

Advanced Equine Nutrition

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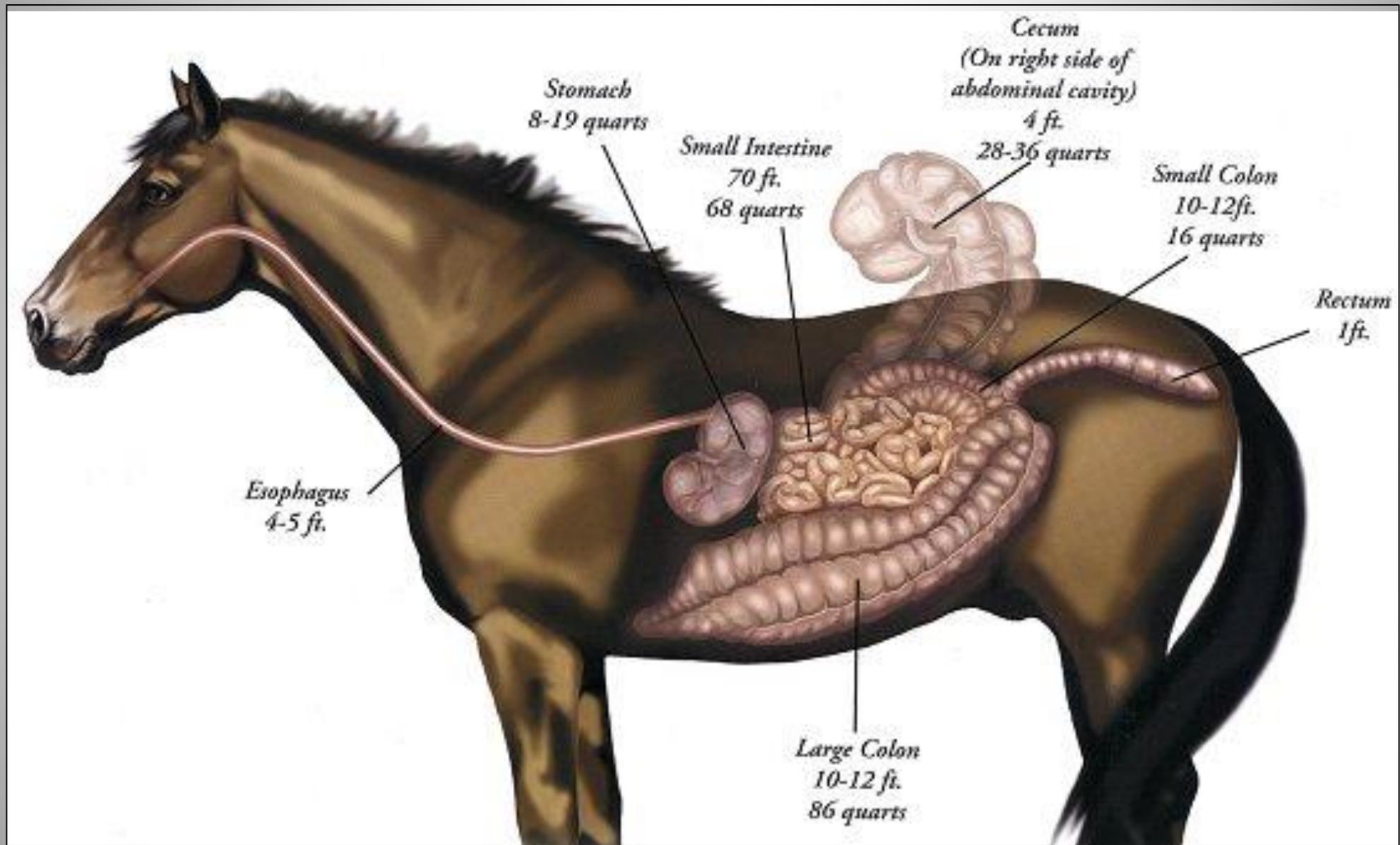


Topics

- **Gastrointestinal tract of the horse**
 - Anatomical overview
 - Unique characteristics
 - Differences between other species
- **Nutrition**
 - Specific nutrients
 - Energy requirements
 - NSC and structural CHO
 - Forage options

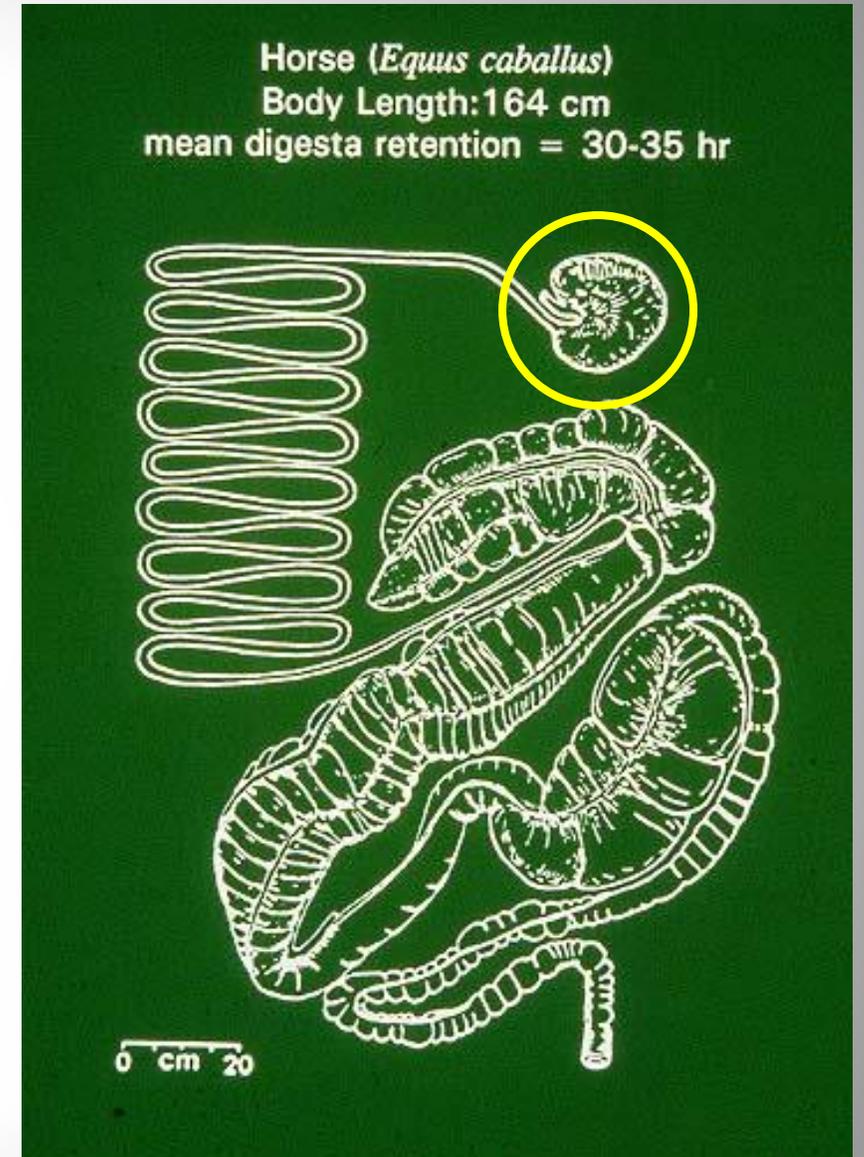
Topics

- **Disorders, syndromes, maladies**
 - Gastric ulcers
 - Acidosis
 - Colic
 - Laminitis
 - EMS
- **Hoof health**
- **Feeding the Competition horse**



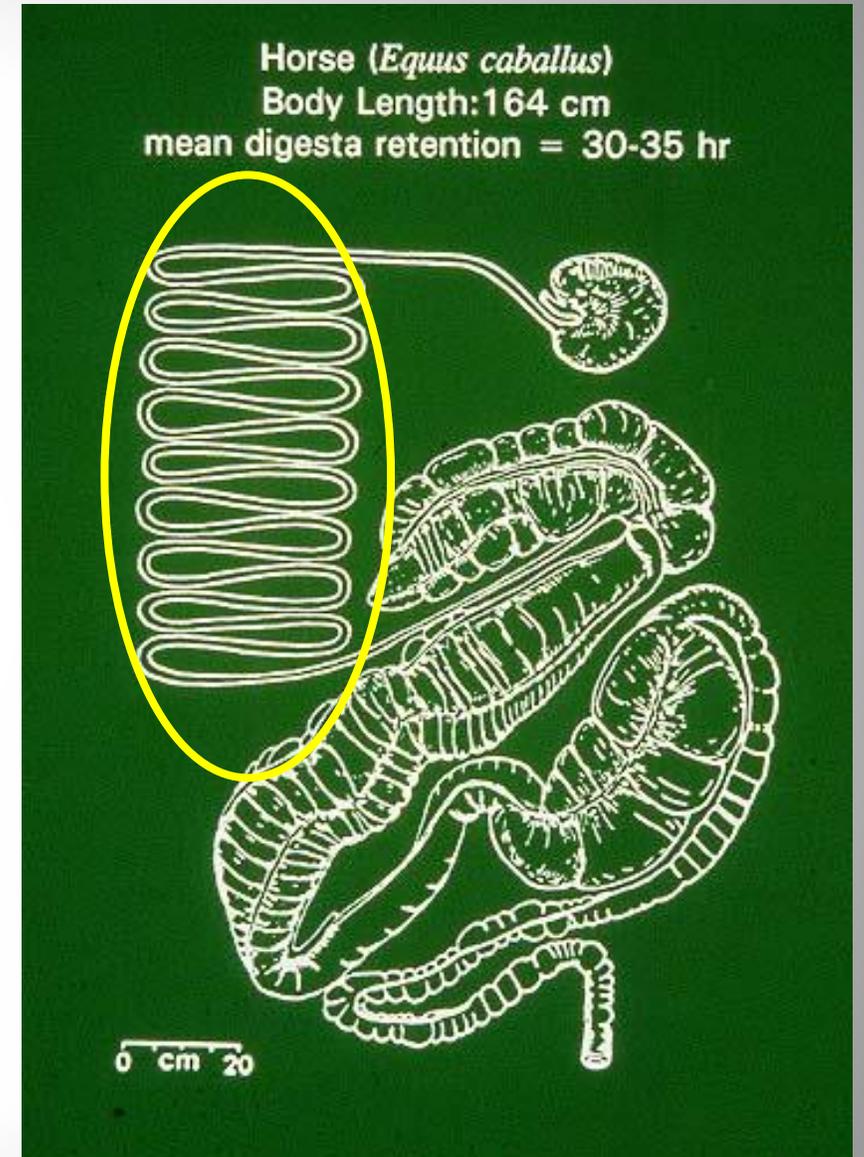
Stomach

- 10% of total gastrointestinal tract (GIT)
 - 8 to 12 Liters
- Small, single compartment
- Protein, starch, fat digestion
- Dictates meal size
 - No more than 2 kg grain per meal



