Review of Nutritional Management and Diseases common to Donkeys: Insulin Resistance, Hyperlipidemia, Hyperlipemia

Drs Amy K. McLean¹ and Camie R. Heleski²

¹North Carolina State University and
²Michigan State University
Introduction to Feeding and Care of Donkeys

• Very little of what we know about the care of donkeys and mules comes from research

• The information that will be shared today comes from both practical experience dealing with mules and donkeys for over twenty years and some scientific studies

• We will discuss management and common nutritional diseases associated with donkeys
  • Ulcers
  • Insulin Resistances
  • Hyperlipidemia
  • Hyperlipemia
# Feeding Donkeys

- **#1 Rule** when feeding donkeys is to not OVER feed them!

  - This is generally not a problem in developing countries where they are still used as beasts of burden

  - Obese (Industrial Countries) vs. Thin (Developing Countries)

- In general young, growing donkeys tend to be harder to keep weight on
Feeding Donkeys

• In 2007 Nutritional Requirements for Donkeys were included in the National Research Council for Nutrient Requirements of Horses 6th edition

• However, little to no nutritional information is available for feeding mules

• Similar to feeding a horse, one should consider the following factors:
  – Age (young, mature, old)
  – Level of Work (amount of exercise in hours and how often during the week)
  – Environment (severe weather such as below 0 temperatures, wind, rain and snow, access to shelters can all create an increase in energy demands)
  – Weight of the animal (feed on weight not volume)
Donkey Diet Info

- Donkeys have been compared to small ruminants in their ability to digest poor quality feeds, meaning feeds/forages that are high in fiber
- Tend to think donkeys and mules can survive on less feed when compared to a horse
- Diets in developing countries are very high in fiber and low in protein and energy
- Donkeys often browse on a variety of plants including the bark of trees or wooden fences
- Not uncommon for donkeys to consume plants high in tannins
Donkey Diet Info cont.

- Take bigger bites and spend less time chewing
- Research has shown donkeys to have a slower gastrointestinal tract time
  - Meaning what they eat stays in their digestive tract longer compared to a horse
    - Therefore, they can maximize digestion and possibly nutrient absorption
- Donkeys continue to eat during times of dehydration
- Donkey and mules’ ability to dissipate heat aid to their possible need for less water when compared to a horse in drought type climates
## Tips for Feeding Donkeys

- Avoid over feeding donkeys
- Monitor their grass intake
- Consider limiting grazing especially for miniature and standard donkeys to the morning
- Feed based on weight and not volume
- High Fiber and Fat diets work well for both Mules and Donkeys
- Don’t over feed Carbohydrates and Protein
  - Donkeys have a unique ability to recycle high levels of urea
- Don’t attempt to rapidly decrease weight in both; can lead to hyperlipemia
- Watch for laminitis in hind limbs prior to front
Body Condition Scoring

- Scored using 1-5 (Donkey Sanctuary System)
  - 1 being thin and 5 being obese
  - “Easy keepers” being able to maintain or even put on weight when grazing relatively moderate pastures
  - Regional deposition of fat
  - Obesity, has been linked with an increased risk of insulin resistance in horses and ponies (Frank, 2007)
Body Condition Scoring Donkeys

- #1 = Thin
- #2 = Moderate
- #3 = Ideal
- #4 = Fat
- #5 = Obese

Horse for Reference
Burden et al. 2008 found:

- 41% (n= 533) of necropsied donkeys in 2 yrs had ulcers
- Ulcers more likely to occur in donkeys consuming cereal based diets (56%) vs forage only (34 %)
- No significant difference seen in donkeys treated with NSAID’s and presence of ulcers
- Increased chance for ulcers when hyperlipemia has occurred (63%) vs no occurrence (36%)
Nutritional Conditions in Donkeys: Insulin Resistance

- Described as an adaptative response when energy is limited (Frank, 2007; Kronfeld et al., 2005; Jenkins et al., 1987)

- Donkeys traditionally lived in an arid environment consumed high forage diets
  - High Forage diets = High in Structural CHO’s and low in NS CHO’s

