gal capacity	Wider tube than the small intestine with three distinct curves that allow it to sit on itself in two rows shaped like a horseshoe	Dryer hose bound with plastic ties to make flexures
Small Colon	10-12 ft long 3-4 inches in diameter 5 gal capacity	Shaped like a tube	Garden hose, panty hose filled with Styrofoam balls

Table 2. List of Model Supplies and Estimated Cost[a]

Item	Description	Estimated Cost
1 Medium Duty Garden Hose	100 ft	$27
1 Plastic Fuel Storage Container	2-4 gallons	$12
1 PVC Tee Junction	1 ½ in diameter	$2
1 Dryer Vent Duct	20 ft long, 4 in diameter	$16
1 Heavy Clear Plastic Garbage Bag or XXL Ziploc Bag	4 ft long	$0.65 each (pack of 32) $3.91 each (pack of 3)
Plastic bugs/insects	1/2 to 1 in long	$0.26 each (pack of 12) x 4 packs = $12.50
Pantyhose (neutral)	Any size	$4
Styrofoam balls	4” diameter	$4/each x 6 = $24
Multipurpose/Electrical Plastic Ties	8 in long	$0.10/each (pack of 20) x 1 pack = $2.18
1 Roll Duct Tape	2 in wide	$4
1 Rectangular Shaped Plastic Garbage Can with Wheels	45 gallon	$25
Permanent Marker	Black	$2
Measuring Tape	100 ft long	$3
Stick horse	1 each	$19
Yarn for tail	30 yds	$3
Scissors	Heavy Duty	$6
Total Estimated Cost		$166

[a]Depending on your location and the type of materials selected, the cost of the model equine digestive tract may vary.

Summary

Congratulations! You are now ready to start using your model equine digestive tract for educational lectures on equine nutrition. Your model may need some minor repairs from time to time because of all of the use you will get out of it, so make sure to keep spare parts handy. The duct tape may be particularly useful in case your model equine digestive tract experiences a bout of colic (i.e., suffers normal wear and tear) and needs to be repaired. Before giving your equine nutrition lecture, make sure to read, “Teaching Basic Nutrition, Part II: Digestive Anatomy and Physiology,” which provides an overview of the unique aspects of the digestive tract and how they relate to good feeding management practices. During your lecture, you may want to involve the audience to help remove and lay out parts of the model. Lastly, handing out copies of the two “Teaching Basic Equine Nutrition” publications is a great way to encourage others to teach and/or learn about equine nutrition.

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References

Hoffman, R.M. 2003. “The ins and outs of digestive physiology: an equine nutrition teaching tool.” Proc. 18th Equine Sci. Soc. Symposium, June 4-7th, East Lansing, MI.

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