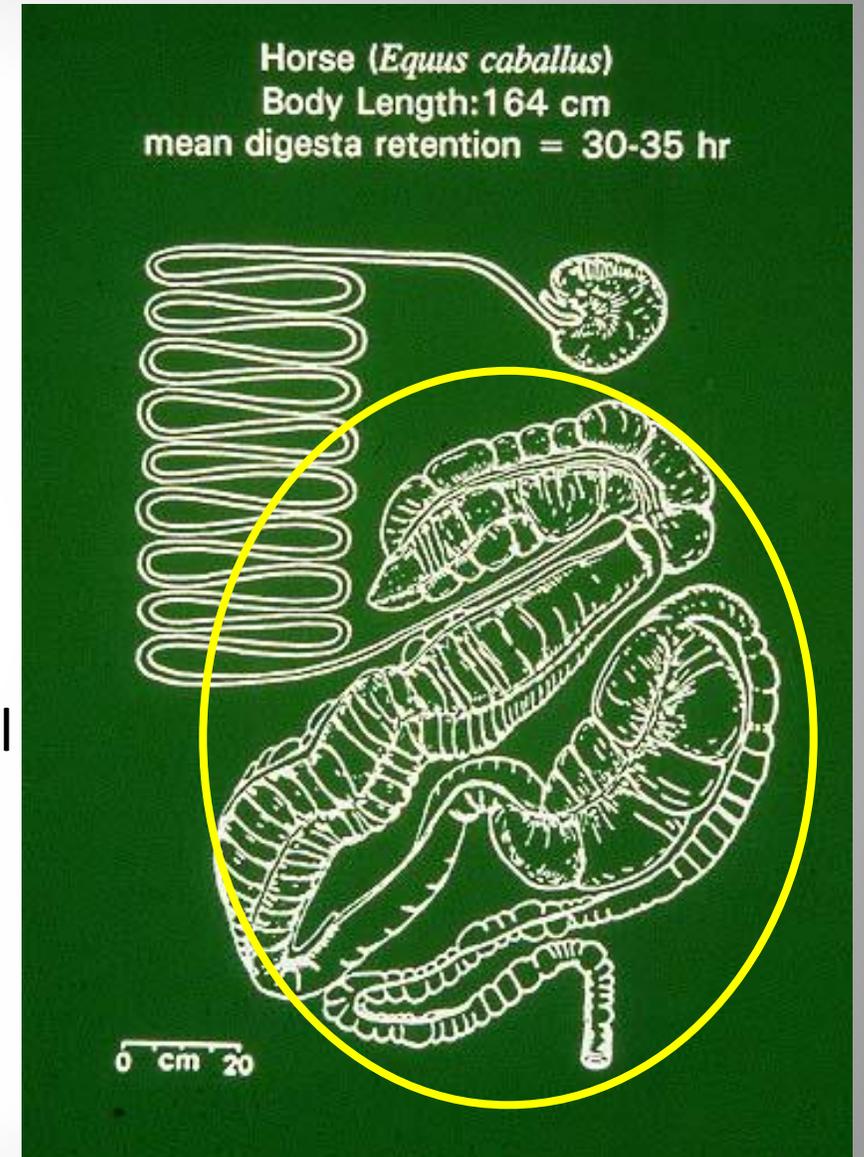
Small Intestine

- 25% of total GIT
- 20+ meters long
- Digestion & absorption
 - Non-structural carbohydrates
 - Proteins
 - Fats
 - Minerals
 - Vitamins



Large Intestine(Hindgut)

- >65% of total GIT
- Cecum, large colon, small colon
 - Cecum: large, sacculated
 - Large colon: 4 sections progressively smaller
 - Right ventral, Left ventral, Left dorsal, Right dorsal
 - Small colon
 - Fecal balls made
 - Rectum



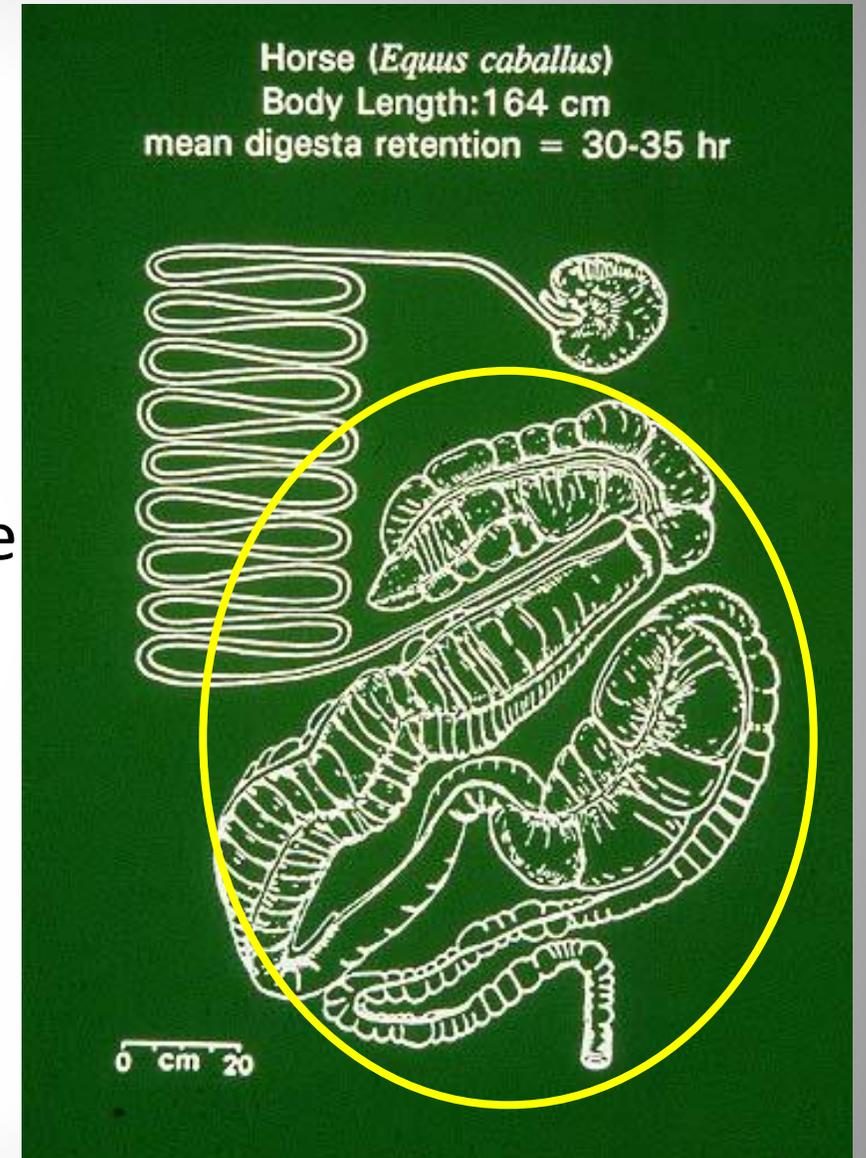
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Large Intestine (Hindgut)

- Microbial digestion of structural carbohydrates (grasses, hays)
- Large volume to allow for long fermentation time
- B and K vitamins produced from bacteria



Unique to the horse

- No gall bladder
 - Can still effectively digest fats
 - Bile constantly produced by liver and delivered directly to small intestine
- Cannot eructate or vomit
 - Toxins and poisons
 - No additional digestion achieved by chewing cud
 - Excessive gas cannot escape from esophagus/mouth



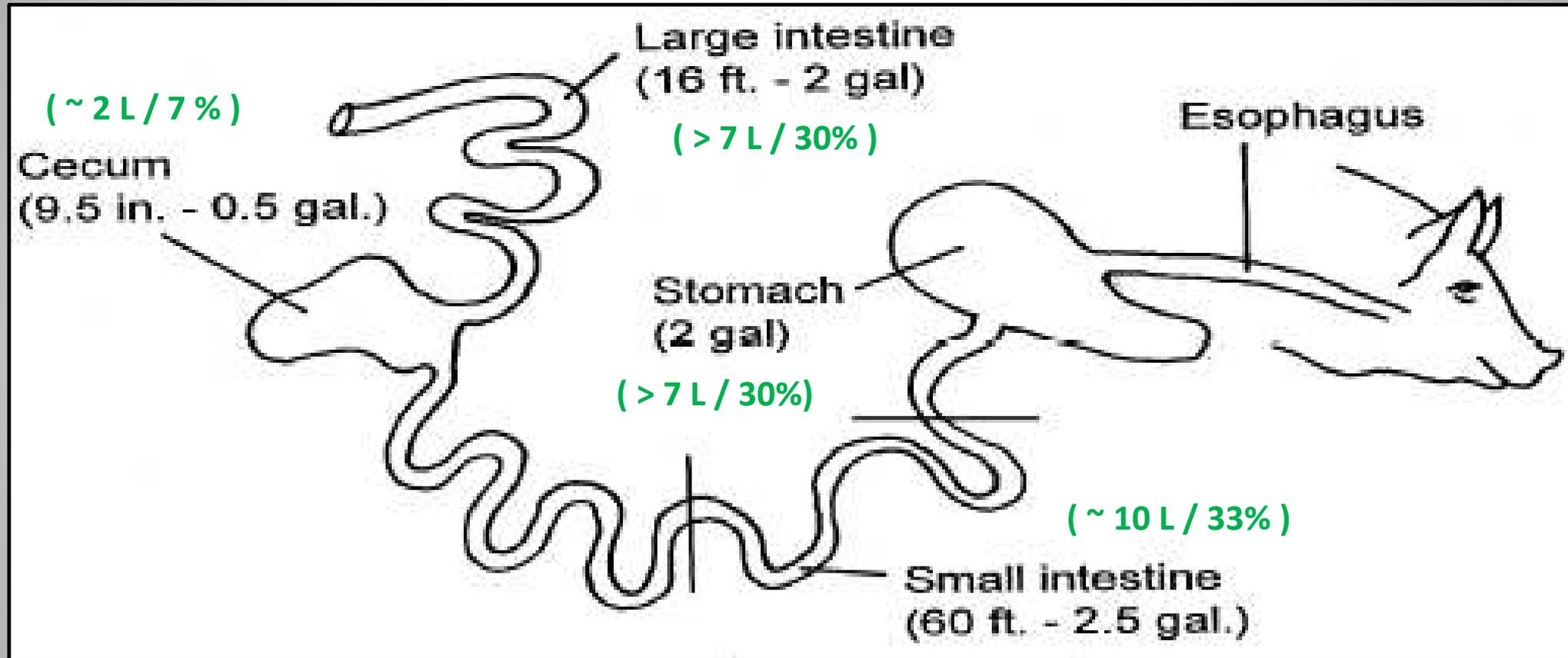
Common questions from horse owners:

Can I feed my horse pig feed?

Can I feed my horse chicken feed?

Can I feed my horse cow feed?

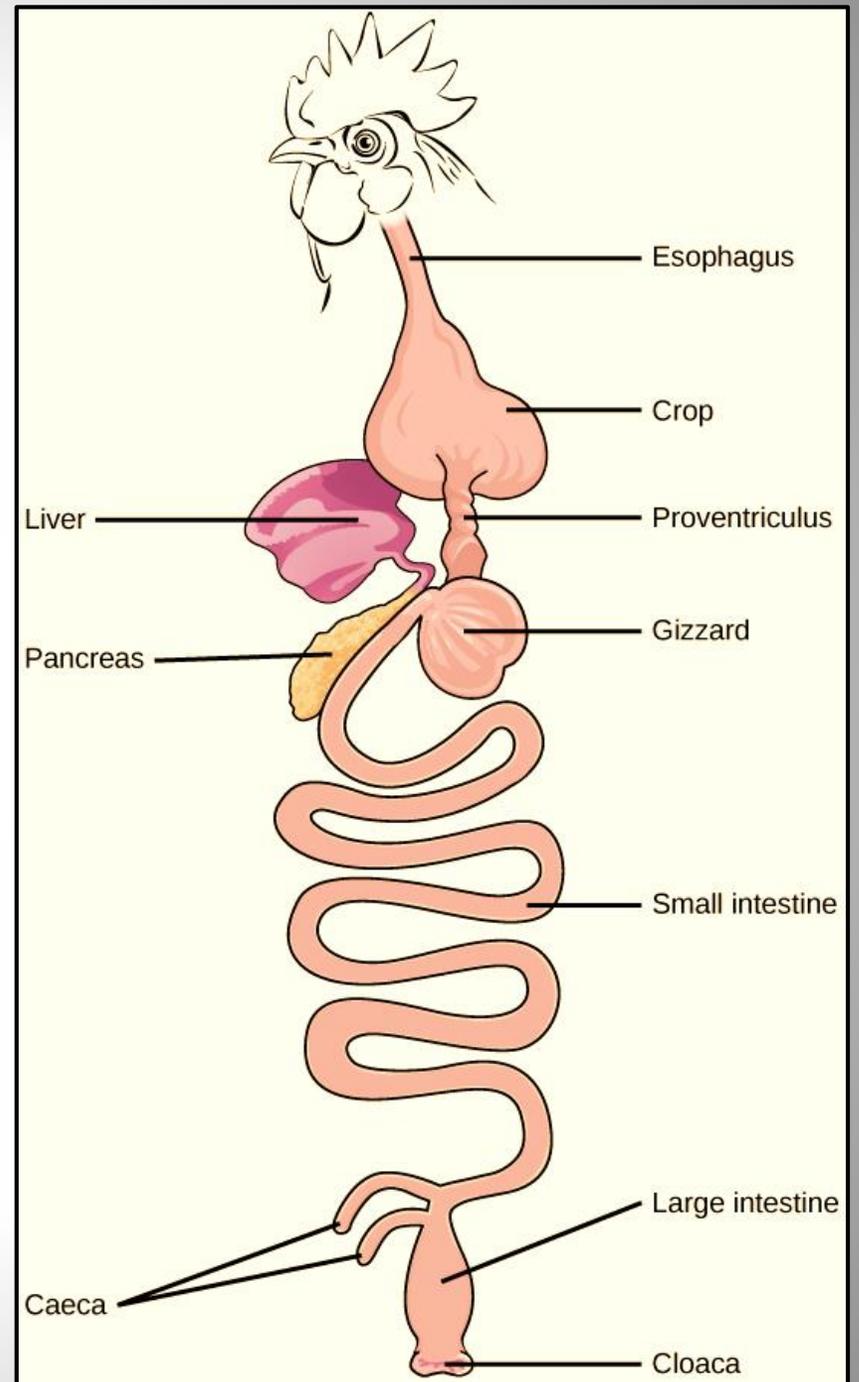
Amylase is a starch digesting enzyme



Pig produces
10x more amylase than horse



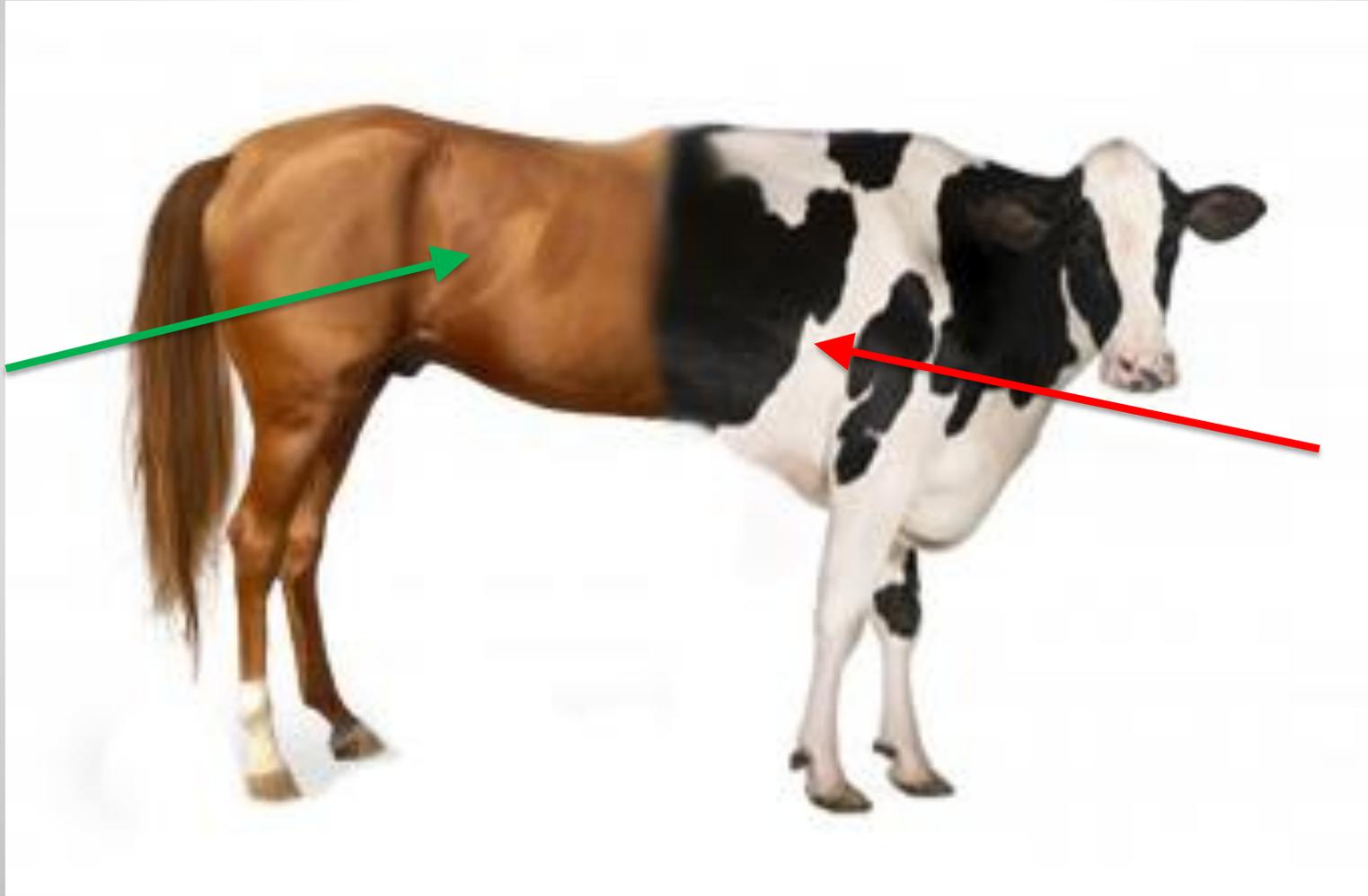
10x more amylase =
10x more starch digestion



Common chicken feed ingredients

- The main animal protein sources used in chicken diets are meat meal, bone meal, fish meal, poultry by-product meal, blood meal and feather meal.
- Corn is by far the most important energy source for chicken feed.
- A variety of fats and oils are used, including fats of animal origins, eg., tallow, lard.
- Chicken feeds often medicated with ionophores that act as coccidiostats.
- Incorrect balance of amino acids for horses.
- Too much corn can lead to gastric upset and acidosis/colic.
- Fat from animals not palatable and poorly digested by horses.
 - Horses are herbivores.
 - Chickens are omnivores.
- **Ionophores are toxic to horses.**

Cow vs Horse



**HINDGUT
FERMENTER**

**FOREGUT
FERMENTER**

Cow vs Horse

- Foregut fermenter
 - Foregut volume > 250 liters
 - Feed retention time \approx 48 hours
 - Eructate and chew cud regularly to increase digestibility of forages
 - Ionophores (monensin, rumensin) common in feeds
- Hindgut fermenter
 - Hindgut volume \approx 130 liters
 - Feed retention time \approx 24 hours
 - Cannot eructate or vomit
 - ***Ionophores are toxic!!***



Ionophores

- **Sign of ionophore toxicity**
 - Weakness, inability to get up, unsteady gait, abdominal pain, diarrhea, excessive urination, heart failure or death.
 - Acute toxicity may progress so quickly that no symptoms observed prior to death.
- **Rarely treatable**
 - Most die or euthanized.
- **Horses that survive generally experience damage to the heart and/or muscles.**
- **Owners should contact veterinarian immediately.**



Equine Nutrition



Nutrients

Energy sources

Forages/fibers

Feeding management

Nutrient Needs

- “Nutrient” is any feed constituent necessary for the support of life.
- Six classes of nutrients:
 - water*
 - protein*
 - carbohydrates*
 - fats*
 - minerals*
 - vitamins*
- Energy is not a nutrient
 - Energy is derived from nutrients.