- High starch rations promote insulin resistance (Hoffman et al., 2003)

- Feast or Famine?
  - Typically, donkeys in developing countries experience this phenomena
  - Thrifty Genotype?
    - Adaptative ability to conserve energy, especially glucose, in times of negative energy balances
      (Kronfeld et al., 2005; Jenkins et al., 1987; Nell, 1962).
Nutritional Conditions in Donkeys: Insulin Resistance

• Negative energy balance (hypoglycemia) during famine
  • Decrease Insulin Sensitivity (homeostatic mechanism)
    • Maintains normglycemia
    • Insulin peaks twice over a period of time
    • Insulin aids in glucose transport activity by stimulating glucose transport proteins
  • Tissue less sensitive to Insulin
    • Glucose preserved for vital organs and tissues
  • Decreases lipid/adipose tissue
    • Increases circulating lipids (esp. [triglycerides]) = hyperlipidemia

(Hoffman et al., 2003; McLean et al., 2010, Treiber et al., 2005)
Nutritional Conditions in Donkeys: Diagnosing Hyperlipidemia

- Presences of elevated lipid concentrations in blood associated with negative energy balance & physiologic stress (loss of companion or pregnancy)

- Diagnosis based on clinical signs vs. blood chemistry
  - Blood Chemistry:
    - Triglyceride (TG) < 500 mg/dL
      - Donkey $66.4 \pm 34.2$ mg/dL
        - range: 23.5-144.0 mg/dL
      - Horse TG 14-77 mg/dL
      - Fasted donkeys: 112.7 mg/dL
      - Fed donkeys: 33.82 mg/dL
  - Clinical Signs:
    - Milky plasma samples, lethargy, decreased appetite, depression

(Dugat et al., 2010; McKenzie III, 2010)
Nutritional Conditions in Donkeys: Diagnosing Hyperlipidemia

- Risk factors for developing hyperlipidemia
  - Obesity
  - Pregnancy
  - Stress
  - Diseases
  - Insulin Resistance
Nutritional Conditions in Donkeys: Diagnosing Hyperlipemia

- Common disorder in donkeys due to high levels/concentrations of serum triglycerides concentrations, a condition that occurs after hyperlipdemia, visible lipemia and fatty infiltration of the liver or multiple organ systems

- TG > 500 mg/dL
  - Females and obese higher risk for hyperlipemia
  - 60-80% mortality rate

- Prevalence 3-5% general population
  - 11-18% inpatient populations

Burden et al., 2011; McKenzie III, 2011
1) Fasting - Energy balance

2) Increase lipase

3) Decrease Insulin

4) HIGH [FFA] - Liver "re-sterifies" FFAs to (VLDL)

5) VLDL in bloodstream = hyperlipidemia

6) Continued increase in VLDL production = hyperlipemia

8) Hyperlipemia can lead to liver failure
Nutritional Conditions in Donkeys: Diagnosing Hyperlipemia

- Risk factors for developing hyperlipemia
  - Age (older donkeys more likely)
  - Environment/area where donkey is kept
  - Feeding concentrates
Nutritional Conditions in Donkeys: Preventing hyperlipidemias

- Avoid stressful situations when possible
  - Donkeys like partners, keep the partner with the donkey when possible
  - Slowly introduce new and stressful situations
    - Example: hauling long distances, try short first, slowly change feeding routines

- Avoid Negative Energy Balances

- Decrease weight slowly

- Attempt to improve insulin sensitivity
  - Consider fat enriched diets (improves TG clearance), exercise, pharmacologic approach (at risk animals)

(McKenzie III, 2010)
Conclusion

• Donkeys may have an adaptive ability regardless of body condition, to conserve energy when compared to horses

• Owners should consider:
  • Nutritional value
  • Quantity of diets being fed to donkeys (FEMALE’s)

• Avoid obesity and metabolic conditions that could lead to adverse conditions such as hyperlipemia or laminitis

(Burnham, 2002; June et al., 1992)
Resources

AAEP Proceedings


Donkey Sanctuary,


Resources


International Veterinary Information Service http://www.ivis.org/home.asp


THANK YOU!