Nutrition for Certain Clinical Cases

ISVMA Conference

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Does Nutrition Play a Role? Can it Help?

Nutrition

Physiology

Clinical Treatment

Disease

Resolution
Does Nutrition Play a Role? Can it Help?

- **Challenges**
  - Research on feeding the “sick” horse is limited
  - Case studies
  - Individual reports

- **Resources**
  - Equine nutritionists
  - Literature
    - NRC
    - Equine Applied and Clinical Nutrition
    - Equine Internal Medicine
    - Clinical Nutrition
    - Equine Clinical Nutrition
Where are we going today?

Feeding the Starved/Malnourished Horse
- Definition and Causes of Emaciation/Malnourishment
- Physiology
- Refeeding Syndrome
- Nutritional Management

Nutritional Management of Chronic Colic

Pre and Post Surgical Nutritional Management

Case Study- Chronic Diarrhea
Malnourished Horse

• Definition

  • “Acceptable” body condition vs. malnourishment
  • Extreme loss of body condition >30% of “ideal” body weight

• Often highly emotive

• Acute vs. Chronic starvation
Causes of Emaciation

- Typically due to underfeeding or inappropriate nutrition

- However:
  - Partial or total deprivation of food
  - Individual nutrient deprivation
  - Seasonal decline in pasture/forage nutrition
  - Malabsorption
  - Parasites
  - Cancer
  - Liver, kidney, heart disease
  - Chronic infectious disease
  - Pregnancy/lactation
  - Old age

Each case is individual
1. Duration
2. Rate of BCS loss
3. Underlying disease
Physiology

• **Acute vs. Chronic Starvation**
  • Continual nutrient deprivation can lead to:
    • Deprivation of body stores
    • Skeletal muscle wasting
    • Cardiac muscle depletion
    • Organ tissue depletion
    • Abnormal joint development

• **Critical body function maintained**
  • Central nervous system is critical
  • Endocrine function altered to support critical systems
  • Maintaining glucose levels are critical
Physiology - Acute Starvation

↓ [Nutrient Intake]  \[\uparrow \text{Thyroid Hormones}]  \[\downarrow \text{Catecholamines}]  \[\uparrow \text{Energy Requirements}]

↓ Blood [Glucose]  \[\uparrow \text{Glucagon}]  \[\downarrow \text{Insulin}]  \[\uparrow \text{Energy Requirements}]

Tissue Metabolism

All occurring to support gluconeogenesis and glucose conservation
Physiology- Chronic Starvation (>72 h)

Adapted from Geor et al., 2013

↑ [Glucagon]  
↓ [Insulin]

↓ Blood [Glucose]

↓ [Nutrient] Intake

↓ Blood Electrolytes

↑ Lethargy

↓ Gut Integrity

↑ Endoparasitism

↑ Adipose Catabolism

↑ Muscle Catabolism

Fatty Acids

Glycerol

Amino Acids

Gluconeogenesis

↑ Adipose Catabolism

↓ Body Condition/Mass

↓ Basal Energy Requirements

↓ Tissue Mass

↓ Voluntary Activity

↓ Heat Increment of Feeding

↓ Protein Turnover

↓ Immune Function

↑ Infectious Disease Risk

↓ Tissue Metabolism

↓ Body Condition/Mass

↓ Basal Energy Requirements

↓ Tissue Mass

↓ Voluntary Activity

↓ Heat Increment of Feeding

↓ Protein Turnover

↓ Immune Function

↑ Infectious Disease Risk

Fatty Acids

Glycerol

Amino Acids

Gluconeogenesis
Physical Changes

- **Body fat stores and body condition score are not linearly related**
  - Each BCS point decrease does not indicate similar amount of adipose depletion
  - Increased appearance of bony structures
  - Topline appearance

- **Gastrointestinal Alteration**
  - Decreased mucosal integrity and villous atrophy
    - Further decreased nutrient absorption/utilization
  - Decreased immuno-competence
Refeeding Syndrome

• So let’s develop a refeeding plan...WAIT!

Chronic Starvation

↓ [Blood Glucose]
↓ [Insulin]
↓ [P, K, Mg, Vit B₁]
Adaptation to ketone utilization

Rapid Feed Reintroduction

↑ ↑ ↑ [Insulin]
↑ ↑ ↑ [Blood Glucose]
↑ ↑ ↑ [P, K, Mg, Vit B₁]

Osmotic changes of ECF

↑ ↑ ↑ Edema

Cardiac/Respiratory Dysfunction

Refeeding Syndrome

• Dramatic hypophosphatemia, hypokalemia, hypothiaminosis
• Cardiac, respiratory suppression, arrhythmia, paralysis, rhabdomyolysis and confusion
• Increased water retention
• Death usually occurs within 3-5 days

Adapted from Geor et al., 2013
Refeeding Plans

• “Start Low and Go Slow!”
  - Must evaluate every case individually
  - Determine underlying disease status
  - Address parasite concerns

• Rehydration is critical
  - Frequent (every 20-30 min) small (2-3 liters) drinks until animal is no longer insatiably drinking
  - May stimulate with salt (0.5-1%) and dextrose (2%)

• Nasogastric or intravenous rehydration may be used
  - Be careful to not include dextrose to avoid refeeding syndrome
Refeeding Plans

• Refusal to eat independently- Enteral Nutrition

1. Provide high quality enteral diet or soaked senior feed
2. Highly digestible fiber to maintain hindgut function and viability
3. Supplemental glutamine may support enterocyte function
4. High quality protein to combat muscle catabolism
5. Low NSC to limit insulin spike post feeding
6. Diet should be easily passed through a nasogastric tube
Refeeding Plans

• Willing to eat independently- Alfalfa to start and then...