What is the most important essential nutrient?

What is the most important essential nutrient?

WATER

Water requirement

- Water is the most important nutrient
 - Free access to clean fresh water
- Horses require large quantities of water
 - Fermentation
 - Healthy GI function
 - Muscle function
 - Large muscle mass



Water requirement

- Factors affecting water requirement
 - Fiber intake (fresh vs. dried)
 - Water intake increases 3-4 liters per kg of hay intake
 - Lactation
 - Early stage approximately equal to working athlete
 - Environmental temperature
 - Temperature $> 24^{\circ}\text{C}$ increases water requirement
 - Exercise training
 - 20 – 300 % over maintenance



Water Precautions

- Horses should be allowed to drink during exercise.
- And after hard work horses should be allowed to drink 1-2 Liters every 20 minutes during cool down.
 - Research indicates not allowing horses to drink after work may further delay rehydration thereby affecting normal digestion and muscle.



Water Precautions



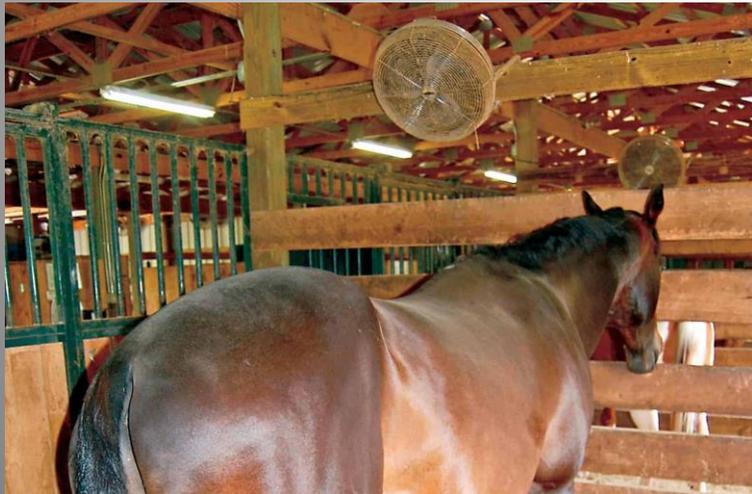
Anhidrosis

- **Non-sweaters**
- **Environmental factors**
 - Humidity
 - Native and imported can be affected
- **Treatment**
 - Move to cooler climate only known “cure”
 - Manage symptoms



Anhidrosis

- **Managing to prevent high body temperature**
 - Provide salt/electrolytes daily to encourage drinking
 - Research does not support “anhidrosis supplements”
 - Keep stalled or in shaded paddocks
 - Fans and misters or sprinklers



Other Nutrients

Protein

- 80% of the horse's body is protein on a dry, fat-free basis.
- Protein is made up of amino acids.
 - Essential amino acid must be consumed from food.
 - Non-essential amino acids can be made by the body.



Is excess protein bad?

- Body removes metabolized protein end-products in urine
 - Ammonia, Urea
- Effects
 - Increased water intake
 - Increased urination
- Protein can be used for energy
 - Not ideal



Macrominerals - Electrolytes

- **During exercise**
 - # sodium, potassium, chloride and magnesium lost in sweat and urine.
- **Loss of electrolytes**
 - # causes fatigue and muscle weakness.
- **Loss of electrolytes**
 - # decreases thirst response to dehydration.



Salt Supplementation

- Free choice access
 - Loose salt or a salt block
 - Adequate for non-working horses
- Athletic horses
 - Add salt or commercial electrolytes to ration
 - Read labels of commercial products taste
 - 2-3:1 (NaCl:KCl)



Minerals

BALANCE

- **Macrominerals**

- Calcium
- Phosphorus
- Magnesium
- Potassium
- Sodium
- Chloride
- Sulfur

- **Microminerals**

- Iron
- Zinc
- Copper
- Manganese
- Iodine
- Selenium

Selenium (Se)



Selenium (Se)

plays an important role in the maintenance of membrane integrity, growth, reproduction and immune response.

Selenium (Se)



- Selenium is a required nutrient
- Selenium is highly toxic
 - Required in very small quantities
- Narrow difference between requirement and toxic levels
- Toxic levels begin at 2 mg/kg intake
- ALWAYS consider all sources of Se when making supplement recommendations

Vitamin E

- Functions as an antioxidant
- Performance horses should receive 800-1200 IU/day



Antioxidant Recycling

- Disabling free radicals → minor free radicals
 - Minor free radicals can be “recycled” or regenerated into active antioxidant status again
 - Vitamin E, Glutathione, glutathione peroxidase, vitamin C, alpha-lipoic acid and Co Enzyme Q₁₀ (ubiquinol) all involved in the antioxidant recycling system in horses.



Recycled Antioxidants

- Vitamin E is the only antioxidant in the recycling system that is not produced by the body
 - Optimal supplementation critical for hard-working and pregnant/lactating horses
 - Natural vitamin E
 - Superior bioactivity
 - Superior absorption



USE the NRC

TABLE 16-3 Daily Nutrient Requirements of Horses (Mature Body Weight of 500 kg)^a

Type	Wt kg	ADG/ Milk kg/d	DE Mcal	CP g	Lys g	Ca g	P g	Mg g	K g	Na g	Cl g	S g	Co mg	Cu mg	I mg	Fe mg	Mn mg	Se mg	Zn mg	A kIU	D IU	E IU	Thiamin mg	Riboflavin mg
Adult—no work^b																								
Minimum	500		15.2	540	23.2	20.0	14.0	7.5	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	15.0	3300	500	30.0	20.0
Average	500		16.7	630	27.1	20.0	14.0	7.5	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	15.0	3300	500	30.0	20.0
Elevated	500		18.2	720	31.0	20.0	14.0	7.5	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	15.0	3300	500	30.0	20.0
Working^c																								
Light exercise	500		20.0	699	30.1	30.0	18.0	9.5	28.5	13.9	46.6	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	22.5	3300	800	30.0	20.0
Moderate exercise	500		23.3	768	33.0	35.0	21.0	11.5	32.0	17.8	53.3	16.9	0.6	112.5	4.0	450.0	450.0	1.13	450.0	22.5	3300	900	46.3	22.5
Heavy exercise	500		26.6	862	37.1	40.0	29.0	15.0	39.0	25.5	66.5	18.8	0.6	125.0	4.4	500.0	500.0	1.25	500.0	22.5	3300	1000	62.5	25.0
Very heavy exercise	500		34.5	1004	43.2	40.0	29.0	15.0	53.0	41.0	93.0	18.8	0.6	125.0	4.4	500.0	500.0	1.25	500.0	22.5	3300	1000	62.5	25.0
Stallions																								
Nonbreeding	500		18.2	720	31.0	20.0	14.0	7.5	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	15.0	3300	500	30.0	20.0
Breeding	500		21.8	789	33.9	30.0	18.0	9.5	28.5	13.9	46.6	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	22.5	3300	800	30.0	20.0
Pregnant Mares																								
Early (< 5 months)	500		16.7	630	27.1	20.0	14.0	7.5	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
5 months	504	0.14	17.1	685	29.5	20.0	14.0	7.5	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
6 months	508	0.18	17.4	704	30.3	20.0	14.0	7.5	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
7 months	515	0.24	17.9	729	31.3	28.0	20.0	7.6	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
8 months	523	0.32	18.5	759	32.7	28.0	20.0	7.6	25.0	10.0	40.0	15.0	0.5	100.0	3.5	400.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
9 months	534	0.41	19.2	797	34.3	36.0	26.3	7.7	25.9	11.0	41.0	15.0	0.5	125.0	4.0	500.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
10 months	548	0.52	20.2	841	36.2	36.0	26.3	7.7	25.9	11.0	41.0	15.0	0.5	125.0	4.0	500.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
11 months	566	0.65	21.4	893	38.4	36.0	26.3	7.7	25.9	11.0	41.0	15.0	0.5	125.0	4.0	500.0	400.0	1.00	400.0	30.0	3300	800	30.0	20.0
Lactating Mares																								
1 month	500	16.30	31.7	1535	84.8	59.1	38.3	11.2	47.8	12.8	45.5	18.8	0.6	125.0	4.4	625.0	500.0	1.25	500.0	30.0	3300	1000	37.5	25.0
2 months	500	16.20	31.7	1530	84.4	58.9	38.1	11.1	47.7	12.8	45.5	18.8	0.6	125.0	4.4	625.0	500.0	1.25	500.0	30.0	3300	1000	37.5	25.0
3 months	500	14.95	30.6	1468	80.3	55.9	36.0	10.9	45.9	12.5	45.5	18.8	0.6	125.0	4.4	625.0	500.0	1.25	500.0	30.0	3300	1000	37.5	25.0
4 months	500	13.55	29.4	1398	75.7	41.7	26.2	10.5	35.8	11.9	45.5	18.8	0.6	125.0	4.4	625.0	500.0	1.25	500.0	30.0	3300	1000	37.5	25.0
5 months	500	12.20	28.3	1330	71.2	39.5	24.7	10.2	34.8	11.7	45.5	18.8	0.6	125.0	4.4	625.0	500.0	1.25	500.0	30.0	3300	1000	37.5	25.0
6 months	500	10.90	27.2	1265	66.9	37.4	23.2	8.7	33.7	11.5	45.5	18.8	0.6	125.0	4.4	625.0	500.0	1.25	500.0	30.0	3300	1000	37.5	25.0
Growing animals																								
4 months	168	0.84	13.3	669	28.8	39.1	21.7	3.6	10.9	4.2	15.7	6.3	0.2	42.1	1.5	210.6	168.5	0.42	168.5	7.6	3740	337	12.6	8.4
6 months	216	0.72	15.5	676	29.1	38.6	21.5	4.1	13.0	5.0	20.1	8.1	0.3	54.0	1.9	269.9	215.9	0.54	215.9	9.7	4793	432	16.2	10.8
12 months	321	0.45	18.8	846	36.4	37.7	20.9	5.4	17.4	6.9	26.5	12.0	0.4	80.3	2.8	401.5	321.2	0.80	321.2	14.5	5889	642	24.1	16.1
18 months	387	0.29	19.2	799	34.4	37.0	20.6	6.2	20.2	8.0	32.0	14.5	0.5	96.9	3.4	484.4	387.5	0.97	387.5	17.4	6161	775	29.1	19.4
18 light exercise	387	0.29	22.1	853	36.7	37.0	20.6	11.6	22.9	11.0	37.1	14.5	0.5	96.9	3.4	484.4	387.5	0.97	387.5	17.4	6161	775	29.1	19.4
18 moderate exercise	387	0.29	25.0	906	39.0	37.0	20.6	11.6	22.9	14.0	42.2	14.5	0.5	96.9	3.4	484.4	387.5	0.97	387.5	17.4	6161	775	29.1	19.4
24 months	429	0.18	18.7	770	33.1	36.7	20.4	6.7	22.0	8.8	35.4	16.1	0.5	107.3	3.8	536.5	429.2	1.07	429.2	19.3	5880	858	32.2	21.5
24 light exercise	429	0.18	21.8	829	35.7	36.7	20.4	12.9	25.0	12.1	41.1	16.1	0.5	107.3	3.8	536.5	429.2	1.07	429.2	19.3	5880	858	32.2	21.5
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24 very heavy exercise	429	0.18	32.5	1091	46.9	36.7	20.4	12.9	46.0	35.4	80.9	16.1	0.5	107.3	3.8	536.5	429.2	1.07	429.2	19.3	5880	858	32.2	21.5

