Equine Digestive Physiology & Reading Your Own Hay Analysis

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Digestive Physiology

The Unique Features of the Equine Digestive Tract

The Equine Gastrointestinal Tract

The Foregut: Enzymatic Digestion

Electrolytes
 Lubrication

Foregut: Enzymatic Digestion cont.

- O Liquefies teed
 O Partial breakdown of proteins
 Constian of major nutrients

Foregut: Enzymatic Digestion cont.

Small Intestine

- Neutralizes acid from stomach
- O Enzymatic digestion of protein, starch, sugar, fat

Accessory Organs

- Produces Digestive Enzymes, Released into SI
 Produces Insulin, Released in bloodstream

- O Bile Production for Fat Emulsification
 O Glucose and VFA Processing

The Hindgut: Fermentation

- O Includes Caecum, Large and Small Colons
- O Up to 48 hour rate of passage

The Hindgut: Fermentation cont.

The Hindgut: Fermentation cont.

Larae Colon

- Same function as Caecum, H2O absorption

The Hindgut: Fermentation cont.

- 10-50 billion bacteria, 1 million protozoa, variable yeasts and fungi
 400 different species of microbes

Main Nutrients

Protein

Non-Structural Carbohydrates (NSC)

Structural Carbohydrates (SC) = Fiber

- O Components of plant cell walls: cellulose, hemicellulose, pectin
- O Sources: beet pulp, grasses, hays, soy hulls and other grain shells/hulls

Fermentation end products: VFA

- O Minor Types: lactate and succinate
- Rapidly absorbed in the hind gut

Microbiology Balancing Act

Nutrient Analysis

What It All Means

"As Fed" vs "Dry Matter"

- As Fed includes the moisture content of feed
- Dry Matter (DM) excludes the moisture content
- Feeds may be compared equally on a DM basis onl
- Moisture Content should be <10% in hay

CP (Crude Protein)

- O Does not indicate protein quality
- Acceptablerange 10-14%
- Varies with age, development, workload etc.

ADF (Acid Detergent Fibre)

- O Represents the least digestible/fermentable part of the plant: Cellulose and Lignin
- Higher ADF% = Lower Digestibility = Lower Energy
- More mature plants hav e higher ADF% (1st cut hay)
- Acceptablerange <40%

NDF (Neutral Detergent Fiber)

- Represents total cell wall content of feed
- O Includes Cellulose, Hemicellulose, Lignin but not pectin
- Higher NDI %= Lower reed in
- O Desirable range 30-60%
- NDF-ADF=~hemicellulose%=15-25%

Starch

- Digested in \$1 to simple sugars and absorbed in \$1
- Limited enzyme production affects starch digestion in the S
- Undigested starch overflows into the caecum causing digestive disturbances**
- Acceptablerange is <1.2%

WSC (Water Soluble Carbohydrates) & ESC (Ethanol Soluble Carbohydrates)

- WSC=Simple Sugars and Fructans
 - Acceptable range is <14%, and <11% for EMS horses
- ESC = Simple Sugars only
 - Best indicator of effect on blood sugar levels
- Acceptable range is <12%, and <8% for EMS horses

NSC (Non-Structural Carbohydrates)

- NSC = WSC (Simple sugars and Fructan) + Starc
- Feed primarily digested in SI and absorbed as simple sugars 🤸
- O Acceptable range is <14%, and <11% for EMS horses**

Fructans

Associated with laminitis

- A local back of a straight of the straight of
- Can lead to colic, diarrhea and laminiti
- WSC (simple sugar & Fructan) ESC (simple sugar) = Fructan content
- Acceptablerange is <4%



Why so many variations in grass hay?





How to Sample Hay for Analysis

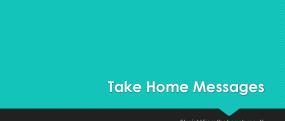
Gold Standard : Hay Drill

- Alternative:
 - O Collect one handful from INSIDE of 10-12 hay bales
 - Thoroughly mix ALL hay samples together in dry bucket
 - Collect sub-sample to fill large Ziploc bag
- O Hay Analysis is only as good as your sampling technique!

How to Balance your Hay

O Mix hays to balance rations BY WEIGHT

- Hay 1 has 6% CP and 16% NSC
- Hay 2 has 18% CP and 8% NSC
- Feeding 50% of each BT WEIGHT = CP 12% and NSC 12%
- O Add hay cubes to increase protein content
- O Use beet pulp or soy hulls to improve fiber content
- O Don't buy poor quality hay!



Straight from the horse's mouth

Hay: Major Diet Component

- O Start with finding a GOOD QUALITY hay, dust free and mould free
- Should be MINIMUM of 50% in horses' diet BY WEIGHT
- Alfalfa should be MAXIMUM of 50% of hay fed BY W EIGH
- Don't forget the importance of adequate FRESH WATER, vitamins and minera
- Mix or add other hays or feeds when needed and know WHY you are giving them

Get a Hay Analysis

- Use hay analyses in choosing the right hay
- Use hay analyses in balancing different has
- Hay analyses VARY from year to year
- O Hay analyses are as good as their sampling technique

Other Feeding Instructions

- O Cereal grains (and other NSCs) add rapidly available energy (sugars) for performance
- O Fiber sources add slowly released energy and help with digestion and weight gain
- O Fat sources help with weight gain and slowly released energy
- Should be slowly incorporated in diet
- O Consult your veterinarian for other special consideration

Grains & Pelleted Feeds

'here's a place for them too

EAA (Essential Amino Acids)

- 12 of 22 AA are synthesized by the horse (Non-Essential AA)
- O 10 others must be found in feed (Essential AA) O Lysine, Arginine, Histidine, Isoleucine, Leucine, Methionine, Phenyldanine Threonine, Valine, Tryptophan
- O The most deficient AA are called Limiting AA
- Building blocks for body's protein needs (muscles, milk, enzymes)
- Quantity of most limiting EAA affects protein development
 - Proteinsource Quality vs Quantity

Take Home Msg: Pellets & Supplements

- O Read the ingredient list: Protein, Fat, Fiber, NSC, Vitamin or Mineral?
- O Read the nutrient analysis or consult your veterinarian
- Don't forget about the NSC not listed
- Feed max 4-5 lbs in one feeding for 500kg hors
- O Case selection: Purpose? Risk? Deficiencies? Surplus