1. 1.3 lb alfalfa hay every 4 hours for first 3 days
2. Increase amount and decrease feedings day 4-6
3. By day 7 three meals of 7.5 kg alfalfa at 8 hour intervals
4. If positive BW response is noted concentrate can be introduced along with free-choice alfalfa
   1. Balanced fiber and low glycemic response feeds should be utilized
   2. Senior feed with highly digestible fiber sources

* Recommendations based on 500 kg horse
Refeeding Plans

• Long Term Feeding Management Plan

1. Should be dictated by BW of horse and desired BW and BCS
2. Consult NRC to determine daily energy requirement based on variety of factors
3. 20 Mcal above requirements to induce 1 kg of weight gain
4. 16-20 kg of gain required for increase of one point BCS
5. 40-60 days to raise 1 BCS point
6. Safe rate of gain is 0.2-0.5 kg/day

\[
\text{Kg of gain required} = (\text{desired BCS} - \text{current BCS}) \times 20
\]

\[
\text{Days to accomplish gain} = \frac{\text{kg gain required}}{\text{desired rate of gain (kg/day)}}
\]

\[
\text{Mcal/day above maintenance} = \frac{\text{kg gain required} \times 20 \text{ Mcal}}{\text{days to accomplish gain}}
\]
Refeeding Plans

• Long Term Feeding Management Plan- Once target caloric requirement has been determined

1. Maximize high quality forage
2. Pasture should be reintroduced slowly
3. Consistent diarrhea or suspected malabsorption/digestive problems
   • Senior horse feed
   • Reduce long stem forage
   • Pelleted or cubed forage alternative
4. Calorie dense fat-added products may be helpful depending on activity level
Refeeding Plans

• **Long Term Success is Possible!**

• Slow and steady progress is expected and desired

• Better understanding the physiology helps to understand nutritional recommendations and concerns

• Ask for help!
Chronic Colic

• Even with optimal nutrition some horses develop “chronic colic”

• Nutritional Balance is critical to support gastrointestinal comfort

• Wide variety of issues:
  • Gastric ulcers
  • Enteroliths
  • Uroliths
  • Malabsorption
  • Diarrhea
  • Colitis
  • Chronic inflammatory bowel
Chronic Colic - Dietary Risk Factors

1. Recent dietary change
   • Allow up to 14 days for change
2. Decreased access to grazing
   • Stabled horses 3 times more likely to experience colic
3. Large concentrate meals
   • Starch overload in hindgut
4. Inadequate dietary fiber
   • Less than 1% BW in forage has negative effects
5. Poor quality forage
   • High ADF and NDF hay can limit intake and digestibility
6. Straight alfalfa
   • May contribute to enterolith and urolith formation
7. Limited water access
   • Allows for proper gut motility but must be clean and available
Chronic Colic

- Attention must be paid towards entire diet of the horse including hay, pasture and concentrate
  - Forage should be major component of the horses’ diet
  - Concentrate typically makes up a small portion of the total diet

- Proper veterinary, dental and farrier care is critical
  - Ability to find food, chew food and digest food all plays a role in GI comfort

- Proper management and housing
  - Maximize turnout
  - Minimize rapid dietary changes (including pasture and hay)
  - Understand forage quality and appropriate forage choices
Chronic Colic - Nutritional Management

• May be necessary to replace hay with a complete feed
  • Managing the fiber source may reduce mechanical load on the gut
  • Utilize alternative fiber sources such as hay pellets, cubes, chaff

• Monitoring soluble carbohydrate levels
  • Some horses may benefit from diets lower in NSC
  • Reduce meal size to reduce NSC load on the hindgut

• Encourage water intake
  • Novel water sources may be less palatable
  • Increasing salt intake may increase water intake
Chronic Colic- Nutritional Management

• **What about supplements?**
  • Do they pass the **RIDE** test?