^aThe daily requirements listed in this table for S, Co, I, Fe, Mn, Se, and Zn are calculated using assumed feed intakes of 2.5% of BW for heavy and very heavy exercise, lactating mares, and growing horses; 2.25% of BW for moderate exercise; and 2% of BW for all other classes. Daily requirements for Cu are also calculated from assumed feed intakes for adult horses (no work) and exercising horses.

^bMinimum maintenance applies to adult horses with a sedentary lifestyle, due either to confinement or to a docile temperament. Average maintenance applies to adult horses with alert temperaments and moderate voluntary activity. Elevated maintenance applies to adult horses with nervous temperaments or high levels of voluntary activity.

^cExamples of the type of regular exercise performed by horses in each category are described in Chapter 1. These categories are based on average weekly exercise. Four categories are given but users should recognize that the nutrient requirements are more accurately described by a continuous function than by discrete groups.

Energy

- Primarily, energy is derived from 2 major nutrients
 - FATS
 - CARBOHYDRATES



Dietary fat

- Energy dense
 - 2.5x corn
 - 3.0x oats
- Highly digestible
 - Some adaptation required
- Health benefits
 - minimize digestive upsets
 - improve coat condition
 - horses with muscle disorders
- “Calm” energy
 - some horses more easily handled when fed fat



Common sources of dietary fat

- Vegetable oils
 - Corn, soya, canola (rapeseed)
 - Linseed (flaxseed)
- Stabilized rice bran
 - Outer coating of the rice grain
 - 20% fat (but low starch)
- How much oil?
 - Up to 100 ml/100 kg kg
 - TOP LEVEL
 - Introduce slowly
 - 50 ml 4-5 days
 - 100 ml 4-5 days
 - 200, 300, 400, 500 ml 4-5 days



Other purposes of feeding oils – Provide omega-3

- Soy oil is most common;
relatively high ratio of omega-3 to omega-6 fatty acids (ALA)
 - High palatability and digestibility at an affordable price.
- Flaxseed (linseed) oil is often fed to horses and is high in omega-3 fatty acids
 - Stability issues
 - Expensive if stabilized
 - Whole seeds not digestible...tough seed coat
- Fish oils best source of omega-3 (EPA and DHA)
 - Palatability and stability issues
 - Can be deodorized and stabilized

Carbohydrates



Carbohydrates



Carbohydrates



Carbohydrates



Energy from Carbohydrates

- **Structural carbohydrates**
 - Cellulose, Hemicellulose
 - Fresh grass, dried grass or hay, beet pulp, soybean hulls...
- **Non-structural carbohydrates (NSC)**
 - Starches, sugars
 - Grains, grain by-products, molasses...



Forage Requirements

- Horses require a minimum forage intake of **1% of BW (DM)**
 - 300 kg horse minimum requirement = 3 kg forage/day
 - 550 kg horse minimum requirement = 5.5 kg forage/day
- Horses optimal forage intake is **1.5%-2% of BW (DM)**
 - 300 kg horse optimal intake = 4.5 kg forage/day
 - 550 kg horse optimal intake = 8.25 kg forage/day

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Fresh Grass
~ 54% water



Grass Hay
~ 8% water

All forage requirements assume **good quality** and **digestible** forages are fed.

- **Good quality** =
clean, mold-free,
adequate nutrition
 - Protein minimum 7-8% CP
 - Local paragrass ~ 2-4% CP
 - Local pangola ~ 4-8.5% CP
- **Digestible** =
adequate energy
can be obtained from digestion
 - 1.5 Mcal/kg (min)
 - 2.0 Mcal/kg (better)

More common forages - Thailand



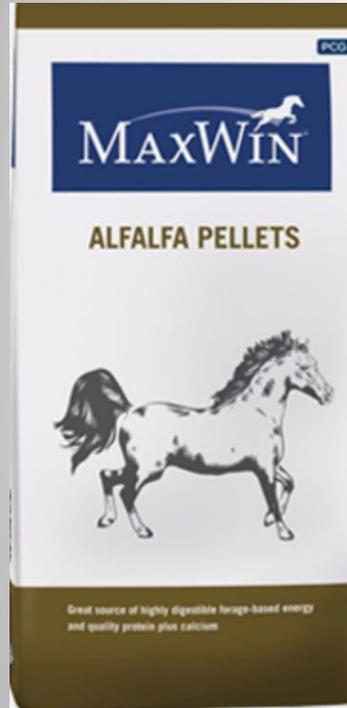


Feeding forage pellets

- High quality forages used
 - Timothy
 - Alfalfa
 - Blends
- Consistent quality throughout
- Consistent nutrition throughout
- Minimal waste
- Easy weighing for adequate intake
- ?? Long stem necessary?? no



MaxWin Forage Pellets



Beet Pulp

- Relatively high in hemicellulose
- Highly fermentable by hindgut microorganisms
- Easier to chew and swallow when soaked in water about 20 minutes.
 - Can help senior horses and those with poor dentition
 - Can provide extra water
 - Weigh prior to soaking
- Similar in calories to oats (w/w basis)



Why feed grain?

- Grain is fed:
 - **1. To increase amount of calories (energy) fed**
 - If working
 - If pregnant/lactating
 - If breeding (stallion)
 - If growing
 - If hard-keeper
 - If recovering from illness or surgery

Why feed grain?

- Grain is fed:
 - 2. **To provide essential nutrients missing from forages**
 - Protein
 - Vitamins
 - Minerals
 - Always consider “Balancer Pellet” for easy keeper and/or maintenance horses
 - **GRAIN SHOULD NEVER REPLACE FORAGE**

Activity	DE requirement (Mcal/day)	Energy increase above maintenance (%)	Amount of grain per day	Amount of hay per day (kg)
Maintenance	15-18	0	0.5 kg balancer pellet	8
Light -Recreational -Show occasional -Low level Dressage	20	20	2.0-2.5 kg performance feed	8
Moderate -Show frequently -Jumping -High Dressage	23.3	40	3.0-3.5 kg performance feed	9
Heavy -Ranch work -Low/med Eventing	26.6	60	4.0-4.5 kg performance feed	9
Very Heavy -Racing -High level Eventing -Endurance	34.5	100	5-6 kg performance feed	10

