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

Drs Amy K. McLean[1] and Camie R. Heleski[2]

[1]North Carolina State University and

[2]Michigan 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.

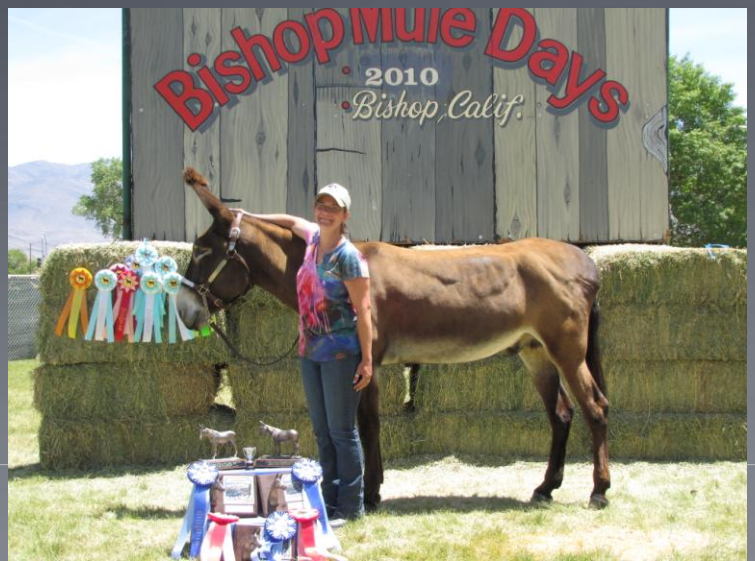
- Take bigger bites and spend less time chewing
- Research has shown donkeys to have a slower gastrointestinal tract time
  - Meaning what they eat stays in their digestive tract longer compared to a horse
    - Therefore, they can maximize digestion and possibly nutrient absorption
- Donkeys continue 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

Nutritional Conditions in Donkeys: Gastric Ulcers

- 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 ± 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)

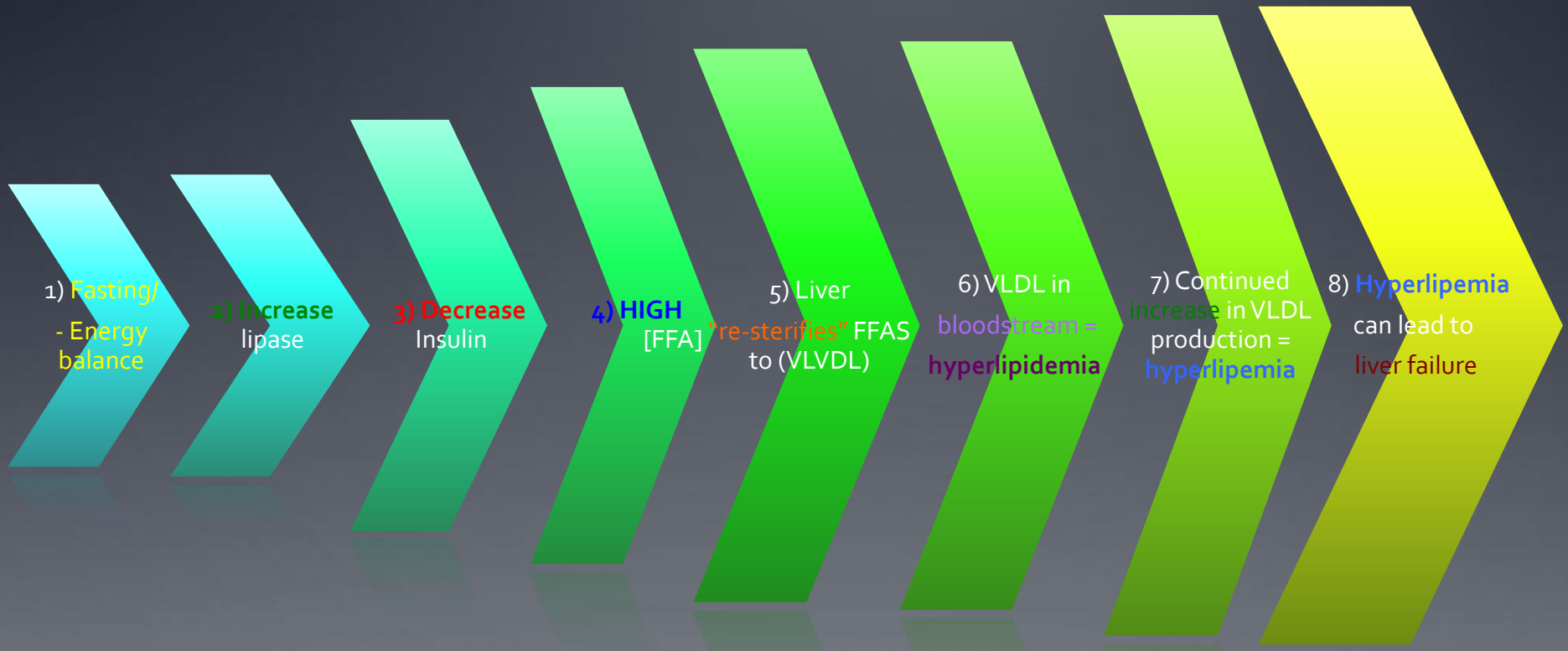
Nutritional Conditions in Donkeys: Diagnosing Hyperlipidemia

- Risk factors for developing hyperlipidemia
  - Obesity
  - Pregnancy
  - Stress
  - Diseases
  - Insulin Resistance

Nutritional Conditions in Donkeys: Diagnosing Hyperlipemia

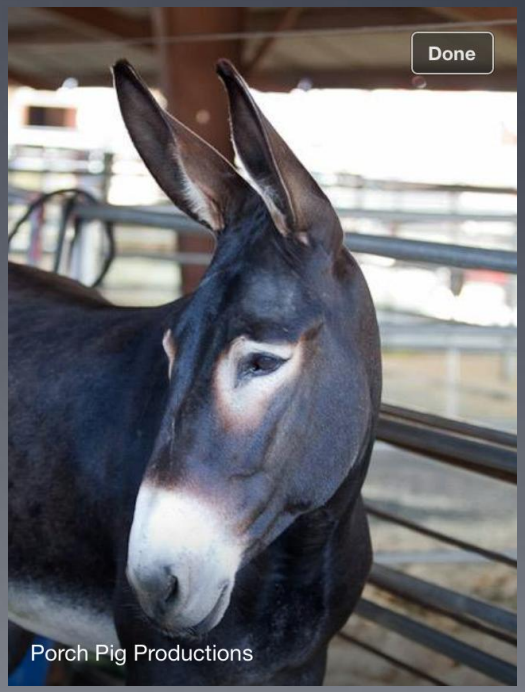
- Common disorder in donkeys due to high levels/ concentrations of serum triglycerides concentrations, a condition that occurs after hyperlipdemia, visible lipemia and fatty infiltration of the liver or multiple organ systems
  - **TG > 500 mg/dL**
    - Females and obese higher risk for hyperlipemia
    - 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]
5) Liver
"re-sterifies" FFAS
to (VLVDL)
6) VLDL in
bloodstream =
hyperlipidemia
7) 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
  - www.ivis.org/**proceedings/aaep/2002**/910102000110.PDF
  - www.ivis.org/**proceedings/AAEP/2002**/910102000102.PDF
  - www.ivis.org/**proceedings/aaep/2002**/910102000115.PDF
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Resources

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THANK YOU!