• **Psyllium mucilloid**
  • Free-choice grass hay may be just as helpful to reduce sand accumulation (Lieb and Weie, 1999)
  • May reduce passage time

• **Probiotics**
  • Research based evidence is lacking
  • Questionable quality of commercial products
  • Administration and results are dependent on age
Pre and Post Surgical Nutritional Management

• Surgery/anesthesia place a major strain on the GI health of the horse
  • General anesthesia has a high morbidity and mortality rate in horses
    (Johnston et al., 1998, 2002)
  • Effects may not be seen until 7 days post anesthesia

• Various metabolic and endocrine changes due to anesthesia
  • Changes necessary to maintain homeostasis
  • Increased cortisol
  • Altered glucose and insulin levels
    • Can also be affected by pre-surgery feed intake
    • Increased plasma NEFA due to increased lipolysis

• Case studies and individual treatments
Pre Surgical Nutritional Management

- Little data available to draw conclusive recommendations. However....
  - Understanding GI physiology and nutritional requirements can help
  - Ability to maintain homeostatic mechanisms is critical
  - Anesthesia can negatively affect nutrient homeostasis necessary for surgical recovery

- Generally recommended to withhold food but not water 6-12 hours prior to surgery
  - Reduces gut content
  - Long-term pre-operative starvation may be harmful

- Horses suffering from abdominal or GI disease may be compromised prior to surgery
  - Negative nutrient balance entering surgery likely sets the horse up to struggle postoperatively
Pre Surgical Nutritional Management

• Nutritional recommendations pre surgery:

1. Fast for 6-12 hours
2. Do not limit water intake
3. Do not make sudden dietary changes
4. Do not make sudden management changes
5. Ensure horse is receiving proper balance of nutrients
Post Surgical Nutritional Management

• Major complications post surgery generally related to post-operative ileus and generalized colic

• Post-operative ileus not fully understood
  • Failure of gut motility to resume
  • Intestinal inflammation and distension are likely culprits

• Gastrointestinal pain following non-abdominal surgery is common
  • Most occur within 72 h of surgery
Post Surgical Nutritional Management

• Post-operative nutritional modification should be done on case-by-case basis
  • Wide variation in timing of feed reintroduction
  • Most horses recovering from non-abdominal surgery begin feeding approximately 6-12 hours post surgery
  • Reintroduction should be slow and to a similar feed as what was consumed prior to surgery

• Post abdominal surgery feeding can be more complicated
  • Short-term and long-term plans are important to consider
Small Intestinal Resection

- **Short Term Nutritional Management**
  - Introduce feed/water with evidence of gastric motility
  - Small, frequent meals
  - Fresh grass
  - Complete feed
    - Decreases mechanical pressure in gut due to lower volume of digesta while providing optimal nutrition
- **Enteral diet**
  - Provide digestible nutrition, glutamine and digestible fiber
- **Reintroduce long-stem hay after 3-4 days**
- **No bran mashes**
  - High bulk and high NSC
Small Intestinal Resection

• Long Term Nutritional Management
  • Emphasize fiber digestion
  • High fiber, low NSC concentrate
  • High quality forage
  • Location of resection is important
    • Duodenum and jejunum- starch, vitamins, minerals
    • Ileum- fat, fat-soluble vitamins
  • Vitamin/mineral supplementation may be necessary
    • >50% resection
  • Complete feeds may be necessary
    • >70% resection
Large Intestinal Resection

- **Short Term Nutritional Management**
  - Introduce feed/water with evidence of gastric motility
    - Possibly as soon as 12 hour post surgery
  - Small, frequent meals
  - May offer ad-libitum alfalfa as soon as 24 hour post surgery
  - Avoid grains for approximately 2 weeks
  - Utilize soft grass hay if diarrhea develops
  - Complete feed
    - Decreases mechanical pressure in gut due to lower volume of digesta while providing optimal nutrition

- **Enteral diet**
  - Provide digestible nutrition, glutamine and digestible fiber
Large Intestinal Resection

• **Long Term Nutritional Management**
  • First 30 days= low fiber, high protein and phosphorus
  • >90% colon resection= continue this plan
  • B-complex and K vitamin supplementation is necessary
  • Emphasize SI digestion and provide highly digestible fiber
    • Fat
    • Soluble carbohydrates
  • Alfalfa or alfalfa mix hay
  • Only cecum or left colon resection may allow for return to “normal” diet
Case Study - Chronic Diarrhea

**Presentation**
- 16 year old gelding
- Chronic diarrhea over 3 years
- Multiple supplements and pharmaceuticals
- Normal blood chemistries and diagnostics
- Various dietary changes and attempts to manage

**Thought Process**
- Inability to properly digest and utilize forages
- Hindgut dysfunction?
- Gastric ulcers?
- Parasites?
- What can we do to completely control the diet?
Case Study - Chronic Diarrhea

Thought Process

• Inability to properly digest and utilize forages
• Hindgut dysfunction?
• Gastric ulcers?
• Parasites?
• What can we do to completely control the diet?

Nutritional Plan

• Completely eliminate long stem forage
• Completely control diet with a complete feed
• Multiple (8-12) meals per day
• Gastric support supplement
Case Study - Chronic Diarrhea

**Nutritional Plan**

- Completely eliminate long stem forage
- Completely control diet with a complete feed
- Multiple (8-12) meals per day
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**Outcome**

- Elimination of diarrhea
- Reintroduction of forage pellets and cubes
- Weight gain
- Suitability to be included in a riding program
Conclusions

- Nutrition **MUST** be considered in majority of clinical cases
- Understanding physiology helps to make nutritional recommendations
Questions

How long are we going to play this game?

How long until your arm falls off?