“ Life phases ” of the horse

- **Breeding**

- Stallion
- Broodmare
 - Barren mare
 - Pregnant mare
 - Lactating mare

- **Growing**

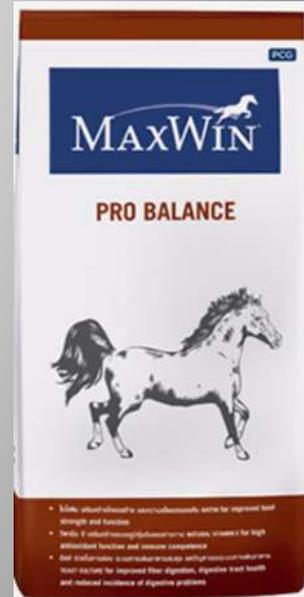
- Suckling
- Weanling
- Yearling

- **Adult**

- No work
- Light work
- Moderate work
- Hard work

- **Senior**

- **Easy Keepers vs. Hard Keepers**



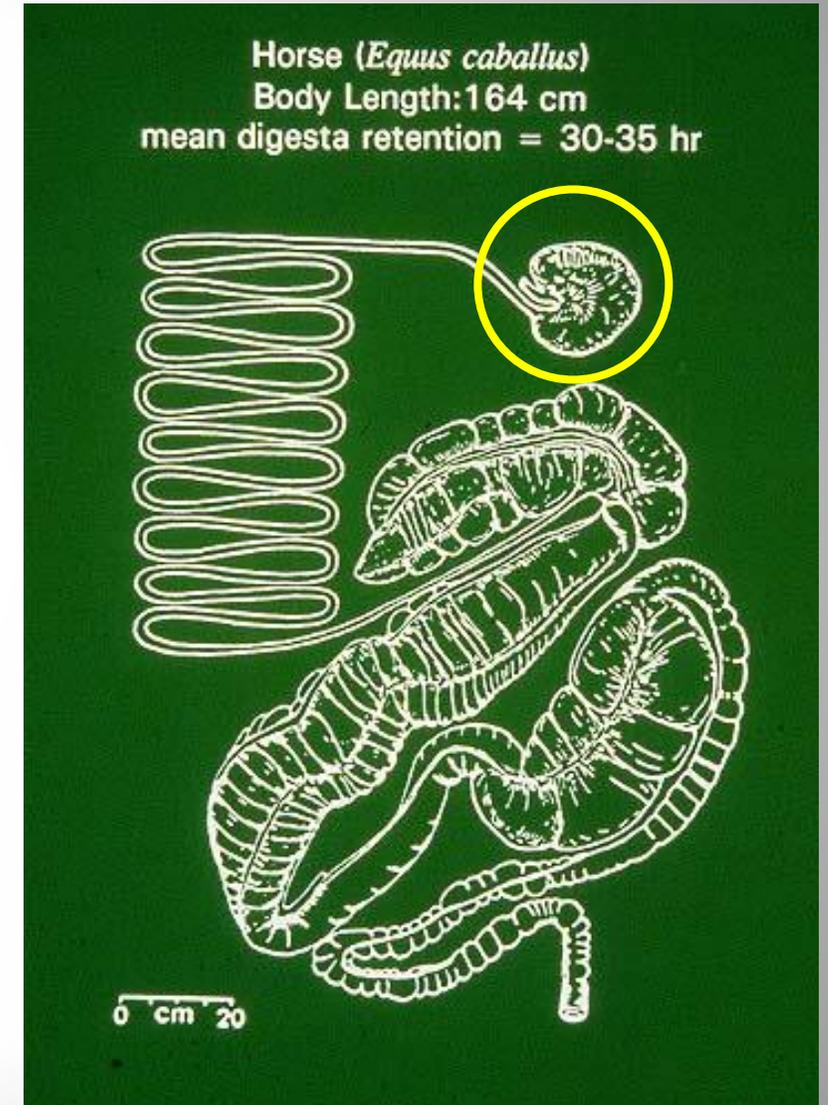
Topics

- **Disorders, syndromes, maladies**
 - Gastric ulcers
 - Acidosis
 - Colic
 - Laminitis
 - EMS
- **Hoof health**
- **Feeding the Competition horse**

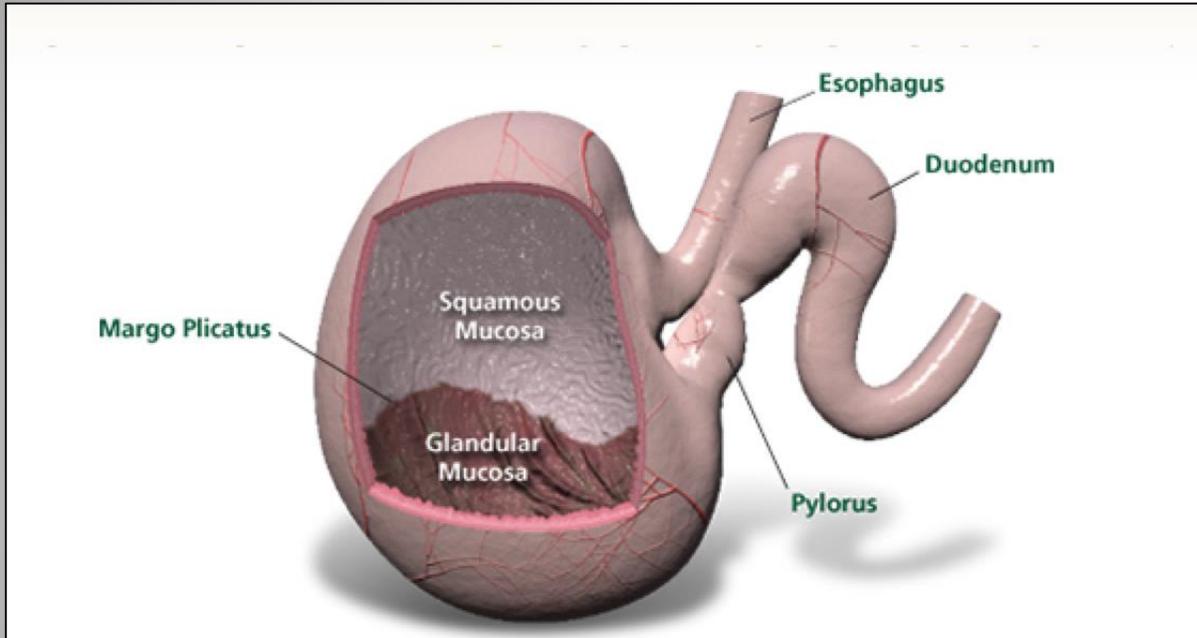


STOMACH

- Constant production of stomach acid
- Buffer only produced when horses chew
 - **Most buffer produced while eating forage**
- When acid produced without buffer
 - ulcers form



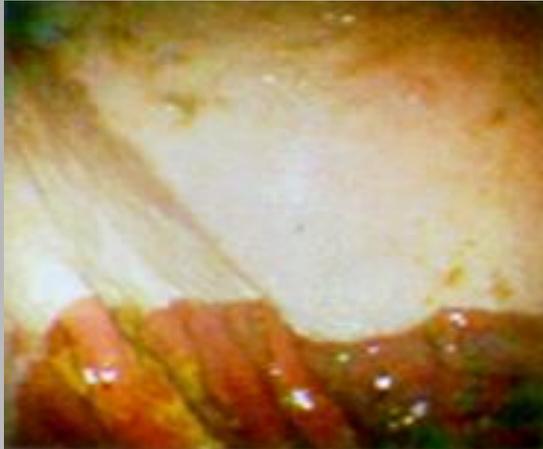
Gastric Ulcers



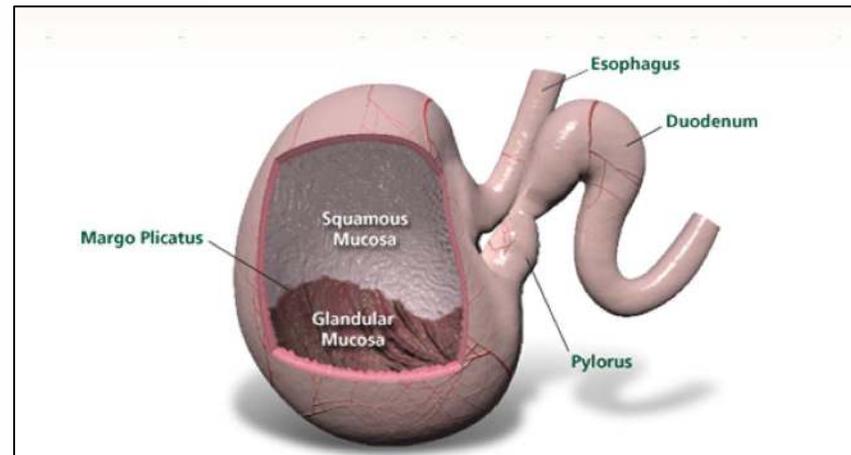
- Very common in stalled horses
 - >90% racehorses
 - >70% endurance horses
 - >60% show horses



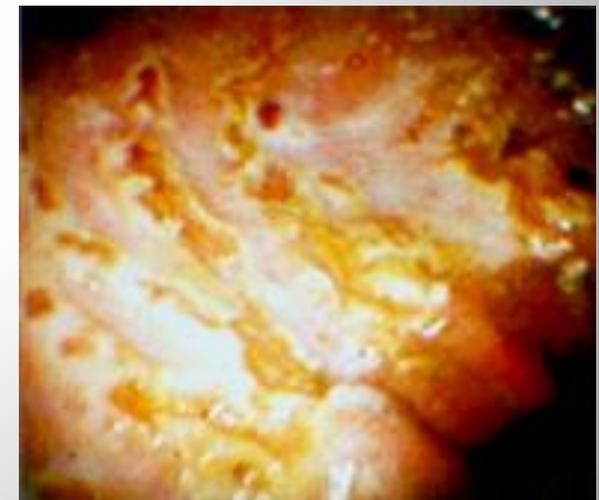
Gastric Ulcers - Role of diet



← Normal squamous gastric mucosa



4 days later



Ulcer development

Change from grazing to intermittent feed deprivation (meal feeding)

Other factors

- Physical and environmental stressors
 - Transport, prolonged stall confinement
- Chronic administration of NSAID's
 - Can decrease the production of the stomach's protective layer of mucous



Signs of gastric ulcer

- Decreased feed intake
- Decreased performance
- Weight loss
- Irritability



Preventing Gastric Ulcers

- Provide good quality forage throughout the day
 - Research suggests alfalfa may have some preventative/treatment effects
 - Divide daily forage into 4-6 meals
 - Frequent access to pasture to stimulate natural grazing
- Worm horses regularly
- Treatment
 - Ulcer medications
 - **Omeprazole**



Non-structural CHO

(Starch and sugar)



Glucose

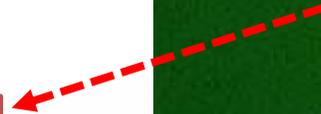


Structural CHO

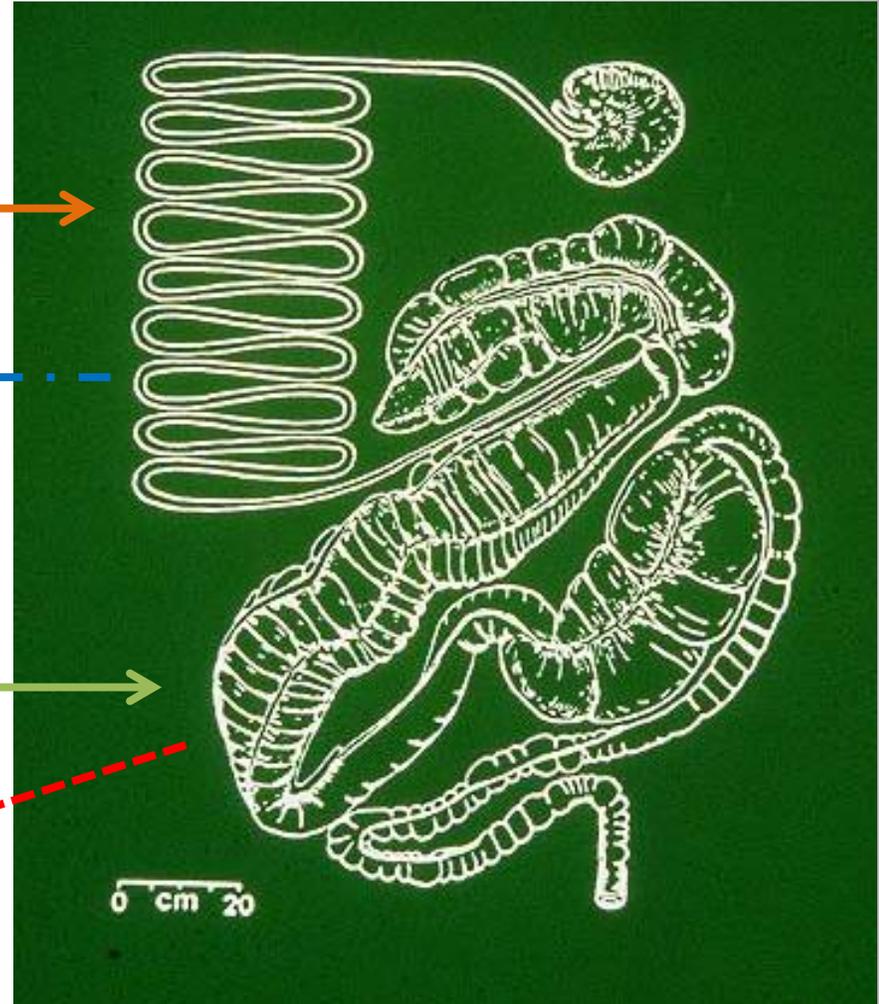
(Fiber)



VFA



Glucose

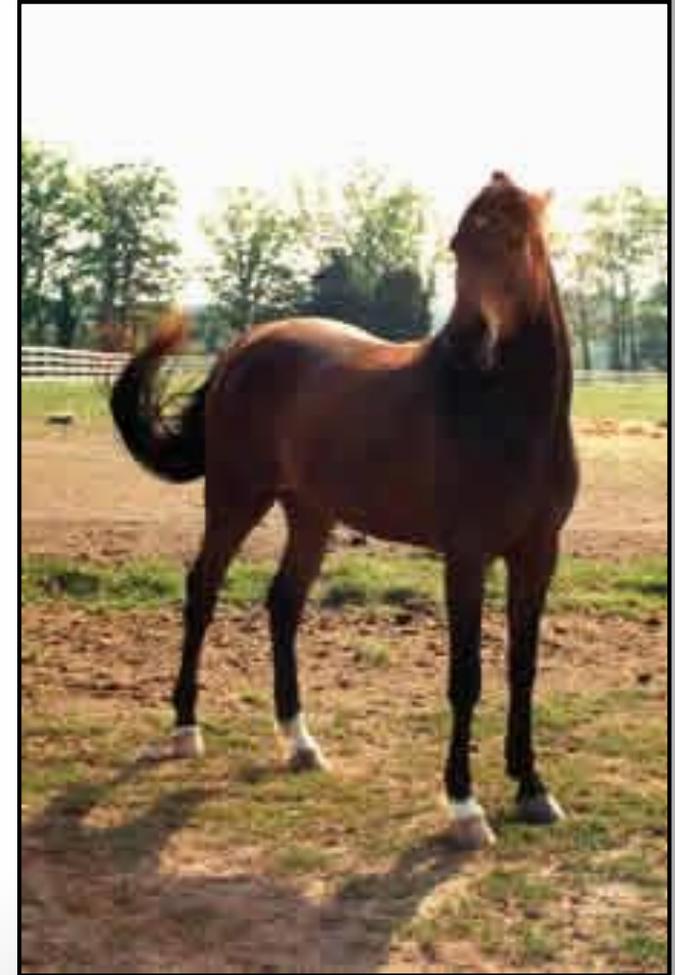


Acidosis

- **Acidosis** (grain/starch overload)
 - Chronic
 - Acute
- **What happens to the hindgut?**
 - ↑ Fermentation
 - ↑ VFA, lactic acid and gas production
 - ↓ pH
 - ↑ numbers of lactic acid-producing bacteria

Acidosis

- **More changes in hindgut**
 - ↓ numbers of lactic acid-utilizing bacteria
 - ↓ numbers of protozoa
 - ↓ fiber-digesting bacteria
 - ↓ fiber digestion
 - ↑ numbers of enteric and clostridia
 - Produce endotoxins and damage gut wall



Avoiding starch overload

- Control amount of NSC fed (grain per meal and per day)
 - No more than 2 kg/meal
- Use digestible starch sources
 - Oats > barley > corn
 - Treating starch can make a difference !!
 - Steam-flaking improves gastric and SI digestibility of barley and corn
- Starch is a good source of energy for most horses.
 - Super low starch formulas (<25% NSC) not needed for most horses.

Acidosis can lead to colic



Laminitis



“Pathologies involving the gastrointestinal tract appear to be the most common causes of laminitis.” – Dr. Chris Pollitt

Causes of laminitis

- Excessive consumption of carbohydrate (starch, fructan)
 - Endotoxins
- Retained placenta
 - Endotoxins
- Overwork or long-term standing on hard surfaces
 - Support limb laminitis
 - “Road founder”
- Endocrine pathology
 - obese and normal



Endocrine pathology (risk factors)

- **Cushing's disease**
 - Pituitary pars intermedia disease (PPID)
- **Equine metabolic syndrome (EMS)**
 - Obese and normal
- **Insulin resistance**
 - Obese and normal



Cascade of NSC overload

- **High NSC in hindgut**

- ↑ Microbial fermentation

- ↑ VFA and lactic acid (stronger acid than VFA)

- ↓ pH

- ↑ numbers of lactic acid-producing bacteria

- ↓ numbers of lactic acid-utilizing bacteria

- ↑ numbers of enteric and clostridia

- Produce endotoxins and damage gut wall**

Cascade of NSC overload

- **High NSC in hindgut**

- Production of bacterial products primarily from Gram negative bacteria
 - LPS, *S. bovis* endotoxins, vasoconstrictive amines
- ↑ colonic permeability
- LPS (lipopolysaccharide) absorbed
- ↓ blood flow to the foot and perfusion of the lamellae with possible hypoxia of the lamellae
 - Arrival of LPS activates constituent enzymes systems that attack connective tissue elements in the hoof

Equine Metabolic Syndrome



Equine Metabolic Syndrome (EMS) and Insulin Dysregulation

- EMS is a metabolic and hormonal disorder
 - More common to “easy keepers”
- Insulin dysregulation significant component of EMS
 - May eventually result in true insulin resistance
- EMS can cause:
 - Obesity, insulin dysregulation, laminitis
 - Relationship to laminitis as a result of altered glucose and insulin levels. This may lead to altered epidermal cell function and glucose uptake by epidermal lamellar cells.

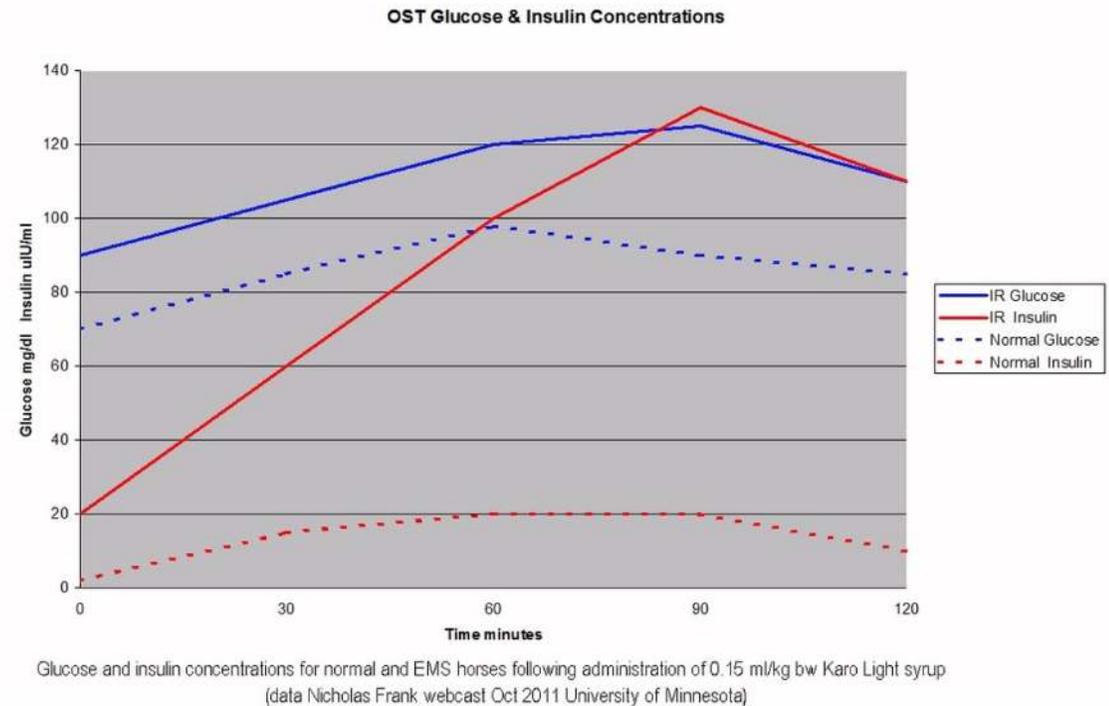
Equine Metabolic Syndrome

- **Risk factors :**
 - Localized, patchy fat
 - BCS 7-9
 - Noticeably cresty neck
 - Pony breeds, Paso Finos, Andalusians, Morgans, Arabians, Saddlebreds, Tennessee Walkers, Quarter horses



Equine Metabolic Syndrome

- **Diagnosis :**
 - Clinical signs
 - Obesity, localized fat, IR/ID
 - Radiographs for signs of laminitis
 - Oral sugar test
 - Serum triglycerides concentration
 - Adiponectin testing
(research still on-going to develop testing)



Equine Metabolic Syndrome

- **Management:**

- Decrease calories if obese
- Feed medium quality (mature) hay
- Do not feed high starch feeds (lower NSC)
 - Avoid treats
- If turnout on pasture must wear muzzle
 - Consider herd behavior!
- Balancer pellet ensures fewer calories while still receiving critical nutrients

NO HOOF



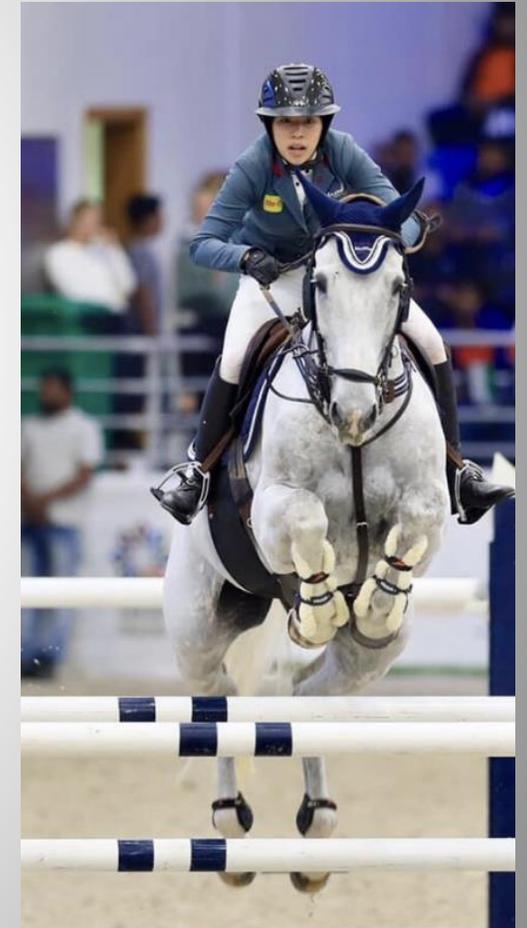


NO HORSE



- **Top 4 key points for hoof health**
 - Quality, balanced nutrition
 - Supplements + good management
 - 15 mg biotin daily; research based
 - Regular farrier visits
 - Clean stalls with adequate bedding
 - Exercise

Feeding the Competition Horse



Endurance Racing – day to day

- Feed high quality fresh pasture or hays free choice
 - Alfalfa can be supplemented as a chaff with grain-based feed (not free choice)
 - high protein and high calcium levels can have negative impacts on race day
- Feed a high fat diet
 - Feed at least 8-10 weeks prior to race to optimize metabolism of fats
 - Best for endurance horses to utilize fat rather than muscle and liver glycogen
 - For example; stabilized and balanced rice bran, vegetable oils (soya, canola)

Endurance Racing – day to day

- Feed electrolytes
 - 50 g salt per day or commercial electrolyte
 - Day to day training
 - Extra electrolytes for harder training days
- Feed sufficient energy
 - Balanced energy sources from grains, fat and easily fermentable fibers
 - Feeds with steam-flaked grains for optimal digestion
 - Energy dense fats
 - Soy hulls and/or beet pulp for easily digestible fibers
- WATER

Endurance Racing – race day

- Arrive at least 4 hours prior to competition to allow time to settle.
- Provide no more than 1 kg grain meal upon arrival
 - 4 hours pre race
- Provide small amounts of hay or hand-grazing leading up to start.
- Do not overload with electrolytes – can cause fluid imbalance
 - Primary benefits at rest stops and post-race
 - Avoid electrolytes with bicarbonate or citrate on race day

Endurance Racing – race day

- Feeding at rest stops – once heart rate has returned to resting level
 - Divide feed into 4 equal parts and offer 1 kg per stop
 - slurry may be a better option for some horses
- Water should be available at each rest stop
- Electrolytes should also be given at rest stops
- Post race – once HR returns to resting level
 - Can feed last grain meal and can be up to 2 kg (plus chaff)
 - Grazing and/or hay free choice
 - Feed at least 4 meals per day for next 48 hours
 - Allow turnout for at least 48 hours
 - Light riding can commence after about 3 days



Thoroughbred Racing – day to day

- Fiber
 - Should be available 24 hours to prevent ulcers
 - High quality, clean Timothy grass hay is best option
 - 7-9 kg per day
 - Additionally, good quality alfalfa (alfalfa pellets) can be supplemented
 - 1-2 kg per day
- Grain-based “performance” feeds
 - Feed to meet energy needs
 - BCS 4 to 5 (+/-)
 - Typically fed at 4.5-7 kg/day
 - NEVER more than 2 kg per meal

Thoroughbred Racing – day to day

- Fat
 - Energy dense
 - Up to 100 ml per 100 kg BW per day
 - MUST adapt slowly over long period of time for optimal utilization
 - Canola (rapeseed), soya better than corn oil (omega-3)
- Additional super-fibers
 - Beet pulp
 - Soybean hulls (often found in feeds)

Thoroughbred Racing – day to day

- Protein (feed to meet requirements)
 - AVOID excess protein
 - Water requirements increase
 - Urea blood levels increase
 - Ammonia blood levels increase
 - Ammonia excretion increases
- Electrolytes
 - Access to salt in stall/box/paddock
 - Top off feeds with daily
 - 50 g salt or commercial electrolyte
- WATER

Thoroughbred Racing – race day

- Do not feed hay or grain approximately 3-4 hours prior to race
- Once completely cooled can have access to hay
- Withhold grain 3-4 hours post-race
- Allow access to water post-race
 - Multiple drinking bouts ok – don't let suck in air
 - Aids in quicker rehydration and quicker recovery of muscle and GIT



Dressage – day to day

- Balance is key
 - Multiple energy sources to avoid too much “quick” energy
 - Steady energy to maintain focus
- Fiber should be available multiple times daily
 - Good quality, clean hay at 1.5-2% BW
 - MONITOR BCS
- Electrolytes
 - Access to salt in stall and paddock
 - Training days and competition days require extra top dress of salt, commercial electrolytes

Dressage – day to day

- Does not generally require high energy output
 - Therefore does not require high energy (calories) input
 - MONITOR BCS (5+ to 6+)
 - Some horses can become overweight and sluggish
 - Some horses may become too excited from too many calories
- Grain based feeds (12-14% CP)
 - Should use multiple energy sources
 - Fat, fiber, starch
 - Not too high in fat to avoid too much energy
- Regular turnout and working outside of dressage ring (hacking)

Dressage – competition day

- Access to hay
 - Hay net to slow eating
 - Good quality hay
- Arrive early to allow time to settle
 - Minimize stress
 - Hand grazing if possible
- Do not feed grain 4 hours prior to test
- WATER



Eventing – day to day

- Fiber
 - Should be available ad libitum
 - High quality, clean Timothy grass hay is best option
 - 7-9 kg per day
 - Additionally, good quality alfalfa (alfalfa pellets) can be supplemented
 - 1-2 kg per day
- Grain-based “performance” feeds
 - Feed to meet energy needs
 - BCS 4 to 5 (+/-)
 - Typically fed at 4.5-8 kg/day
 - Research found average 4.8 kg/day
 - NEVER more than 2 kg per meal

Eventing – day to day

- Protein (feed to meet requirements)
 - AVOID excess protein
 - Water requirements increase
 - Urea blood levels increase
 - Ammonia blood levels increase
 - Ammonia excretion increases
- Electrolytes
 - Access to salt in stall/box/paddock
 - Top off feeds with daily
 - 50 g salt or commercial electrolyte
- WATER

Eventing – competition day

- Do not feed hay or grain approximately 3-4 hours prior to start of any of the three disciplines
- Once completely cooled can have access to hay
- Withhold grain 3-4 hours post cross-country
- Allow access to water post-competition
 - Multiple drinking bouts ok – don't let suck in air
 - Aids in quicker rehydration and quicker recovery of muscle and GIT



Jumping – day to day

- Fiber
 - Should be fed *ad libitum* or approximately 2% of BW
 - High quality, clean Timothy grass hay is best option
 - Additionally, good quality alfalfa (alfalfa pellets) can be supplemented
 - 0.5-1 kg per day
- Grain-based “performance” feeds
 - Feed to meet energy needs
 - BCS 5 to 6 (+/-)
 - Typically fed at 3-6 kg/day
 - NEVER more than 2 kg per meal

Jumping – day to day

- Electrolytes
 - Access to salt in stall/box/paddock
 - Top off feeds with daily
 - 50 g salt or commercial electrolyte
- WATER



Jumping – competition day

- Small amounts of hay can be available up to 1-2 hours prior to competition/warm up
- No grain fed 4 hours prior to competition
- Once completely cooled can have access to hay/hand grazing
- Withhold grain 3-4 hours post-competition
- Allow access to water post-competition
 - Multiple drinking bouts ok – don't let suck in air
 - Aids in quicker rehydration and quicker recovery of muscle and GIT





The Science of MaxWin

- State – of – the – art manufacturing facility
- Dedicated production line for horse (no cattle feed, poultry feed, swine feed)
- Every lot of grain tested for mycotoxin, moisture, protein, fat, fiber
- Complete feed tested for moisture, protein, fat, fiber, bacterial, fungi, and mycotoxin
- Quality System Standard
BRC, ISO 9001, ISO 14001,
GMP, HACCP and ISO 10725



Thank You!!

